Omokoroa Peninsula Stormwater Management Plan

July 2002

Western Bay of Plenty District Council

Beca

Omokoroa Peninsula Stormwater Management Plan

Prepared for

WESTERN BAY OF PLENTY DISTRICT COUNCIL

By

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EXECUTIVE SUMMARY

This Stormwater Management Plan (SWMP) for the Omokoroa Peninsula has been prepared for the Western Bay of Plenty District Council (WBOPDC) by Beca Carter Hollings & Ferner Ltd (BCHF). It forms part of a Structure Plan (SP) study for future urban development of the Peninsula.

The SP focuses on the northern "Future Urban" area, but the SWMP covers the entire peninsula north of SH2. This in parts reflects the natural stream catchment boundaries, and enables each distinct subcatchment area to be addressed in its entirety. This is essential for effective stormwater and catchment management.

The SWMP reflects the concepts developed for the SP, and provides a basis for WBOPDC to manage stormwater within the area, with a focus on the effects of future development. It will also form the basis of an application to Environment Bay of Plenty (EBOP) for a comprehensive discharge consent for all stormwater from the Peninsula (i.e. from the state highway northwards, including the current urban area). This will facilitate the management of individual developments and provide for a co-ordinated approach to stormwater disposal.

There is normal residential development in the north of the Peninsula. The balance is in rural and rural residential use, apart from a limited number of specific development areas. The topography is steep in the north and east, with more gentle slopes and a well defined stream pattern to the south west. Much of the peninsula is suitable for urban development, subject to appropriate controls on land stability and drainage. The SP provides a framework for such development.

The conceptual approach taken in both the SP and the SWMP is to recognise and enhance the natural drainage patterns of the peninsula, preserving natural streams where possible or appropriate, and providing reserve corridors. It is recommended that Council acquire these corridors (typically 20m wide) to ensure good maintenance and performance, and to avoid the risk of encroachment by development. In areas where the streams are identified as of high ecological value (refer constraints map) it is further recommended that adjacent land be covenanted for a total width of up to 100m, to provide riparian planting and a viable ecological corridor.

The SWMP provides for a number of stormwater management devices. However, it also recommends consideration be given to achieving effective stormwater management within individual developments through the use of low impact design techniques. These can result in an aesthetically pleasing urban environment, with significantly lower impacts on the environment, and less need for large, costly "end-of-pipe" stormwater management solutions.

Thirty two stormwater management pond sites have been identified, along with reserve corridors. In addition there are two existing ponds which could be enhanced. These

serve for both flood detention (to offset the erosion and flood risk effects of increased runoff from development) and stormwater quality improvement (to protect the harbour from sediment and other contaminants). The total value of these proposed works in areas not yet developed is estimated at $4.9 million, and would primarily be funded through Development Impact Fees. Annual maintenance on the works is estimated at $177,000. In addition to the above works, a further $1.15 million is identified for the existing urban area, including one new pond, some other water quality measures, and pipe upgrades identified in an earlier study of the existing urban area.

The comprehensive consents being sought would enable WBOPDC to grant consents for individual developments on the peninsula, so long as they complied with the comprehensive consent or were covered by works undertaken as part of the implementation of the SWMP. Individual major works associated with implementing the comprehensive consent would still require technical approval by EBOP, and earthworks would still require submission of erosion and sediment control plans.

In addition to the works, there are a number of control provision which will need to be incorporated into documents such as the District Plan and the WBOPDC design standards. These measures will provide the necessary statutory backing for WBOPDC to enforce the provision of the comprehensive consent.

Prior to the granting of the comprehensive consent, this SWMP can still provide a sound planning basis for WBOPDC to manage stormwater on the peninsula.

1. BACKGROUND

1.1. STATUTORY

The provision of stormwater infrastructure derives from several different Acts of Parliament. These provide the basis for stormwater management by regional and local authorities.

- The Local Government Act (1974) gives powers to Local Authorities to build and manage stormwater drainage infrastructure, but does not specifically require that this be done.
- The Building Act (1991) requires the protection of buildings from inundation in a flood having a 2% probability of occurrence in any year, and avoidance of nuisance from stormwater runoff in a flood event having a 10% probability of occurrence in any year.
- The Resource Management Act (1991) provides for management and mitigation of the effects of development, both in terms of natural hazards and the protection of the environment. This is generally worked out in terms of the Regional Water and Land Plan, the District plan, and specific Resources Consents for discharge of stormwater. The focus is on both quantity and quality of discharge.
- Other Acts that can have a bearing on stormwater management include the Land Drainage (1908), the Soil Conservation and Rivers Control Act (1941), the Health Act (1956) and the Conservation Act (1987).

Subordinate documents such as the Regional Plan, District Plan, Council policies and design manuals provide the detailed basis for implementation of stormwater management. Specific resource consents provide for individual discharges of stormwater to the receiving environment, except where such discharge is a permitted activity under the Regional Plan.

1.2. SCOPE OF THIS STUDY

The Omokoroa Peninsula forms part of the southwestern side of Tauranga Harbour. The northern end of the Peninsula is developed for urban use, while the south is in a mix of horticultural, agricultural and lifestyle land uses. It is likely that in the near future additional land on the Peninsula will be developed for some form of urban use.

This study looks at the management and discharge of stormwater on the Peninsula under current and expected future land uses. Key objectives of the study are to:

- describe existing stormwater management practices
- identify existing stormwater management problems (quality and quantity)

- identify the effects of current and proposed future practices on the receiving environment (i.e. the streams of the Peninsula, and Tauranga Harbour)
- propose remedial measures and management practices to achieve acceptable environmental outcomes from stormwater management, even with development
- provide the technical basis for application by Western Bay of Plenty District Council to Environment Bay of Plenty for a comprehensive discharge consent for all stormwater discharges on the Peninsula.

The study looks particularly at future development, and recommends preferred approaches to stormwater management to ensure that the effects of the development are sustainable.

This Stormwater Management Plan (SWMP) has been prepared as part of a wider project to prepare a Structure Plan (SP) for development of the Omokoroa Peninsula. This has had two implications in the context of the SWMP:

- concepts identified in this SWMP for development approaches and protection of stormwater reserves have been incorporated into the SP
- the SP layouts and features for the area from the existing urban boundary to the railway, plus broad concepts for the area south the SH2, have formed the basis for assessment of future land use for the hydrological analysis of the SWMP.

1.3. CATCHMENT DESCRIPTION

1.3.1. Topography

The Peninsula consists of undulating topography, with cliffs around much of its coastline. Figure 1.1 shows the Peninsula, with 5m contours and principal roads shown.

In the northern 2 km (generally the existing urban area) there is a central ridge at typically 25 to 30 m elevation, and the Peninsula is approximately 500 m across. The western coast is generally steep, but there are small sandy flats below the cliffs along much of the eastern coast.

In the southern 3.5 km the Peninsula widens out to 2 km, and rises in the east and south to 50 m elevation. There is a general ridgeline running north along the eastern side of this part of the Peninsula. The topography on this side is therefore relatively steep, while to the west there are much gentler slopes and several clearly defined valley systems.

The nature of the topography has some influence on the potential land development. Many areas, especially in the north and the south-east, have potential problems with stability, and are sensitive to the effects of high water content in the soils.

1.3.2. Geology and soils

The distribution of soils on the Peninsula is shown in Figure 1.2.

Most are volcanic in origin, and the underlying structure is not well understood. Similar layering to that found in Tauranga is expected, and this is important for stormwater management. The coastal cliffs are unstable in place, and perched groundwater is thought to be a significant factor in this instability. There is no certainty as to the subsurface flow paths, or of the depth and slope direction of low permeability layers. It is conceivable that water infiltrating on one side of the Peninsula could travel along subsurface layers to emerge at cliffs on the other side. As a result, it is not considered appropriate to dispose of stormwater into the ground using soakage in any part of the Peninsula.

The hydrological characteristics of the soils of the Peninsula are give in Table 1.1, along with the equivalent USSCS soil group used in the later hydrological analysis.

Table 1.1 Soils

Soil type	***Description***	***Hydrological characteristics***	***US SCS Soil Group***
Ka, KaR, KaH	Sandy Loam	Well drained	B
MM	Man Made	Well drained	B
Oe	Sand	Excessively drained	A
Pa, Tp	Silt Loam	Poorly drained	C
Pp	Sandy Loam	Excessively drained	A

1.3.3. Current land use

The current District Plan zoning is shown in Figure 1.3. The current land use is similar to that of the Plan, i.e. there is little further scope for urban expansion except to a limited extent in the south of the present urban zone.

The northern tip of the Peninsula is largely developed for urban residential use. There is very little commercial area, and the housing density is low (average lot size 600 to 1000 m^2).

The central area, between the northern urban portion and the railway, is a mix of small urban developments, horticulture and lifestyle blocks. Specific features include:

- the Country Estate retirement village, covering approximately 3 ha
- the residential development of Kayelene Place covering about approximately 8 ha
- the Western Bay Golf Course, on flat coastal land in the west
- the recreation reserve on Western Drive.

The southern area, between the railway and SH2 is largely in horticultural and agricultural use.

1.3.4. Natural drainage

The natural drainage patterns of the Peninsula suggest that there is significant infiltration to the soils, and the natural streams are only permanent in the lower reaches. Nevertheless the gully systems are quite wide, and indicate significant flows and/or channel erosion and bank instability in the past. The natural gullies have been identified based on contour information, to reflect the area between the steeper gully banks. These are illustrated in Figure 1.4.

The Golf Course occupies an area that appears to have been formed as a coastal swamp. The low marginal sand dune area would, under normal circumstances, have led to ponding of water on the golf course land. Several of the larger valley systems discharge into this area, and drains have been cut through to discharge the flows to the coast. While these drains are on private (golf course) land, and appear to have been altered to provide improved drainage efficiency, they remain the principal flow path for natural water from upstream areas. Under common law, the Golf Course is obliged to accept this water, and pass it safely through the property.

1.3.5. Stream receiving environment

There are a number of streams in the area, with differing values. The significant ecological sites are identified in Figure 1.6.

In the northern residential area there are no significant streams, although there is a small wetland upstream of the piped drainage system at the Beach Grove/Omokoroa Road intersection.

North of the railway, the streams do not appear to have high ecological values apart from one short stream on the eastern coast. This reflects their highly modified state, and their generally ephemeral nature. However, the gullies have been identified as being an important landscape feature of the area, and protection of this is warranted. There is potential, either in conjunction with future development or under current land use, to enhance the ecological value of the stream corridors with appropriate riparian and marginal planting, and protection of the gully system. There are several degraded wetland areas (e.g. upstream of Kayelene Place) which may have fishery values, if the downstream channel and culverts permit fish access. This stream drains a significant area south of the railway.

The principal stream with identified ecological values is that south of Proles Road, discharging to the Waipapa Stream. There is also a small wetland area with significant ecological values adjacent to SH2, in the southeastern corner of the Peninsula. This stream discharges to upstream limit of Mangawhai Bay.

There are extensive areas of significant ecological value identified along parts of the coastline. These must also be considered in terms of the effects of development on the quantity and quality of stormwater discharge.

Under current levels of development, there is no evidence of significant stream erosion.

1.3.6. Harbour receiving environment

All the streams on the Peninsula discharge to Tauranga Harbour. The location of the Peninsula is such that it is towards the upper extent of the tidal flows that discharge to the Tauranga (southern) entrance, rather than the Katikati Entrance. The extent to which tidal flushing is effective in the Omokoroa area is not well understood. The area has been included in some water quality monitoring work carried out by EBOP. This work indicates that there is some sedimentation, but few other contaminants in the streams and coastal waters of the Peninsula. The exception is bacteriological levels, which appear to be relatively high in some specific sites. This has been linked to poor design and operation of septic tanks in some locations on the Peninsula, notably the Beach Grove and wharf areas, and nearby the bowling green on the western coast. High groundwater levels are also a contributing factor, and are influenced by the methods used to manage stormwater runoff. EBOP is addressing the issue of septic tank design and management in Omokoroa as part of a wider programme to reduce bacteriological contamination in receiving environments. WBOPDC is upgrading stormwater reticulation and eliminating the use of soakage.

Studies in the Tauranga area indicate that higher levels of contaminants in the Harbour are generally related to industrial activities. Therefore contaminants such as heavy metals are unlikely to be a major concern for the primarily residential developments expected at Omokoroa, and specific measures are unlikely to be needed for quality improvements for the existing urban area, except in specific high traffic areas.

There is evidence from recent (unpublished) EBOP work that in the southern Tauranga Harbour there has been a 50% decrease in sea grass beds in the past 40 years. This is attributed largely to sediment effects, both from rural and urban development and land use practices. There is therefore an "effects based" justification for control of sediment discharge, and EBOP will expect any development proposals for Omokoroa to address the control and reduction of sediment discharge to Tauranga Harbour.

1.4. URBAN DEVELOPMENT

1.4.1. Urban development

Future development in the Omokoroa area will be from a combination of two forms:

- Infill, increasing the density of housing in existing developed areas leading, through increased roof and paved areas, to increasing stormwater runoff.
- Greenfield, where new areas are developed, along with appropriate infrastructure.

There are other effects of growth and infrastructure improvements on stormwater disposal:

- A tendency towards improved roads, with kerb and channel, concentrates flows and leads to increased storm runoff in the drainage system, increasing the costs and difficulties of conveyance safely to the outlet. Generally these "improved" drainage systems reduce the water quality of the discharge, carrying contaminants quickly and efficiently to the receiving environment, where they accumulate.
- Moving from septic tank disposal of sewage towards a reticulated system can permit greater use of stormwater disposal to the ground where this is appropriate from a geological perspective. This is unlikely to be possible in much of the Omokoroa Peninsula, due to land stability constraints related to groundwater movement. Retention of the septic tank systems further mitigates against the use of soakage disposal as the resulting higher groundwater levels flood septic tanks and lead to poor treatment and more direct discharge of faecal coliform.

The area to the south of Tralee Street has significant potential for development. The SP work looked at a range of options, from full conventional residential development to lifestyle and large lot development. The SP focused on the area north of the railway, and a preferred concept was developed for this area. In addition, there was provision made for possible future commercial and industrial development in the west, near SH2. This SP layout is midway between the two limits of development concept. There are significant areas of "conventional" housing, a limited amount of high density, and also some rural residential. A primary driver in the selection of the SP concept was the desire to retain as far as possible the natural character of the Peninsula. This has resulted in a landscape design that includes significant stormwater reserves and reserve linkages, protection of some other key landscape features, and encouraging the use of complementary concepts for subdivision layout and servicing.

In order to assess the effects of development on stormwater runoff, this study has taken the proposed SP, and developed a conceptual layout with similar characteristics for the area between SH2 and the railway. This has been used for stormwater flow calculations for the future "developed" scenario. The concept plan is shown in Figure 1.5.

1.4.2. Drainage infrastructure

The existing urban area is serviced with water supply and some stormwater, but relies on septic tanks for disposal of sewage. In recognition of the sensitivity of the soils, and the effects of overland flows on the cliff edges, the piped stormwater system is generally designed to a standard of 50 year return period according to the Stormwater Development Report prepared by Bruce Henderson Consultants Ltd (BHCL). This is

high compared to common practice elsewhere in New Zealand, and exceeds the normal WBOPDC standards. These standards are discussed further in Sections 1.5.2 and 1.5.8.

Most of this stormwater drainage system discharges directly to the coast, and generally through many small pipe outlets. Erosion at some of these outlets is an issue. There are reportedly (WBOPDC pers. comm.) some soakholes in use, but these are being progressively phased out.

The Stormwater Development Report (BHCL1991) has reviewed the adequacy of this system for present development, and makes recommendations on upgrading works. This is described in more detail under Section 1.5.1. The present study has not reconsidered these recommendations for the urban area, as there is not expended to be significant increased runoff from these areas from future development.

Both the retirement village and the residential area off Kayelene Place have their own stormwater drainage systems, which discharge to drains running through the golf course.

The remainder of the Peninsula uses unlined open channels and natural stream drainage systems. In some areas this includes the use of swales for road drainage. Apart from a few very local problems, this approach appears to be adequate, and the concept is sound for future development, subject to appropriate development management strategies.

In calculating flows for the "developed" scenario, it has been assumed that within each subdivision development there will generally be piped drainage systems, which will require treatment of stormwater for sediment reduction, and also detention for the attenuation of flood peaks. In the middle to upper reaches of the streams, the need to protect the channel against erosion means that attenuation of the post-development 2 year ARI flood to a peak less than the undeveloped peak is needed. In the middle to lower reaches, this is still an issue, but attenuation of the 100 year ARI peak is also required, to protect downstream properties from flooding. So long as adequate flood plains are in place in the upper reaches, this is less of an issue in those areas.

1.5. EXISTING DATA AND REPORTS

The work for this study is based on review of available data, including those documents detailed in the following sections.

1.5.1. Stormwater Development Report, Omokoroa (April 1991)

The Stormwater Development Report for Omokoroa (BHCL 1991) covered the urbanised northern part of the Peninsula in some detail, and southern parts of the Peninsula in less detail. It focused primarily on the piped drainage system, and recommended specific pipe upgrading works. These works were to a value of $1,067,000. These upgrades have not yet been carried out. The plan does not appear to have identified or mapped flood risk areas. Rather, it has sought to ensure that the 50

year ARI flood was piped to the estuary in all cases. Further, it does not address stormwater quality issues, and the effects on the receiving environment.

This new SWMP includes most of the works recommended in the BHCL report.

1.5.2. Asset Management Plan for Stormwater (October 1998)

The WBOPDC goal for stormwater asset management plan is "to ensure a clean and healthy environment that sustains the diversity of life in the Western Bay of Plenty, and to ensure that areas of important environmental, cultural and heritage values are protected".

The basic policy is that "*Stormwater must be controlled in a manner that will avoid erosion, increasing groundwater pressure and pollution of existing water courses (4.4)*". This will involve:

- minimising the use of soakholes,
- having discharges enter defined water courses and not over or onto steep slopes
- having discharges of road run-off at frequent intervals to reduce concentration of flow.

The AMP states that the Omokoroa area has;

- 2,786m of open drains
- 11 soak holes
- 196 catchpits
- 173 manholes
- 10,739m of pipes, approximately 90% are concrete and approximately 80% are 300mm diameter and smaller. These are primarily in the northern, urban part of the peninsula.

The level of service for the Omokoroa stormwater system has been assessed as part of the improvement plan (AMP 5.1, 5.7). The levels of service proposed in the AMP (6.7) for Council stormwater systems throughout the District are:

1. *That stormwater drainage does not cause significant hazard to the public health and safety.*
2. *That stormwater arising from a 100 year storm event does not enter dwellings constructed in accordance with the requirements of the WBOPDC District Plan.*
3. *That no property (residential, commercial to industrial) experiences surface flooding arising from a secondary flow path during a 1 in 5 year return period storm.*
4. *That wherever practicable, stormwater overflows from pipes, drains or swales be directed through defined overland flow paths.*
5. *All complaints received about stormwater will be responded to inside 24 hours.*

To date these proposed levels of service do not appear to have become part of the design Standards (see Section 1.5.8). However, they are generally compatible with standards adopted in other parts of New Zealand.

No stormwater system renewal or capital works are planned for the Omokoroa area through to the year 2017 despite the recommendations in the BHCL report.

The Stormwater AMP is currently being updated. The revised document has not been reviewed in this study.

1.5.3. EBOP Transitional Regional Plan

Two general authorisations, GA 7 and GA 8 primarily cover the issues with respect to stormwater in the current plan. The Transitional Regional Plan below gives more consideration to the whole water quality issue and the fact that it is related to many aspects of land use management and change.

General Authorisation 7.
This authorisation deals with the construction of dams. It allows for small dams to be constructed under the following conditions.

- The spillway height is less than or equal to 1.5m.
- The construction of the dams be notified.
- There are no adverse effects on the adjacent land.
- There are no adverse effects on fisheries, wildlife and aquatic life.
- Erosion control measures are in place in the spillway area.

Any dam that does not meet these conditions will require a resource consent.

General Authorisation 8.
This authorisation deals with the discharge of stormwater to natural waters. It allows for stormwater discharges to natural water under the following conditions.

- The maximum discharge be no greater than 80 litres/second or the flow from a 300mm pipe laid at a flat grade.
- The suspended solids concentration be no greater than 150g/m^3.
- The water discharged to be substantially free from grease and oil.
- The discharges works shall be constructed such that it shall not cause flooding or erosion or adverse effects to land owned or occupied by other people.

Any discharge that does not meet these criteria will require a resource consent.

1.5.4. EBOP Operative Regional Land Management Plan

The Proposed Regional Land Management Plan provides policies and methods to apply these policies. There are key issues in this catchment management plan affected by these policies. These key issues include water quality, erosion, riparian areas, wetlands, earthworks and stream works.

The key issues are interdependent in many ways. This requires a holistic approach to considering changes in land use. The water quality is perhaps the most dependent issue. All other issues will affect water quality in some way.

Water Quality

There are natural processes that transport the water from where it lands during a rainfall event to the receiving water. In this case the receiving water is a stream or eventually the Tauranga Harbour. These natural processes such as infiltration, detention, evaporation, overland flow, sediment transport, erosion and biological decomposition are all part of the water quality issue. All land use changes affect the balance of the above natural processes.

As an example, (2.3, 6.4, 7.5.2 of the Plan) water quality can be affected by stock grazing in the following ways;

- The stock introduce nutrients to the water.
- The stock can reduce the infiltration of water by compacting the ground, which will increase overland flow.
- The stock can reduce the grass cover on the soil, which increases the entrainment of fine soil particles as raindrops impact on the bare soil.
- If the stock graze steep slopes the overland flow increases.

Riparian Margins

This is a specific horizontal distance from a water body. The magnitude of the distance depends on the water body (i.e. lake, stream, wetland etc.) and the slope of the land. This margin is used via vegetation choice to improve the quality of the water that passes through it and thus protect the quality of the lake, stream or wetland.

The riparian margin can filter and slow down overland flow thus reducing suspended solids in the receiving water. The vegetation can also stabilise the stream of river banks and reduce stream erosion. The riparian margin may be an area where biological decomposition of deposited sediments occurs. It is primarily a tool for water quality improvement. The permitted, discretionary and controlled activities in the riparian margin are listed in Section 10.5 of the Plan. The rules that have direct relevance to the riparian margins are;

- 10.5.1 Exotic and Plantation Vegetation Disturbance.
- 10.5.2 Indigenous Vegetation Disturbance.
- 10.5.3 Clearance of Exotic and Plantation Vegetation by Burning.

- 10.5.4,5 Small & Large Scale Earthworks.
- 10.5.6 Stream Crossings.

Stream works
These are construction works in a river or stream. They all require a resource consent or must be expressly allowed for by rule in the regional plan. These activities are strictly controlled as they have a significant potential to initiate erosion and sediment transport and thus reduce water quality. Section 10.5.6 allows for the construction of culverts up to 900mm diameter, single span bridges for catchments of up to 100 ha and fords with a low flow water depth of up to 600mm. These are permitted activities. Larger stream works are discretionary activities.

Earth works
Earth works have the potential to produce large amounts of suspended sediments, which reduce water quality. Greater slope on the site intensifies the sediment production and high percentages of clay in the soil will also magnify the problem. There are specific practices for minimising the erosion specified in the Land Management Plan. See Section 6.5 of this document.

Wetlands
Wetlands are natural or man-made depressions which "*are permanently or intermittently wet ... water margins that support a natural ecosystem of plants and animals that have adapted to wet conditions*". Ideally they are bounded by riparian margins and together with these margins they are effective tools for the improvement of stormwater quality. The regional plan promotes the protection and enhancement of the existing wetlands (10.5.7).

1.5.5. EBOP Proposed Regional Water and Land Plan (2002)

EBOP has developed a Proposed Regional Water and Land Plan (RWLP) which integrates the Regional Water Plan and the Regional Land Management Plan.

The current Land Management Plan is now operative and the current policy developed in the Land Management Plan continues in the interim until such a time as the policy in the new RWLP supersedes it.

As such no consideration needs to be given to the RWLP.

1.5.6. EBOP Proposed Regional Coastal Environmental Plan (version 9.0, June 1999)

The entire Omokoroa Peninsula is part of the Coastal Management Zone (3.3.2). This zone covers most of the coastline in the Bay of Plenty. These are unmodified areas of coastline. The above plan focuses on the protection of these unmodified areas such that

changes in land use will not adversely affect the coastline environment. This protection seeks to keep stormwater flows at the same magnitude and quality, as they would be from an undeveloped catchment. It is recognised that there may well be uses and developments which would be appropriate within this zone.

Mangawhai Bay on the southern coast of the Omokoroa Peninsula has been identified as a significant Area of Flora and Fauna (SSCMA-10). Relevant policies for this area are contained in Chapter 6.

There are many policies that govern the discharge of stormwater to the coastal environment (9.2.3). These policies promote the following;

- The integration of the management of water quality in the coastal marine area (C.M.A.) with the management of land use and freshwater.
- The setting of water quality standards.
- The installation of stormwater treatment devices in new of upgraded stormwater systems.
- The use of monitoring programmes to ensure the above policies are achieved.

Two key areas of policy are related to discharges of stormwater and disturbance and deposition in the coastal environment.

Discharges

Any discharges is a discretionary activity except as expressly provided for or prohibited by other rules to this plan (9.2.4).

The discharge of stormwater for the C.M.A. is permitted if the suspend solids concentration does not exceed 150 $g.m.^{-3}$, that the water is substantially free of grease, oil, scums and foam, are that the maximum discharge does not exceed 80 litres per second for a 20 AEP storm event.

Disturbance and deposition

The land use also has implications on the disturbance and deposition that occurs in the coastal environment, (14.1). This includes things such as:

- The adverse effects of stock grazing and trampling
- The disturbance that is caused by construction and maintenance of open drains.
- The adverse effects of the disposal of spoil.

The PRCP provides for disturbance and deposition within the C.M.A. only as appropriate. Policies (14.2.3) provide for disturbance and deposition where necessary to protect the integrity of drainage schemes and to discourage channelisation of piping of streams flowing into estuaries or harbours.

1.5.7. WBOPDC Proposed District Plan (February 2002)

This version of the district plan recognises the value of improving stormwater quality, managing riparian zones and the enhancement and protection of wetlands. These are listed among the significant issues in Section 9.1 of the Plan. The above recognition of the value of higher quality stormwater, riparian areas and wetlands is echoed in the policies and rules.

Section 12 provides for the protection of the coastline and corresponding ecological features with respect to natural hazards. A key policy within this Section (12.2/2/4) is to ensure that new subdivision, land use activities or other development is located and designed so as to avoid need for further hazard protection works. Subdivisions are primarily covered by Section 15. This section defines the District Council policies and rules about the type of land use and the services that must be supplied with respect to the developer and the landowner. The key issues in this section are defined in 15.3.5.5 these include:

- The stormwater system must provide adequate safeguard of people from injury and illness and property from damage by surface water.
- Primary flow is to be contained in a pipe system and secondary flow paths provided for large runoff events and occasions when the pipe system fails.
- Return periods for design vary from 5 to 100 years depending on the facilities in the flood plain.
- Adequate provision shall be made for the collection and disposal of stormwater runoff from impermeable surfaces.
- Design and construction life of the drainage system shall be 50 years.
- Damage to the environment both during and after subdivision construction shall be minimised or avoided.

1.5.8. WBOPDC Design Standards

The design standards include specification of the design storm, drainage work guidelines and criteria for stormwater discharges that will not require a consent. These are defined in detail in the *Western Bay of Plenty Subdivision and Development Code of Practice* (February 2002), and are given below.

<u>Design storm size</u>
The hydraulic design of stormwater systems shall meet the following standards;

- A 100 year return period flood for design of stormwater systems to protect major communal facilities related to supply of electricity, telecommunications, and water and sewage disposal systems and bridges
- A 50 year return period flood for design of stormwater systems to protect residential property, commercial and industrial buildings

- A 10 year return period flood for design of stormwater systems to protect important recreational fields, and streets without alternative access
- A minimum 5 year return period flood for any primary (piped) stormwater system in the District.

There is a range of other standards and design requirements set out in the C.O.P.

Stormwater discharges
The discharges that do not require a discharge permit must meet the criteria of GA 8 in the Transitional Regional Plan.

1.5.9. Existing consents

EBOP report (1999) that there is only one set of consents on the Omokoroa Peninsula relating to discharge of stormwater. This is for the Omokoroa Country Estate, and required construction of a detention dam to reduce the effects of peak flood discharge on the downstream land (primarily the golf course).

There may have been additional consents issued since the original data was collated, but these have not been considered in this SWMP.

1.5.10. Other data

The following additional sources of data have been used in this study:
- Aerial photographs, with 1m interval contours, pipe system layouts and constraints maps, all on a DCDB and plotted at 1:5000 scale.
- Resource consent hearing evidence relating to water quality issues in Tauranga Harbour.
- Site visits, discussions with WBOPDC and EBOP staff, meetings with representatives of the Golf Course and the Omokoroa Country Estate, and input from public consultation.

Site work has included both team meetings and inspections, and specific stormwater-related inspections.

2. HYDROLOGY

2.1. THE STUDY AREA

The physical area of the study introduced in Section 1.3 stretches from the northern tip of the Omokoroa Peninsula to SH2. The soils and geology are also defined in Section 1.3 of this report. Ninety percent of the Omokoroa Peninsula drains to the north-west via the major catchments (Figure 1.4). The remaining catchments drain to the south-east.

For the purposes of this study the area has been divided into thirty catchments. The first 17 are those dealt with in the BHCL report. The catchment numbering system initiated in the BHCL report has been continued in this plan, except that catchments OM18 to OM21 have been redefined.

Hydrological analysis has been performed as part of this plan for 12 major catchments from south of the existing urban area up to SH2. These are shown as catchments OM18 to OM29 on Figure 1.4. Each of the 12 major catchments has an associated stream or streams of some form. Three of these streams are of ecological significance (Figure 1.6). The major catchments have main channel lengths of 800m to 2000m and average slopes from 0.01m/m to 0.04m/m. The streams are all first or second order and typically have steep gully reaches.

2.2. DESIGN FLOOD METHODOLOGY

2.2.1. Existing Urban Area

For catchments OM1 to OM17 the analysis by BHCL has been adopted. This analysis used the rational formula. The design flows are listed in Table 2.1.

Table 2.1 Design Flows – Existing Urban Area, Existing Land Use

Catchment	*Area (ha)*	*Peak flows (m^3/sec)*					*Land use*
		Q2	*Q5*	*Q10*	*Q50*	*Q100*	
OM1	0.4	-	-	*0.05*	0.07	*0.08*	Res
OM2	2.8	-	-	*0.25*	0.38	*0.44*	Res
OM3	Coastal	-	-	na	na	na	Res
OM4	2.3	-	-	*0.22*	0.34	*0.40*	Res
OM5	8.7	-	-	*0.72*	1.1	*1.3*	Res
OM6	7.6	-	-	*0.79*	1.2	*1.4*	Res
OM7	12.3	-	-	*0.72*	1.1	*1.3*	Res
OM8	Coastal	-	-	na	na	na	Res
OM9	1.5	-	-	*0.18*	0.27	*0.32*	Res
OM10	2.4	-	-	*0.23*	0.35	*0.41*	Res
OM11	2.3	-	-	*0.19*	0.29	*0.34*	Res
OM12	2.3	-	-	*0.18*	0.27	*0.32*	Res
OM13*	15.1	-	-	*0.79*	1.2	*1.4*	Res
OM14	4.2	-	-	*0.32*	0.49	*0.57*	Res
OM15	Coastal	-	-	na	na	na	Res
OM16	Coastal	-	-	na	na	na	Res
OM17*	2.1	-	-	*0.11*	0.16	*0.19*	Res

* These areas will need to be increased slightly to match the BCHF work for the southern zone.

The Q50 values are from the BHCL report. These have been adjusted using regional correlation factors to estimate the Q10 (Q50 x 0.66) and the Q100 (Q50 x 1.17) flow rates.

Coastal discharges are distributed, and have not been calculated.

2.2.2. Future Development Area

The main Omokoroa catchments south of the present urban development are relatively small in a regional sense, with short steep channels. These catchments are susceptible to short duration high intensity rainfall events. These are possible at any time of the year in the Bay of Plenty. A 24 hour storm containing shorter duration intensities of the same return period was used to generate the expected runoff flows for these catchments and subcatchments.

Methodology

The stormwater runoff was estimated using the methods outlined in "Guidelines for Stormwater Runoff Modelling in the Auckland Region". These guidelines were completed in 1999 by Beca Steven for the Auckland Regional Council. They are based on the United States Soil Conservation Service rainfall runoff model contained in

Technical Release No.55. This methodology has been adapted to the Auckland region and can be easily applied to other parts of the country.

There are two aspects of the application of this methodology to the Omokoroa area that require some explanation. Firstly the soil types chosen as representative of this site were based on soil maps of the area and the behaviour of the soil in rainstorm situations. Secondly the shape of the rainfall depth/duration graph for Auckland (at Albert Park) & Omokoroa was compared to check that the profiles where similar.

The key inputs to calculating a flow via this method are:

- The soil type, cover description and percentage of impervious area are used to give a curve number (CN) for each component of area in a catchment which are combined to give a weighted CN for the catchment. These curve numbers are key values and have a similar function to the runoff coefficient in the rational method.
- The slope, length and characteristic of the main channel and the curve number are used to develop a response time for the catchment.
- The twenty-four hour rainfall depth for the return period of the storms being considered.

Key assumptions for each type of land use are given below.

Land use	***Description***	***Percent impervious***
Rur	Rural or reserve	2%
RRes	Rural residential	15%
Res	Medium density residential	50%
HRes	High density residential	80%

A standard spreadsheet was used to calculate flow for the major catchments each of the principal subcatchments. In some coastal areas minor catchments were grouped to give a total discharge to a length of coastline. The complete results are summarised in the tables to follow.

Design flow results for existing landuse

The design flows relative to the existing land use for each major catchments are shown below in Table 2.2. The major land use categories are listed in order of the percentage of the catchment they represent (i.e. catchment OM18 has the largest percentage of Rural/Reserve (Rur) land use and second next percentage of land use is Residential (Res)).

Table 2.2 Design Flows – Future Development Area, Existing Land Use

Catchment	*Area*	*Peak flows (m^3/sec)*					*Land use*
	(ha)	*Q2*	*Q5*	*Q10*	*Q50*	*Q100*	
OM18	49	1.3	2.1	2.7	4.3	5.0	RRes
OM19	20	1.0	1.6	2.1	3.3	3.8	RRes
OM20	92	2.4	3.9	5.0	7.8	9.1	RRes
OM21	139	2.7	4.5	5.9	9.2	10.7	Rur
OM22	12	0.5	0.9	1.2	1.8	2.1	Rur
OM23	30	1.0	1.7	2.1	3.3	3.9	Rur
OM24	18	0.7	1.1	1.5	2.3	2.7	Rur
OM25	57	2.2	3.7	4.8	7.5	8.7	Rur
OM26	21	0.5	0.8	1.0	1.6	1.9	Rur
OM27	59	1.6	2.7	3.4	5.3	6.1	Rur
OM28	127	3.2	5.2	6.7	10.2	11.8	Rur
OM29	41	1.7	2.9	3.7	5.8	6.7	Rur
Total	**665**						

Design flow results for future landuse in main catchments

The design flows relative to the future land use for each major catchment are shown below in Table 2.3. The major land use categories are again listed in order of the percentage of the catchment they represent. Figure 1.5 shows the future land use scenario and the catchment areas.

Table 2.3 Design Flows – Future Development Area, Future Land Use, Without Mitigation

Catchment	*Area*	*Peak flows (m^3/sec)*					*Land use*
	(ha)	*Q2*	*Q5*	*Q10*	*Q50*	*Q100*	
OM18	49	1.6	2.6	3.4	5.2	6.1	Rur, Res
OM19	20	1.2	1.9	2.4	3.7	4.3	Rur, RRes, Res
OM20	92	4.0	6.3	7.8	11.4	13.0	Rur, Res, HRes
OM21	139	4.0	6.4	8.1	12.2	14.0	Rur, RRes, Res
OM22	12	0.58	0.95	1.2	1.9	2.2	Rur
OM23	30	1.1	1.7	2.3	3.5	4.1	Rur, RRes
OM24	18	1.2	1.9	2.4	3.5	3.9	Rur, HRes
OM25	57	2.6	4.2	5.4	8.3	9.6	Rur, RRes, Res
OM26	21	0.78	1.2	1.5	2.3	2.6	Rur, Res, HRes
OM27	59	2.4	3.7	4.7	6.9	7.9	Rur, RRes, Res
OM28	127	5.1	7.8	9.7	14.1	16.0	Rur, Res, HRes
OM29	41	2.5	3.9	5.0	7.5	8.6	Rur, Res, HRes
Total	**665**						

The possible increased urbanisation of the study area has produced increases in runoff of:

- up to 20 percent for catchments OM18, OM19 and OM20.
- from 21 to 30 percent for catchments OM20 and OM25.
- from 31 to 40 percent for catchments OM23 and OM21
- from 41 to 50 percent for catchments OM26, OM27, OM28, OM29.

The catchments where there is already some residential development or where the amount of future development has a large percentage of reserve have shown the least increase in stormwater runoff. Those catchments that were previously rural residential and would become residential or high density residential have shown larger increases in runoff. It may be appropriate to provide for retrospectively addressing the effects of the existing residential areas (within the future development area) by increasing the capacity of flood attenuation and water quality treatment devices.

Secondary flow paths

The adopted philosophy has been to assume that open channels will be used where possible. This would mean that primary and secondary flow paths are located together for the principal stormwater reserve areas, while the tributary catchments would have piped and swale drainage systems. The issue of secondary flow paths must be addressed by each developer as part of an application for a resource consent for subdivision.

2.2.3. Subcatchment analysis

The hydrological analysis has been taken from the major catchment level to focus on portions of the subcatchments or whole subcatchments. These key subcatchments are the primarily the areas where land use changes will occur.

The SCS methodology was used with typical values of land slope, drainage path length, land use type and area. The results of this section of the analysis form the basic inputs for the design of the stormwater management devices in Section 6.8. The percentage increases in flow from the various subcatchments are typically higher than for the major catchments. This is because change in land use generally forms a greater percentage of the catchment area.

3. STORMWATER QUALITY

3.1. OBJECTIVES

As a result of the requirement of the RMA that regional and territorial authorities incorporate into their planning statements and mechanisms to implement the sustainable management of the environment, stormwater quality has become a significant aspect of regional plans. Stormwater quality is referred to in policies in the EBOP Proposed Regional Land Management Plan. This Plan has policies to promote consideration of the effects of land use changes on water quality, the protection and enhancement of wetlands/riparian areas and controls on earthworks and stream works. The Proposed Regional Coastal Environmental Plan has specific policies that govern stormwater discharges to the coastal area.

The Transitional Regional Plan and the Regional Coastal Environmental Plant contain some guidance about water quality issues. General Authorisation 8 is used for small discharges of stormwater to natural water. This includes discharges up to 80 litres/second and requires that the suspended solids be less than 150g/m^3, that the water be substantially free from grease and oil and that no erosion occur as a result of the works. In conjunction with the general authorisation EBOP Technical Report No. 28 (Erosion and Sediment Control Guidelines for Earthworks) gives more useful methods of reducing sediment in runoff from earthworks.

Some aspects of long-term water quality of runoff from established sites are not addressed by this Plan. These aspects include nutrient concentration, heavy metal concentrations and odour problems. These are generally not a concern in Omokoroa although bacterial concentrations related to septic tanks are a problem in some locations. The main sources of degradation of the stormwater quality are sediments and contaminants attached to the sediments from roads, construction sites and residential areas.

3.2. OPTIONS

There are three basic approaches to improving the quality of stormwater runoff from urban areas. The *source of the degradation of quality can be controlled*, the amount of *runoff can be reduced* and *treatment devices* can be employed to reduce quantities of contaminants in the water.

3.2.1. Source Control

The source control options for the Omokoroa area are;
1. On-site treatment devices for commercial or industrial areas.

2. Roadside cleaning via swale drains, enviropods, vegetative filter strips and maintenance of the road side drains.
3. Education of the public about stormwater quality.
4. Control of illegal dumping.
5. An effective wastewater reticulation and treatment system.

3.2.2. Runoff Reduction

Runoff reduction reduces the total volume of water to deal with by promoting more infiltration to the ground water system. In the Omokoroa area this appears to contribute to the instability of the cliff areas. There may however be areas where infiltration is appropriate. This is likely to be primarily in lower lying areas, below and remote from steep slopes, and would be accomplished by the use of infiltration devices such as soakpits.

3.2.3. Treatment Devices

The treatment devices will either transform the contaminant via biological and/or chemical reactions to a less harmful substance, or they collect contaminants via filtration and sedimentation. These devices can be used at the outlet of a catchment as an end treatment, or throughout the catchment to catch contaminants at the source, or close to the source (for non-point sources).

The concept that is proposed in this Plan is to protect and enhance the stream environment. For this to be effective most stormwater quality improvement and flood attenuation must occur before the flows reach the stream. This is achieved by treating each subcatchment or drainage system before it discharges to a stream.

3.3. RECOMMENDED MEASURES

3.3.1. Source Control

On-site treatment should be handled on a case by case basis. The developer would show how he would meet the water quality standards or some portion of them before he receives a consent.

The roadside cleaning via swale drains and vegetative filter strips will be detailed below in Treatment Devices.

Source control options 3 & 4 are a matter of Regional and District Councils taking ownership of these tasks, and option 5 is discussed elsewhere in this Plan.

3.3.2. Treatment Devices

The treatment devices include riparian margins, swale drains, vegetative filter strips, enviropods, wetlands, forebays and detention ponds.

Typically the effects of urban development and land use change are to produce more stormwater at larger peak flows and carrying contaminants (including sediments) that adversely effect the habitat and environment quality in streams, wetlands, rivers, estuaries and finally the sea. The stormwater treatment devices attempt to counteract the effects of land use changes by slowing down the stormwater, protecting erosion prone areas, filtering runoff and providing environments for sedimentation and biological remediation.

Riparian Margins
Riparian margins are the vegetated areas around water bodies and would be promoted according to the proposed regional plan. They would occur in all the stormwater reserve areas. These reserves are shown for the proposed future land use in Omokoroa in Figure 1.5. They promote the removal of suspended solids in the stormwater and use sedimentation filtration and infiltration as key treatment mechanisms before runoff reaches a water body. They also provide cover and improve the habitat of streams.

Swale Drains
The swale drains are vegetated channels that convey stormwater runoff and can replace or complement the conventional piped systems. They can attenuate stormwater flows, act as a filter and settling area and provide partial contaminant removal. It proposed that they be the primary and secondary flow path in many areas of Omokoroa. They can be used in the following situations;

- Carpark drainage.
- Reserve drainage.
- Roadside drainage in lower density residential areas.
- Roadway median strips.

Swale drains promote ground water recharge through increasing the infiltration. The location (and possibly the design) of these drains will have to be considered along with the instability issue associated with groundwater seepage at the cliff bases.

Conventional Road Drainage
Conventional road drainage will be used with the addition of filter bags for the catchpits. These filter bag units (e.g. Enviropods) capture the coarse sediment in road run-off and require regular cleaning.

3.3.3. Stormwater Quality Ponds

The treatment devices outlined in the previous paragraphs are a form of source control and are generally located in the upper catchment areas where flows are low. They may be the first treatment device that the stormwater comes in contact with. The water quality and detention ponds can handle much larger flows and can be located as single treatment devices for the entire catchment or placed throughout the catchment to give the same result as a single treatment device at the outlet. If these ponds are distributed throughout catchment then the stream habitat is protected and stream erosion can be reduced.

Wetlands
Wetlands are typically shallow (0.5m deep) with a small deeper area up to 3m deep. They provide for sedimentation and biological remediation of stormwater. They need to be protected from large flood flows. They could be incorporated with forebays.

Forebays
Forebays are ponds used to trap the coarse sediments. They protect detention pond inlets from build-up of sediments. There may be more than one for a large detention pond. The forebays may be located adjacent to a detention pond or some distance upstream. They require regular maintenance in the form of sediment removal. This sediment removal would be undertaken one or two times a year and reduces the need to disrupt the main water quality pond. The key aspect of design for these ponds is that the water velocity be less than 0.25m/s for the 1.5 to 2 year ARI flood. In Omokoroa they are shown as single treatment devices at the outlet to the sub and main catchments but they could be installed throughout the catchment also (see Figure 6.2). If they were dispersed this would provide better water quality inside the catchment. This dispersed treatment would be appropriate where catchment streams have ecological significance.

Detention Ponds
The detention ponds provide water quality treatment and flood attenuation. If forebays are installed and maintained the detention ponds would be cleared of sediment every five to ten years. They can be placed at the outlet to the sub and main catchments as end treatment devices. The above advantages of dispersed locations of these devices also apply. A key objective in the design of flood detention is protection of the stream from erosion. To achieve this objective ponds must be designed to ensure the 1.5 to 2 year ARI flood is not increased, and preferably is reduced. This affects the outlet design. In addition, for flood risk prevention the 100 year ARI flood should not increase.

Table 3.1 shows the cumulative size of these ponds for each of the major catchments in the study area. A possible location of these treatment devices is shown in Figure 6.2. There are no wetlands shown on the figure but any inclusion of a wetland would be beneficial to the stormwater quality. The wetlands would also be beneficial to the ecologically sensitive areas and within the spirit of the Regional policies to enhance

natural wetlands. The possibility of creating wetlands in stormwater reserves should be considered.

Table 3.1 Water Quality and 100 Year Flood Detention Volumes

Main Catchment	*Total Catchment Areas (ha)*	*Design Water Quality Volume (m^3)*	*Estimated Flood Detention Volume - Q100 (m^3)*	*Total Pond Volume Required (m^3)*
OM18	49	4,600	3,500	8,100
OM19	20	1,600	250	1,850
OM20	92	11,000	12,000	23,000
OM21	139	14,000	13,000	27,000
OM22	12	750	600	1,350
OM23	30	1,900	880	2,780
OM24	18	2,400	1,300	3,700
OM25	57	4,100	1,300	5,400
OM26	21	2,400	2,400	4,800
OM27	59	5,900	6,200	12,100
OM28	127	14,000	17,000	31,000
OM29	41	4,100	1,800	5,900
TOTAL	**665**	**66,750**	**60,230**	**126,980**

In most catchments the full 100 year flood storage will be included in the ponds shown in Figure 6.2. There are some catchments where this is difficult. These catchments are typically coastal, with multiple discharges such as OM19, OM25, and OM29. The flood mitigation in these catchments or subcatchments should be maximised but may not reach the 100 year storm level.

4. EROSION

4.1. REGIONAL PLANS

The control of erosion is an issue of focus in the EBOP regional plans and is included in or affected by water quality, stream works, earthworks and soil conservation. The key policies in the plan that reduce or control erosion are:

4.1.1. Earthworks and development

The erosion hazard zones (10.4 EBOP Regional Land Management Plan) in Omokoroa area are:

- *any land with a predominant slope greater than 40 degrees ;*
- *or any land within a Riparian Management Zone with a predominant slope greater than 35 degrees ;*
- *or all sand country including undulating to steep unstable coastal sand dunes, up to 200 meters landward from the line of the mean high water spring*.

Erosion and sediment control plans are required (10.4 EBOP Regional Land Management Plan) for major earth works and stream works. The key principles in sediment control are to keep clean water off site, minimise erosion and to control sediment discharge from the site. These sediment control plans include:

- *a locality plan*
- *a site map showing catchments, earthwork extents, erosion control measures and offsite source of runoff*
- *engineering drawings and specifications*
- *vegetation used for erosion control*
- *contingency plans for unexpected events*
- *construction programme*
- *monitoring and maintenance schedules*

The EBOP Proposed Regional Coastal Plan (10.2.4(a)(iii)) provides for discharge of stormwater to the Coastal Marine Area (CMA) as a permitted activity, provided the suspended solids concentration discharged does not exceed $\underline{150g/m^3}$, and the works are designed, constructed and maintained in such a manner so as not to cause erosion. These provisions are also reflected in the WBOPDC stormwater design standards. Peak flows in storms occur for a very short periods. It is difficult to measure the above suspended solids concentration and this value is not a good indicator of the total sediment load. A more useful alternative would be to focus on the total long term sediment load and promote best management practices that reduce this total load.

Erosion in Omokoroa will occur primarily where there are;
1. Earthworks with poor sediment control measures.
2. Land with little or no vegetation cover.
3. Places where the surface water is flowing over unprotected soil. These include the streams (especially the steeper areas), drainage channels and land exposed to major flood events.

4.1.2. Erosion control measures

Erosion can be controlled via;

- education of the land users,
- careful checking of erosion and sediment control plans,
- physical works that protect streams and drainage channels,
- the enhancement of wetlands and riparian areas,
- the promotion and correct design of stormwater detention ponds (especially in the upper catchment areas).

The erosion and sediment control standards that apply to land development and major construction projects must reach down to the individual builders and small contractors. The cumulative affect of many small earthworks sites produces just as much sediment as one large site. The requirement that erosion and sediment control be addressed at each building site could be incorporated into the building permit system. The monitoring could occur with key inspection times, and a bond would give the Council some leverage in this area.

4.2. STREAM EROSION

The erosion in streams is a natural process. This process is directly related to the flow of water in the streams. As flows increase in size and flood events increase in frequency the stream erosion must also increase. The stream channel will be reshaped upwards to match the larger and more frequent flows. Both the total volume of flow and peak flow from the 1.5 to 2 year ARI are important considerations when assessing stream erosion.

Erosion Reduction Measures
The possible erosion reduction measures that can be considered for the Omokoroa area are listed below. Each area will have to be given specific consideration, as no two areas will behave in exactly the same way.

1. Infiltration should be maximised by reducing the impervious areas where possible.
2. The 100 year ARI flood peaks from newly developed areas should be kept to predevelopment levels by use of flood detention ponds and water quality treatment devices.

3. The 2 year ARI flood peak should be of the order of only 30% of the predevelopment peak.
4. The riparian margins should be enhanced where required and maintained regularly.
5. The stream banks should protected with planting or riprap where appropriate.
6. Provision for sediment removal should be allowed for in the lower catchments.
7. The steep stream areas should be investigated to define the potential for erosion and the possible works required to protect these stream channels.

5. STORMWATER MANAGEMENT OPTIONS

5.1. APPROACH

The approach taken has been to initially identify key issues, options and opportunities for effective stormwater management for the Peninsula. At that stage there was no attempt to identify specific projects, or to calculate flows or estimate development costs. Rather, development and stormwater management concepts were considered, with only limited scoping covering the location of stream reserve areas. A second stage, covered in this Plan, includes flow estimates, and an assessment of possible pond locations.

From a stormwater management point of view, it is appropriate to split the Omokoroa Peninsula into a number of distinct areas, reflecting existing development and infrastructure, the nature of topography and soils and the coverage of the study area. It should be noted that wherever possible, stormwater management is best undertaken on a catchment-wide basis. While the Structure Plan has focused on the area between the railway and the existing Omokoroa urban limit, the stormwater component has encompassed (to differing levels of detail) the entire Peninsula, from SH2 north. SH2 in general represents the catchment boundary.

We have distinguished between existing urbanisation, where issues related primarily to piped system capacity and potential stormwater quality improvement, and the largely rural areas, where opportunity exists for a strategic approach to development which seeks to maintain or enhance environmental quality in association with good stormwater management practices.

5.2. KEY ISSUES

Several key issues affect decisions on stormwater management:

- There is a need to improve the quality of stormwater discharged to Tauranga Harbour. Stormwater runoff from urban areas contains sediment, heavy metals and bacteria, along with other contaminants. Improvement of the discharge quality should be considered both for existing development (where there are constraints to improvement options) and for new development areas (where the opportunity exists to plan for this in advance).
- Land stability is a major issue in many of the steeper parts of the Peninsula, and increasing stormwater infiltration increases the risk of instability. This is the basis for full piping of stormwater in the existing urban area, and will also be required in steeper parts of the new development areas.
- Development results in increased impervious areas, which have a direct detrimental effect on streams and their ecology. Increased, more rapid runoff leads to stream

erosion, which can be managed to some extent if measures are put in place to attenuate peak flows to levels that existed pre-development.

- There is a good network of small streams in the undeveloped part of the Peninsula, although the environmental quality of these is generally not high, due to significant modification associated with agricultural practices. These streams nevertheless offer a significant opportunity to work towards environmental enhancement and effective stormwater management, as well as providing for reserve linkages in many cases.

5.3. OPTIONS

In broad terms there are several approaches that can be taken to stormwater management.

1) *Do minimum*. In practice, this can only be applied to existing development areas (i.e. not to greenfield), and effectively means maintaining the existing approach to drainage. There will, over time, be specific problem areas that arise which can be dealt with on a case by case basis. This approach can also be applied (with caution) to infill development, resolving problems only as they arise, or identifying and remedying in advance the effects on the existing drainage system of a specific development proposal. It is typically reactive rather than proactive, and can result in a general perception by residents that the stormwater drainage system is performing poorly.

2) *Planned progressive improvement* of existing infrastructure to cope with problems before they arise, and with the effects of growth. This approach is more pro-active, and is based on an assumption that the existing system is fundamentally sound in concept and performance under existing conditions, and with planned improvements can cope with the effects of growth and improved performance requirements. However, one weakness common in existing stormwater systems (including that of Omokoroa) is that they make no provision for stormwater quality improvement, and therefore contribute to degradation of the receiving environment.

3) *Conventional drainage in new areas*. This approach seeks to collect water as quickly and efficiently as possible into an engineered drainage system, and convey it directly to the outlet. It generally includes kerb and channel and piped systems, and in the context of this study relates to greenfield development (most existing development is already based on conventional design). Pipe systems are generally only designed to convey the 5 or 10 year storm event, and this approach therefore requires provision of secondary flow paths (generally surface floodways) for more extreme events. In practice these secondary flow paths are often not included in subdivision designs, with the result that once the subdivision is established, flooding problems arise during severe events. In order to meet current accepted standards for stormwater management, the conventional approach will generally require that flood detention and stormwater quality improvement/treatment features be included in the design. These detention and/or treatment devices can occupy significant areas of land, but

with appropriate design can in some instances be incorporated into multi-purpose reserve areas.

4) *Low impact design*. This method seeks to reduce the effects of new or existing development on the environment, using drainage systems that mimic natural systems, and retaining or even enhancing existing natural drainage features and vegetated areas. The approach seeks to hold back storm runoff within the system, increasing infiltration to the soil and reducing storm peak flows and volumes.

   With appropriate design, sediment and other pollutants can be retained or "treated" within the drainage system, reducing the effects on the receiving environment (especially the estuary). Road drainage will typically be by swales and infiltration and vegetated open channels will be used wherever practicable (see Figures 5.1 and 5.2). It is still likely that ponds will be required in some places for stormwater quality improvement and flood peak attenuation, but these will generally be much smaller than with a conventional approach.

   The reduction of impervious areas and the maximising of infiltration can be achieved by using grass areas for parking and driveways, minimising paved areas by replacing (where possible) with lawns, gardens and vegetation filter strips (see Figures 5.1 and 5.2). If the low impact design philosophy is not adopted then the upper catchments will require larger ponds for stormwater quality improvement and flood attenuation.

In practice, a mix of 3 and 4 is likely in future development areas of Omokoroa. This SWMP provides full capacity ponds as a robust backup to any areas where low impact design might be used.

6. RECOMMENDATIONS

6.1. GENERAL

The initial constraints mapping has identified a number of natural surface flow paths and streams. Whatever option is adopted for stormwater drainage, these paths should be protected. Under a low impact design they will form the principal flow path. Under a conventional design, they will be required as secondary flow paths, or could still be primary flow paths in their lower reaches. Further to this, all subdivision plans should be required to identify how these flow paths will be incorporated into and protected by the subdivision design. Further, the subdivision plan should identify any other natural or appropriate flow paths requiring protection, so that there is a comprehensive secondary flow path plan for both the subdivision itself, and for any overflows from upstream land. These protected flow paths could be provided as easements with right of access and restrictions on landowner activities through the easement. This approach will be suitable for the minor flow paths. For the major flow paths (generally those identified in the constraints map) it would be more appropriate that they become reserve linkage areas, possibly combined with footpaths or walkways. Issues of ownership and management are discussed later in this report.

All developments should be required to demonstrate how they would address:

- passage of surface flows from upstream and from the site itself
- protection of houses from flooding
- improvement of stormwater quality
- management of runoff peaks to downstream so they are no greater than prior to development, or are fully managed through to the receiving environment (e.g. the Harbour)

The recommended solution set out below involves a combination of the different approaches, as appropriate to each particular part of the peninsula.

6.2. EXISTING URBAN AREA

(Generally north of Tralee Street and Margaret Place)

This area is outside the primary scope of the Structure Plan. In most cases it has kerb and channel, with a piped drainage system. There are a few areas where there is no record of piped drainage, and we do not know what sort of system exists in those areas. It is not realistic to plan for low impact design in this area, and the most realistic option is therefore to pro-actively develop the existing piped system to cope with the effects of development. It will also be necessary to consider stormwater quality improvement where practicable.

It will be important to keep stormwater out of the ground wherever possible. Even infiltration on the upper terrace levels will potentially flow through subsurface layers and reach the coastal cliffs and steeper slopes, exacerbating the existing instability.

Generally the piped systems should be designed for the 50 year ARI event, including the upgrades mentioned in the BHCL 1991 report. While this is a higher standard than normally adopted, it is necessary in the existing urban area due to the lack of planned secondary flow paths, the risk of discharge over the cliffs and the sensitive nature of the soils in steep areas. Despite this high standard, attention still needs to be given to the provision of secondary flow paths where possible in critical areas, to cope with the scenario of the drainage system becoming blocked or the storm exceeding the system capacity. There are a number of places indicated on the constraints maps where secondary flow paths may pass through or around houses. We have not undertaken an exhaustive analysis, but only identified those that were evident from the data and site inspection. In general these areas should be protected from further development or from blockage caused by land reshaping by property owners. The areas are shown on Figure 6.3 for the existing developed area only.

Wherever possible provision should be made for stormwater quality improvement. The focus should be on areas with potentially high contaminant loadings in runoff, associated with main roads or industrial/commercial areas. Three locations have been identified. Nells Dell, upstream of the intersection of Omokoroa Road and Beach Grove, already provides partial treatment. Improved design as a wetland and redirection of flow from parts of Omokoroa Road would improve its effectiveness. Two sources of contaminants are adjacent to the Domain, the boatyard north of the domain, and the parking area and jetty to the south east. In both cases, redirection of drainage to a sand filter prior to discharge would significantly reduce contaminant discharge. In other areas there is little opportunity for specific devices in outfalls, or for source controls. Some water quality improvement could be achieved through regular catchpit maintenance, and improved catchpit facilities (e.g. inclusion of enviropods in the catchpits), especially in commercial areas or where there is significant traffic volume or parking.

The stormwater outfalls along the cliff edge are often make-shift in design, particularly the private ones, and are a potential source of erosion. These should be checked comprehensively as part of stormwater system management and maintenance and remedial measures put in place. Some of the beach outfalls owned by the Council are also aesthetically unsuitable. However upgrade of these is unlikely to be economically justified.

6.3. STRUCTURE PLAN AREAS

(North of the railway)

The area specifically covered by the Structure Plan, and identified for future development, includes areas of rural and lifestyle blocks, and some small section subdivision. There is also land that is within the existing urban limits, but is still largely undeveloped, which could be included in this area category. In some parts of this area kerb and channel is used, but there is also significant use in the less intensively developed areas of grassed swales for drainage.

There are a number of possible conceptual options for development, in terms of the type of drainage system implemented. All options will need to address the increased flows and contaminant loading resulting from development, and include means to resolve these. In broad terms the options include:

1. Fully conventional approach, with kerb and channel and piped systems throughout. This will require provision for large stormwater quality treatment devices within the drainage system, and flow attenuation and energy dissipation at the outlet. The possibility for ecological enhancement of the existing stream corridors will largely be lost, as this approach is also likely to involve significant earthworks to remove the existing landforms defining the natural streams.
2. Conventional approach, with kerb and channel then short pipes to reserved stream corridors. This will also require stormwater quality improvement devices and flood peak attenuation and energy dissipation where piped systems meet the streams. Ideally, the streams should be enhanced to provide better environmental quality, with large trees in the stream corridors, and riparian planting along the stream banks. In some areas (especially higher density) this may be the only practicable option.
3. Low impact design approaches to a greater or lesser extent. This approach is appropriate where there is a lower density of development. It could be applied to conventional residential development to varying degrees from a full implementation of low impact design, through to a modified approach which included conventional section sizes and building coverage, but with grassed swales as the primary drainage system, discharging to reserved stream corridors. The swales would already provide significant attenuation and stormwater quality improvement, and therefore there would be less need for specific separate treatment and attenuation devices. This approach is well suited to the rural residential areas, and is already implemented in parts of the rural area.

The approach adopted depends very much on the overall landscape design approach, and the "character" selected for the development. There may be scope for some variability in drainage type to match both the "character" of different blocks, and other physical constraints.

In this area it is recommended that a mix of options 2 and 3 be adopted. There are good stream corridors available, often with existing large trees. In many cases the stream gullies are well defined, and their steeper margins are best not developed, giving a clearly defined edge to the corridors. Where general land gradients are flatter, use of swales is likely to give the best approach from the point of view of overall best stormwater management practice. In the steeper areas, where infiltration must be kept to a minimum, kerb and channel and short piped systems are likely to be necessary.

The stream corridors should be kept to a width sufficient for multiple purposes, including ecological corridors, reserve linkages, and stormwater management functions. They need not be of uniform width, but can follow the contours. Wider areas will be useful for development of stormwater ponds or wetlands, and narrower areas for conveyance and linkages. General guidelines for corridor width would indicate 100m as a suitable width for principal waterways, especially where there is high ecological value. Minor streams should still have riparian corridor widths of typically 50m. Narrower corridors quickly become little more than drainage channels. Wider margins provide buffers to developed areas, protecting stream ecology, providing cover and shading, and contributing to the development of good habitat, ecological linkages and environmental quality. In terms of basic drainage corridors for Council maintenance purposes, these should be at least 20m. In the Structure Plan area there are only a few areas where wider corridors are justified.

The eastern side of the peninsula is generally steeper and there is little opportunity (apart from in a few places) to preserve stream corridors. Similarly, these areas need rapid drainage to safeguard land stability. Along the coastal margins and in the short gullies provision should be made for reserves suitable for development of wetlands and ponds for stormwater management of discharges (quality improvement and attenuation) before they reach the estuary.

The western side is flatter, and more suited to the use of swales and the preservation of stream corridors as the principal means of stormwater management and conveyance. In higher density development areas, where the proportion of impervious areas is likely to be high, piped systems discharging to attenuation and treatment ponds will be the most appropriate approach.

Figure 1.5 shows the recommended stream reserve corridors. The preliminary locations of ponds are shown in Figure 6.2. These are discussed further later in the report.

6.4. FUTURE DEVELOPMENT AREAS

(Between SH2 and the railway)

These areas are not part of the principal Structure Plan, but are part of the stormwater study. Future land use has been assumed based on a similar approach to the land between the railway and the existing urban area. The proportions of reserve, residential,

rural residential and high density residential are similar. The location of these land uses is shown on Figure 1.5.

Figure 1.5 identifies the zones in this area that should be considered for stormwater reserves. The preliminary locations of ponds are shown in Figure 6.2. In general the same stormwater management principles should be applied in this area as for the area north of the railway.

6.5. PROTECTION AND MANAGEMENT OF RESERVE CORRIDORS

Long term effectiveness of low impact design and drainage reserves is dependent on appropriate management, which in turn is strongly influenced by ownership issues. Key issues that must be addressed are:

- Ownership (Council or private)
- Access to reserves (public or restricted); with public access recreational activities would require some control.
- Long term operation and maintenance of reserves (private, District Council or Regional Council)
- Responsibility for development of riparian areas (private, District Council or Regional Council)

It should be noted that overseas and locally experience has shown proximity to reserve areas such as this enhance property value. Therefore reduction of land for development is balanced by an increase in the value of the remaining land for development.

The options to address these issues include (see Figure 6.1):

1. *Fully Council ownership and management*. This would be a significant burden on Council both for initial purchase, and for long-term maintenance, although with proper design and establishment in the first few years, long term operating costs should be relatively low.

2. *Fully private ownership and management*, but with drainage easements identified for the core stream channel, to ensure Council access in the event that remedial works were needed. The owner would be responsible for routine stream channel maintenance, but in practice this would not be a major burden on each owner. In order to protect the riparian margins, caveats would be needed on each title or a specific "riparian management zone" put in place limiting what the owner can do on that part of the property. This is only appropriate where the properties bordering the stream are large enough for the owner to develop adequate area outside the riparian management zone.

3. A third option used overseas (and with similar precedents in New Zealand) is for the ownership to be transferred to a *Body Corporate*, made up of the residents of the area (and tied into the ownership of the surrounding properties). This body would have responsibility for the enhancement and maintenance of the reserve and stormwater system, possibly subsidised by Council out of reserves and stormwater management budgets. The basis for such a subsidy would be determined from the scope of maintenance activities that the Body Corporate undertook on behalf of Council, with costs for more general enhancement coming from private sources.

4. *A combination of options 1 and 2*, with Council ownership of the core stream system (e.g. 20m width, and wider in the areas where specific stormwater management devices are needed) but with enhancement and protection of wider ecological corridors in private land. This will reduce direct costs to Council, but will have some cost to developers.

The areas involved are significant, and Council is unlikely to be willing or able to purchase the entire stormwater reserve area identified. Private ownership of the riparian margin areas would significantly reduce this cost to Council, while retaining adequate reserve corridors. While the land in reserve would have a lower sale value than if it were fully able to be developed, the total value of each of the properties containing reserve land is likely to be higher than if they were limited to the size of the area available for development. These properties are likely to attract owners who are keen on having a larger block of land, with significant areas in natural vegetation.

In conclusion, a narrow council-owned corridor is recommended to give Council full control of the drainage system, to provide for public reserve access, and to ensure easy access for maintenance. In areas where there is an existing or potentially high value stream environment or landscape, additional riparian buffers would be provided through land use controls on adjacent private land. This is the approach set out in Figure 6.2, and recommended for inclusion in the Structure Plan.

6.6. DESIGN FEATURES AND POND LOCATIONS

Figure 6.2 shows the areas where specific pond features have been identified. This is a preliminary assessment, and the final requirements will only be addressed when subdivision of each area is undertaken.

There are a number of stormwater management features identified, and key elements of these are described below.

Stormwater quality improvement ponds (see Figure 3.1). These ponds are designed to settle out sediments in the stormwater, at the same time reducing the loading of contaminants attached to the sediment. A cost-effective level of sediment removal on a long-term basis is 75%. Generally there is a forebay area, then a main pond. The forebay will take the larger sediment, and will tend to fill up more rapidly, and require cleaning out every few years. The main pond will settle finer particles, and need

cleaning perhaps on a 10 to 20 year cycle. The ponds can be normally wet or dry, the former giving the option (in the main pond) of wetland planting and habitat improvement.

Flood detention basins. These are used to reduce the peak flow rates following development (and thereby reduce the risk of increased flooding and stream erosion downstream). They can be incorporated into a stormwater quality improvement pond, or built separately. If a dry pond is used, there is considerable flexibility in how that land is used most of the time. Sports fields or grassed reserve areas are commonly used, with low banks around the margins providing the storage "dam". These areas can still be well drained under normal circumstances, but during heavy rainfall, a constriction in the downstream capacity forces the water level to build up and put the flood peak into the temporary storage.

Swales (see Figures 5.1 and 5.2). These are channels for collection and conveyance of stormwater. If designed to a suitable width and storm flow depth, and with appropriate grasses to provide flow resistance, these can attenuate flows and settle sediments. They are particularly suitable for road margins, and differ from conventional roadside drains in being wide (e.g. 1 to 2m base) and shallow with a flat or only very slightly dished base. In residential areas they can be placed along the rear boundaries of properties. They are fully grassed, and preferably that grass should be of species which can be maintained at about 150mm height with minimal mowing. On steeper slopes simple drops should be used to reduce hydraulic gradient, e.g. a railway sleeper with stones downstream to reduce the risk of scour. Specific guidelines for their use in Omokoroa area are:

- In rural residential zones
- Where grades are between 1% and 5%
- Where there are no more than one crossing per 50 metres
- No planting other than grass in the invert.

As a general principle, it is better to undertake the treatment or stormwater management before the runoff reaches the main stream, i.e. in the tributary channel adjacent to the stream. This ensures that stream quality is kept high throughout, and that fish access within the main channel is not impeded. This is not possible in all cases, but has been adopted where possible in this Structure Plan.

6.7. OMOKOROA GOLF COURSE

The Omokoroa Golf Course has been specifically addressed in this plan because of its location on flat land at the outlet of several significant catchments that are future development areas. Already several developments have impacted on drainage and flood risk on the course, and this is the area most directly affected by future development. As such, it is crucial in the effective management and discharge of stormwater from much of the Peninsula. The issues associated with the Golf Course area also provide some

insight into issues that will need to be addressed in land development and stream enhancement and management in other parts of the Peninsula.

The Course is situated on what used to be the lowland areas of five farms. It was naturally wet, and prone to flooding, although the sandy soils meant that it used to dry out sufficiently to be used as hay paddocks. The topography is low and undulating, with few natural drainage paths. The Golf Course has improved the drainage channels which had been part of the farm drainage, and which conveyed the normally permanent flow of water from five different catchments to three principal outlets through a low coastal sand dune. These channels are on private land and are maintained by the Course, even though they are in reality the principal watercourses draining much of the central Peninsula. They need regular maintenance to remove weed and accumulated sediment from upstream, but are a satisfactory means of conveyance of runoff and should be retained as far as possible. Development appears to be contributing increased sediment and nutrient, contributing to weed growth, which in turn traps more sediment and reduces channel capacity. Upstream wetland ponds, which can contribute to sediment removal and some biological nitrogen removal, would assist in maintaining downstream channel capacity.

Current problems are a mix of natural conditions and the effects of development. Housing along the fringes of the course has contributed to natural springs and seepage along the edges of the course. Flooding of the southern drain is also attributed to development, although to date there is not a significant area of development in this catchment. The Golf Course is obliged to accept the flows in the drains that come from upstream, and must safely convey these through their property to the Harbour. However, under the RMA the effects of development in the upstream catchments should be managed to avoid, remedy or mitigate the effects on the Golf Course.

The drainage outlets from the Course consist of the following:

- The western outlet discharges the main central peninsula catchment (OM21), through an open drain, a tide gate and a salt marsh and mangrove area to the Harbour. In the past the Course has modified the lower reaches of this drain, using a weir and natural ponding area to control the storage and release of floodwaters. The mangroves around the outlet have spread significantly over the years, and the channel through them has progressively silted up to the extent that it now reportedly is a constraint to discharge from the drain. However, since this marine area is identified as having high ecological value, it is unlikely that it will be able to be dredged to improve outlet flows, and alternative measures will be necessary. This drain reportedly floods several times each year, whenever significant rainfall coincides with a high tide.
- The central outlet collects water from three subcatchment areas that drain into a single natural outlet through the beach (OM20). This can work effectively but is prone to the effects of north-westerly storms, which drive seaweed and sand under a footbridge at the edge of the course, blocking the outlet. The only practical solution to this appears to be regular maintenance, which at present is carried out by the Course. A feature pond in the central channel is prone to sedimentation, but has

potential to be developed for more effective sediment management and flood detention, without detracting from it aesthetic appeal. There are currently no significant problems with flooding in this catchment, despite the increased flows from the Kayelene Place residential development.

- The eastern outlet drains catchment (OM18), which includes some of the existing urban area. There is a small pond in the Golf Course that accumulates sediment (i.e. it already serves as a stormwater quality improvement pond) and could be made more efficient as part of the overall drainage system, reducing sediment discharge to the harbour. However, it is probably more appropriate in this instance to place the primary sediment ponds upstream of the Golf Course. There is not a serious problem with flooding in this area at present, although the outlet is small even for current flows, and will not cope with the effects of development. Thus some improvements to the outlet will be needed as development occurs.

Overall there is significant potential to develop the drainage system through and within the Golf Course to increase capacity and manage flood risk on the Course (i.e. mitigating the effects of development), while at the same time providing enhanced aesthetics and course features. In addition to playing features, ponds could be used as a source of water for irrigation of the course. The current ponds are subject to algal growth in summer, and this would need to be addressed in any pond developments.

Any improvement works on the drains through the Course should take account of specific design criteria relating to safety and playability of the course, including flat side slopes, low banks and only low marginal planting of reeds, grasses and the like. This approach is compatible with objectives of improved channel flow and storage capacity, but is not as amenable to development of instream habitat.

It is strongly recommended that any works in or adjacent to the Course be designed in conjunction with the Course staff.

6.8. STRATEGIC PROJECTS

6.8.1. Major Project Areas

The strategic projects include

- Cliff outfalls for the existing urban area.
- Recommended works from the BHCL report.
- Channel protection and riparian enhancement work.
- Forebays, water quality and flood detention ponds.
- Swale drains and or enviropods for roadside drains and commercial areas.
- Work associated with the Omokoroa Golf Course.
- Water quality devices in the existing Urban area of Omokoroa.

No specific projects have been described for the cliff outfalls and the works recommended by BHCL are listed in Appendix B. The channel protection and riparian enhancement work is best scheduled after each regular inspection of the stream areas. The forebays, water quality and flood detention ponds can be estimated but a confirmation (that the total catchment requirements are being met) will be required with each new consent that is granted. An estimate of these ponds for catchments OM18 to OM29 is made in Appendix C. The swale drains and or enviropods would be incorporated in the developers' designs. The work associated with the Omokoroa Golf Course is covered in Section 6.7 and three ponds are shown Table B-1 of Appendix B as part of catchment OM20. One water quality pond and two sand filters are proposed for existing Urban area of Omokoroa. These are shown on Figure 6.2 and the volumes recorded in Table B-1.

6.8.2. Forebays, water quality and flood detention ponds

The specific location of the various stormwater treatment devices is only possible when a defined land use scenario has been developed (for example a design for a subdivision or for the Omokoroa Golf Course). At this stage the pond volumes can be estimated based on the average runoff expected from the proposed future land use. These ponds are shown in Figure 6.2 as combined water quality and flood detention ponds.

The location of the combined water quality and flood detention ponds for the upper catchment areas is shown in Figure 6.2. These ponds will have a minimum size equal to the sum of the water quality volume and the flood detention volume (see Table 6.1).

The forebay(s) can be designed and located as single or multiple ponds by the developer in his application for subdivision. These single ponds may occur as a number of smaller ponds inside the subcatchment area.

Where it is not possible or desirable to have upper catchment treatment as a major focus of the stormwater management of a particular subcatchment then end treatment should be considered. The sum of the upper catchment treatment pond volumes (water quality and 2 year flood detention) for a particular subcatchment may supply all that is required for the entire catchment as detailed in Table 3.1.

The water quality, forebay and 2 year flood detention volumes for each subcatchment have been totalled in Table 6.1. The comparison between these and the required total water quality and 100 year flood detention volumes from Table 3.1 are also given.

The table shows that the some proposed upper catchment ponds can give full water quality treatment, but large amounts of flood detention are still required for most catchments. In places the topography and economic considerations suggest that larger runoff storage/detention than is required for the 2 year flood event is best situated in the upper catchment areas. This increased storage/detention in the upper catchment areas would provide better water quality treatment but would primarily be for flood mitigation reasons.

The catchments OM21, OM23 and OM28 must have complete flood and water quality treatment in the upper catchments to protect the streams of ecological significance. Catchments OM19, OM25 and OM29 have multiple discharges with small contributing areas, and there will be some specific design required in these coastal type catchments to ensure that the stormwater runoff from these sites passes through a treatment device.

The placement of the stormwater treatment devices and flood detention ponds in upper catchments is the preferred philosophy. This philosophy protects and preserves all the ecological features of the stormwater reserves and allows greater protection of the water quality of the Tauranga Harbour. This greater protection is provided by the stormwater reserve's capacity to reduce contaminant levels in the outflow from upper catchment ponds.

It may be appropriate to provide for retrospectively addressing the effects of the existing residential areas (within the future development area) by increasing the capacity of flood attenuation and water quality treatment devices.

Table 6.1 Proposed Water Quality and 100 Year Flood Detention Volumes

Main Catchment	*Area Served By Ponds (ha)*	*Water Quality Volume In Proposed Ponds (m^3)*	*Flood Storage In Proposed Ponds (m^3)*	*% Catchment Covered*	*% Of Full Water Quality Volume*	*% Full Flood Storage Volume*
OM18	34	4,500	2,800	69%	98%	80%
OM19	0	-	-	0%	0%	0%
OM20	72	9,200	8,100	81%	84%	68%
OM21	113	14,700	14,600	81%	105%	112%
OM22	3.5	400	200	29%	53%	33%
OM23	15	1,000	700	51%	53%	80%
OM24	11	2,200	1,000	63%	92%	77%
OM25	36	2,900	1,200	63%	71%	92%
OM26	11	1,400	1,200	54%	58%	50%
OM27	38	4,700	3,700	65%	80%	60%
OM28	80	11,700	7,500	63%	84%	44%
OM29	14	2,500	1,400	36%	61%	78%
Totals	**427.5**	**55,200**	**42,400**	**64%**	**83%**	**70%**

6.9. COST ESTIMATES

The capital cost estimates are set out in Appendix C, Table C-1. These estimates provide for the works required for flood detention and stormwater quality improvement, related primarily to the principal stormwater reserve corridors. This will provide the means for setting up and maintaining a principal drainage system, based on natural channels. However it will be the developers' responsibility to connect to this principal drainage system in appropriate locations, which may require them to install pipe systems across adjacent sites.

The capital estimate for the ponds and related works is $5.21 million. Annual maintenance costs are estimated at $177,000 per year. In addition, there are estimated capital costs of $1.15 million to carry out improvement on the existing urban area.

The costs associated with developers connecting to the primary system have not been estimated, as the layout and costs will depend on the parcel sizes developed, and the approach taken by individual developers.

An approximate estimate to pipe all the stormwater instead of retaining open channels and stormwater reserves is between $4 million and $5 million. In addition, in order to use the land that would be "released", significant earthworks would be required to address stability issues on the gully margins. This estimate is based on existing storm flows, and therefore assumes that all the ponds are also needed for stormwater quality improvement and flood peak attenuation (i.e. the pond capital costs need to be added to this). The alternative would be to increase the pipe sizes and costs. This approach of piping the main channels would also require that secondary flow paths be left undeveloped along the base of all main gullies, effectively occupying the 20m minimum stormwater reserve set out in the concept plan.

6.10. IMPLEMENTATION METHODS

The key implementation methods for the Stormwater Management Plan are listed in Appendix A. These provision will be implemented through a variety of mechanisms, including the District Plan, Design Standards, and the process of granting individual development consents.

6.11. FURTHER WORK

It should be noted that the hydrological analysis is based on standard predictive methods, and is not backed by any specific flow monitoring data. It would be appropriate for WBOPDC to undertake some flow monitoring in selected catchments to better calibrate the models and confirm appropriate design flows.

With better calibration of flood flows, it would also be appropriate to undertake floodplain mapping in the developed area of the Peninsula. This would assist in identifying the areas that are flood prone, providing better control of development there, and future protection of existing flood prone buildings and roads.

The improved hydrological model calibration, and a more careful review of flood problems in the existing development areas, may permit a less costly approach to remedial works in this area.

A key factor affecting both stormwater management and septic tank operation is the characteristics of the underlying soils, and their water capacity and stability. With more careful study of these soils (as has been undertaken in parts of Tauranga) a less conservative approach to soakage may be possible in some areas.

7. RESOURCE CONSENTS UNDER THE RESOURCE MANAGEMENT ACT

7.1. INTRODUCTION

The applications by WBOPDC for a resource consent for discharge of stormwater comprise a single consent. Within that consent there are a number of provisions for specific actions and stormwater management works. Principal among these are:

- design discharges from each of the pipe system or stream outlets
- specific remedial works within stream channels, including riparian planting, channel improvement works and erosion protection
- specific major structures for detention or stormwater quality improvement
- ongoing maintenance activities in streams.

This application applies to all the land from the state highway northwards, including the existing township.

The specific activities covered by the consent are listed in Appendix B. In addition, there will be policies and rules to be applied by WBOPDC to all consenting of subdivisions and site developments on the Peninsula. These will be enforced through new provision within the District Plan, so that WBOPDC have powers necessary to enforce the policies of the comprehensive discharge consent. These new provisions are about to be notified as a Plan Change to the District Plan.

Appendix D contains the resource consent application forms to the Environment Bay of Plenty for the discharge of stormwater and the associated construction of ponds and other facilities.

7.2. ASSESSMENT OF ENVIRONMENTAL EFFECTS

This AEE has limited scope, addressing only issues arising from the management of stormwater. The assumption is that as development occurs appropriate measures, in accordance with this Plan, will be put into place for management of stormwater. The SWMP therefore addresses the following:

- the effects of development on stormwater runoff and the receiving environment,
- appropriate measures to avoid, remedy or mitigate these effects.

Much of the scope of the AEE is covered in earlier sections of this SWMP. The Fourth Schedule of the Resource Management Act describes the matters which should be

included in an Assessment of Environmental Effects. The following schedule provides cross referencing to the sections of this document that provide the relevant material:

(a) Description of the Proposal

Section 6 and Appendix B

(b) Alternative Methods

Sections 5 and 6

(c) Assessment of Environmental Effects

In summary, the following are the effects that increased stormwater resulting from urban development has on the environment, and the measures proposed to mitigate these.

Issue	*Remedy*
1. Increased sedimentation of streams and the harbour	• provide for sediment removal through source control, Erosion and Sediment Control Plans (ESCP), swales, ponds, riparian planting
2. Increased heavy metals, hydrocarbons and other contaminants in harbour sediments and beyond (primarily from motor vehicle operation)	• use of sediment control measures to remove attached contaminants with sediment • source control at identified sites (e.g. industrial and commercial areas, principal roads etc.)
3. Increased runoff rates and volumes due to impervious areas	• encourage the use of pervious surfaces wherever possible • set limits on impervious area • swales and other low impact design measures to reduce the rate and volume of runoff
4. Increased erosion of stream channels	• swales and other low impact design measures to reduce the rate and volume of runoff • detention ponds at discharge points to the streams to attenuate flood peaks • enhanced stream corridors with riparian planting
5. Damage to high value or ecologically sensitive areas	• identify these areas for protection • provide stormwater treatment and detention at principal discharge points upstream of identified ecological areas • enhance stream corridors with riparian planting

6. Increased flooding in downstream areas	• swales and other low impact design measures to reduce the rate and volume of runoff • detention ponds to provide attenuation of flood peaks
7. Poor performance of septic tanks	• no use of soakage pits for stormwater disposal • proper design and operation of septic tanks (under EBOP programme), or • implementation of sewerage scheme
8. Coastal erosion	• combine coastal outfalls where possible • provide proper outlets with erosion protection

The following stormwater management works, as proposed in this Plan and application, are identified as having potential effects on the environment:

Stormwater Works	***Identified effects***
1. Construction of stormwater quality and flood detention ponds	• blockage of fish passage • erosion and sedimentation during construction
2. Channel improvement works	• stream bank erosion during construction of instream works
3. Stream maintenance	• sediment release into the stream from bare earth banks
4. Stormwater infiltration and disposal by soakage	• increased instability in steep areas • poor performance of septic tanks

(d) Mitigation Measures

Specific measures proposed under this Plan to avoid, remedy or mitigate the effects of the stormwater management works are as follows:

Effect	***Remedy***
1. Erosion and sedimentation during construction	• Application of EBOP TR28 to construction of each SWMP project • Each construction contractor to submit an ESCP to EBOP for approval to demonstrate how erosion will be minimised and sediment controlled during earthworks, in accordance with TR28
2. Blockage of fish passage	• All on-line structures with natural channel upstream to provide for fish passage • Council to incorporate cascading weirs or other suitable permanent fish passage (for eels and inanga) into the outlet works of all instream structures

3. Degradation of fish habitat	• Council to improve habitat through riparian planting, in co-operation with adjacent landowners
4. Stream bank erosion during construction of instream works	• Council contractors to work in the watercourse only during low flow periods • instream diversion to be used to avoid or minimise work in flowing water
5. Land instability	• In issuing building consents, Council to ensure there is no use of soakage pits • Council to ensure through the Design Standards that infiltration trenches and swales are only used on flatter land remote from risk of land instability
6. Sediment release into the stream from bare earth surfaces	• Council and development contractors to ensure that they carry out earthworks during the lower rainfall summer period • Council and developers to retain vegetation cover on stream banks wherever possible

Note that the matter of poor septic tank performance is being addressed by WBOPDC through the Sewage Investigations which are aimed at a community improved treatment and disposal system.

The above provision need to be implemented through District Plan rules, and through the provision for EBOP approval of contractors ESCPs.

(e) Receiving Environment

The receiving environment (both streams and the harbour) is described in Section 1.3. Urban development on the Omokoroa Peninsula has the potential to increase erosion and flooding in the receiving streams, sedimentation in the streams and the harbour, and discharge of contaminants such as heavy metals and hydrocarbons to the streams and harbour. The measures proposed in this SWMP seek to avoid, remedy or mitigate these effects, as outlined in (c) and (d) above. The net effects on the receiving environment will be as set out below:

Erosion	Small increase in stream erosion, which should stabilise after 10 years due to channel resizing and establishment of riparian planting. This will also lead to short term increased sediment loads. The measures proposed for flood detention provide a cost effective measure to limit this effect.
Sedimentation - short term	Some increase in sediment loads as a result of development activities. This is an inevitable consequence of any decision to develop the land. The measures proposed are the normal standards applied by EBOP for control of earthworks.
Sedimentation - long term	Reduction in overall sediment loads over that from current rural use.

Contaminants	Some increase, but not expected to be sufficient to limit usage or environmental value of the receiving environment. The measures proposed provide a cost effective measure to limit this effect.
Stream habitat	Proposed riparian planting and enhancement will improve the quality of the stream environment and available habitat.

(f) Interested Parties

This Stormwater Plan is an adjunct to the Structure Plan Study of Omokoroa (2002), which has considered the constraints and opportunities for growth and the type of urban environment desired by the majority of the community. The parent study (the Structure Plan) has involved community consultation through two newsletters, three Open Days, twelve Cottage Meetings and numerous discussions with various members of the community. Submissions have been received from the community on two occasions. The second Open Day identified the Stormwater Reserves required for the treatment ponds, swales, flow paths, outlets and pipework. Approximately 30 of the 121 submissions received on the Structure Plan expressed concern or provided comment on site specific stormwater matters.

Typical issues were as follows:
- Accuracy of the location of the draft stormwater ponds/swales on property
- Council to own/manage Stormwater area
- Council to own/manage all or at least the critical land in the Stormwater area
- Support the need for Stormwater system to reduces erosion on the foreshore
- Preference for piped systems as the land is needed for horticulture.

The first of these issues reflect the preliminary nature of concept plans at the time of consultation, and has been resolved within the plans now included in this SWMP. The second and third are addressed in the recommendation that Council own a core stormwater management reserve along streams, and provide for limitation of use and for riparian planting along a wider buffer zone in higher value habitats. Stream erosion is addressed in the provision of flood detention, but foreshore erosion is generally beyond the scope of the SWMP and the discharge consents. The last item reflects the current land use, and is not applicable to the fully developed situation.

(g) Monitoring

The provisions of this SWMP will be implemented through District Plan provision, EBOP resource consent conditions and through works to be implemented by Council as development proceeds.

Council will undertake monitoring of individual development sites as part of the consent monitoring for those sites. This will include ensuring that the contractors' ESCP is being applied.

No specific state of the environment monitoring is proposed.

(h) Implementation

Any resource consents granted by WBOPDC under the terms of this EBOP discharge consent, shall require the following:

1. The construction plans for any in-stream works identified as required under this plan shall be provided to EBOP prior to construction commencing, in order to obtain confirmation that they comply with the provisions of the consent.
2. An Erosion and Sediment Control Plan (ESCP) for any in-stream capital works identified as required under this plan shall be provided to EBOP prior to construction commencing, in order to obtain confirmation that they comply with the provisions of the consent and of TR28.

In addition, WBOPDC shall provide to EBOP an annual summary of the maintenance works carried out in the streams and flood control/water quality devices, including the location (or reach), the nature of the work done and the date of completion.

(i) Statutory Assessment

The landuse and discharge applications will be considered in the light of a range of the Regional and the Transitional and Proposed District Plans.

Bay of Plenty Regional Policy (December 1999)

The Regional Policy Statement for the Bay of Plenty Region addresses the sustainable management of the natural and physical resources of the region.
Objective

6.3.1.
" (a) The adoption of sustainable land use and management practices"

Policy 6.3.1

" (b) (ii) To safeguard the life-supporting capacity of the soil and association ecosystems, particularly indigenous ecosystems, and to protect soil form degradation"

" (b) (xi) To protect, and enhance where practicable, the region's remaining wetland"

Objective 8.3.1

" (a) Water quality is maintained, and where practicable enhanced, to a level s8ufficient to safeguard aquatic life, to sustain the potential of water resources to be used ad developed to meet existing and reasonably foreseeable future needs, and to provide for the protection of aesthetic or cultural values associated with water"

Policy 8.3.1

"(b) (ii) To improve the quality of the region's water resources by avoiding, remedying or mitigating the adverse effects of diffuse and point source discharges of contaminants onto or into land or into water"

The development phase of the Stormwater System requires construction measures that avoid the discharge of sediments and uncontrolled discharge of stormwater. Sections 1 and 4 of this document refer to the ***Regional Land Management Plan (2002***) rules which implements the following relevant policies:

Objective 6.5.2
" *(a) A further decrease in the discharge of sediment resulting from unsustainable land uses*"

Policy 6.5.3
"*(a) To actively promote sustainable land management and use through soil conservation and erosion control practices*"

Riparian Margins

Objective 6.6.2
" (a) The appropriate management of riparian margins to protect and enhance where necessary the soil conservation and water quality values of the riparian margins and adjacent waterways"

Policy 6.6.3
" (c) To actively promote the establishment of riparian areas whose primary purpose is to protect soil conservation and water quality values"

The permitted, discretionary and controlled activities in the riparian margins are listed in Section 10.5 of the Plan. The riles that have direct relevance to the riparian margins are:

10.5.1	Exotic and Plantation Vegetation Disturbance
10.5.2	Indigenous Vegetation Disturbance
10.5.3	Clearance of Exotic and plantation Vegetation by Burning
10.5.4	Small and Large Scale Earthworks'
10.5.5	Stream Crossing

Earthworks
There are specific practices for minimising erosion specified in the Land Management Plan.

Objective 6.5.2

" (a) A further decrease in the discharge of sediment resulting from unsustainable land uses"

Policy 6.5.3

" (a) To actively promote sustainable land management and use through soil conservation and erosion control practices"

The rules for Small Scale and Large Scale Earth works are outlines in Sections 10.5.4 and 10.5.5 respectively.

Wetlands
The regional plan promotes the protection and enhancement of the existing wetlands.

Objective 7.4.2

"(a) The retention and enhancement of the values of the remaining wetlands in the Bay of Plenty"

Policy 7.4.3

"(b) To require consents for the modification or the protection, maintenance or enhancement of all wetlands"

Rules under Section 10.5.7 provide the activity status for wetland modification.

Stream Works
All construction works in a river or stream requires resource consent or must be expressly allowed for by a rule in the regional plan.

Section 10.5.6 provides the rules for Stream Crossings. The rules allow for the construction of culverts up to 900 mm diameter, single span bridges for catchments of up to 100 ha and fords with a flow water depth of up to 600 mm. These are permitted activities. Larger stream works are discretionary activities.

The mitigation measures described above will ensure that urban development particularly the low impact stormwater systems will be undertaken in a manner that minimises the construction discharges and maximises soil conservation.

Bay of Plenty Proposed Water and Land Plan (2002)
Environment Bay of Plenty has developed a Proposed /regional Water and Land Plan which integrates the Regional Water Plan and the Regional Land Management Plan.

The current Land Management plan I snow operative and the current policy developed in the Land Management Plan continues in the interim until such a time as the policy in the new Regional water and Land Plan supersedes it. As such no consideration needs to be given to the Proposed Regional Water and Land Plan at this time.

The Proposed Regional Coastal Environment Plan (June 1999) has been referred to in Section 1 of this document.

Bay of Plenty Proposed Regional Coastal Environment Plan (June 1999)

The entire Omokoroa Peninsula is part of the Coast Management Zone (3.3.2). This zone covers most of the coastline in the Bay of Plenty. The plan focuses on the protection of these areas such that changes in land use will not adversely affect the coastal environment. It is recognised by the plan that there may well be uses and developments that would be appropriate within this zone.

Mangawhai Bay on the southern coast of the Omokoroa Peninsula has been identified as a Significant Area of Flow and Fauna (SSCMA-10). Relevant policies for this area are contained in Chapter 6.

There are many policies that govern the discharge of stormwater to the coastal environment.

Objective 9.2.2

"Maintenance and enhancement of the water quality in the Bay of Plenty Region.

Policy 9.2.3

"(a) To integrate the management of water quality in the coastal marine area with the management of land use and freshwater"

"(d) Urban land use will be managed to ensure that stormwater does not cause estuarine and harbour water quality to fail the standards set in policies 9.2.3 (b*) and* (c) *or cause accumulation of contaminants in harbour or estuary sediment at levels which have adverse effects on marine life. The following techniques should be considered:*

- *Integrated management of whole stormwater catchments;*
- *The installation of stormwater treatment devices in new or upgrades stormwater systems;*
- *Ensuring that the layout of subdivision and services facilitates the retention of riparian margins and wetlands.*

Two key areas of policy are related to discharges of stormwater and disturbance and deposition in the coastal environment.

Discharges

Any discharges is a discretionary activity except as expressly provided for or prohibited by other rules to this plan (9.2.4).

The discharge of stormwater to the coastal marine area is permitted if the suspended solids concentration does not exceed 150 gm^{-3}; that the water is substantially free of grease oil, scums and foam, and that the maximum discharge does not exceed 80 litres per second for a 20% AEP storm event.

Disturbance and deposition
The land use also has implications on the disturbance and deposition that occurs in the coastal environment (14.1). This includes things such as:

- The disturbance that is caused by construction and maintenance of open drains.
- The adverse effects of the disposal of spoil.

The Proposed Regional Coastal plan provides for disturbance and disposition within the coastal marine area only as appropriate. Policies provide for disturbance and deposition where necessary to protect the integrity of drainage schemes and to discourage channelisation or piping of streams flowing into estuaries or harbours.

Objective 14.2.2

" (a) Provision for disturbance and deposition within the coastal marine area only as appropriate and while avoiding, remedying or mitigating any associated adverse environmental effects"

Policy 14.2,3

" (a) To avoid the adverse effects of disturbance and deposition within the coastal marine area caused by disposal of spoil from land-based activities"

" (d) To provide for dredging, disturbance and deposition where necessary to protect the integrity of major flood protection/or drainage schemes"

" (f) To discourage channelisation or piping of streams flowing into estuaries or harbours"

The SWMP has been prepared as a whole catchment scheme to assist in the integrated management of urbanisation. In addition the Council is also preparing a Sewerage Scheme to reduce the possibility of cross contamination of sewage with stormwater. Mitigation systems such as treatment ponds are part of the system to ensure minimal contamination of the coastal waters. Council's Structure Plan identifies the areas of significant habitats which are to be protected from urban development.

REFERENCES

Auckland Regional Council. *Guidelines For Stormwater Runoff Modelling In The Auckland Region*. (TP 108). April 1999.

Auckland Regional Council. *Stormwater Treatment Devices Design Guideline Manual (TP10*). 1992.

Bay of Plenty Regional Council. *Erosion And Sediment Control Guidelines For Earthworks* (TR28). Guideline 1.

Bruce Henderson Consultants Ltd. *Western Bay Of Plenty District Council - Stormwater Development Report - Omokoroa*. April 1991.

Environment Bay of Plenty. *Proposed Regional Water and Land Plan*. 2002.

Environment Bay of Plenty. *Proposed Regional Coastal Environmental Plan*. Version 9.0. June 1999.

Environment Bay of Plenty. *Operative Regional Land Management Plan.*

Environment Bay of Plenty. *Transitional Regional Plan.*

Western Bay of Plenty District Council. *Proposed District Plan*. February 2002.

Western Bay of Plenty District Council. *Subdivision and Development Code of Practice - Section 3 – Stormwater.* February 2001.

Western Bay of Plenty District Council. *Asset Management Plan For Stormwater*. Version 2. October 1998.

GLOSSARY

AEP — Annual Exceedance Probability - the probability that a given storm event magnitude will be exceeded in any year
Note the approximate relationship between "% AEP" and "years ARI"

100 years ARI	1% AEP
10 years ARI	10% AEP
2 years ARI	50% AEP

ARC TP10 — Auckland Regional Council's publication TP10, *Stormwater Treatment Devices - Design Guidelines Manual* (1992)

ARI — Average Recurrence Interval - the average interval between storm events of a given magnitude (see above for relationship to AEP)

DCDB — Digital Cadastral Database - a GIS map base of property boundaries

DIF — Development Impact Fees, levied to cover the costs of Council infrastructure development necessary to service or mitigate the effects of subdivision development

EBOP — Environment Bay of Plenty

ESCP — Erosion and Sediment Control Plan

GIS — Geographic Information System - a mapping system including an underlying data base

SH2 — State highway 2, between Tauranga to Katikati

soil group — The USSCS methodology categorises soils into four groups for the purposes of hydrological analysis:

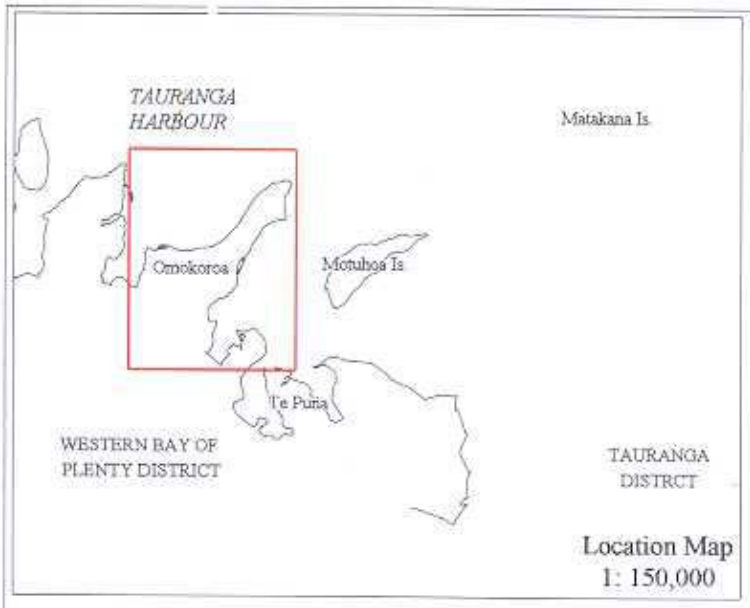
- A Well to excessively well drained sands and gravels. High infiltration and low runoff potential
- B Moderately well to well drained soils. Moderate infiltration and runoff potential.
- C Poorly drained soils. Fine texture, layers which impede drainage. Low infiltration when wetted.
- D Clays with high swelling potential, permanent high water table, clay pan. High runoff potential.

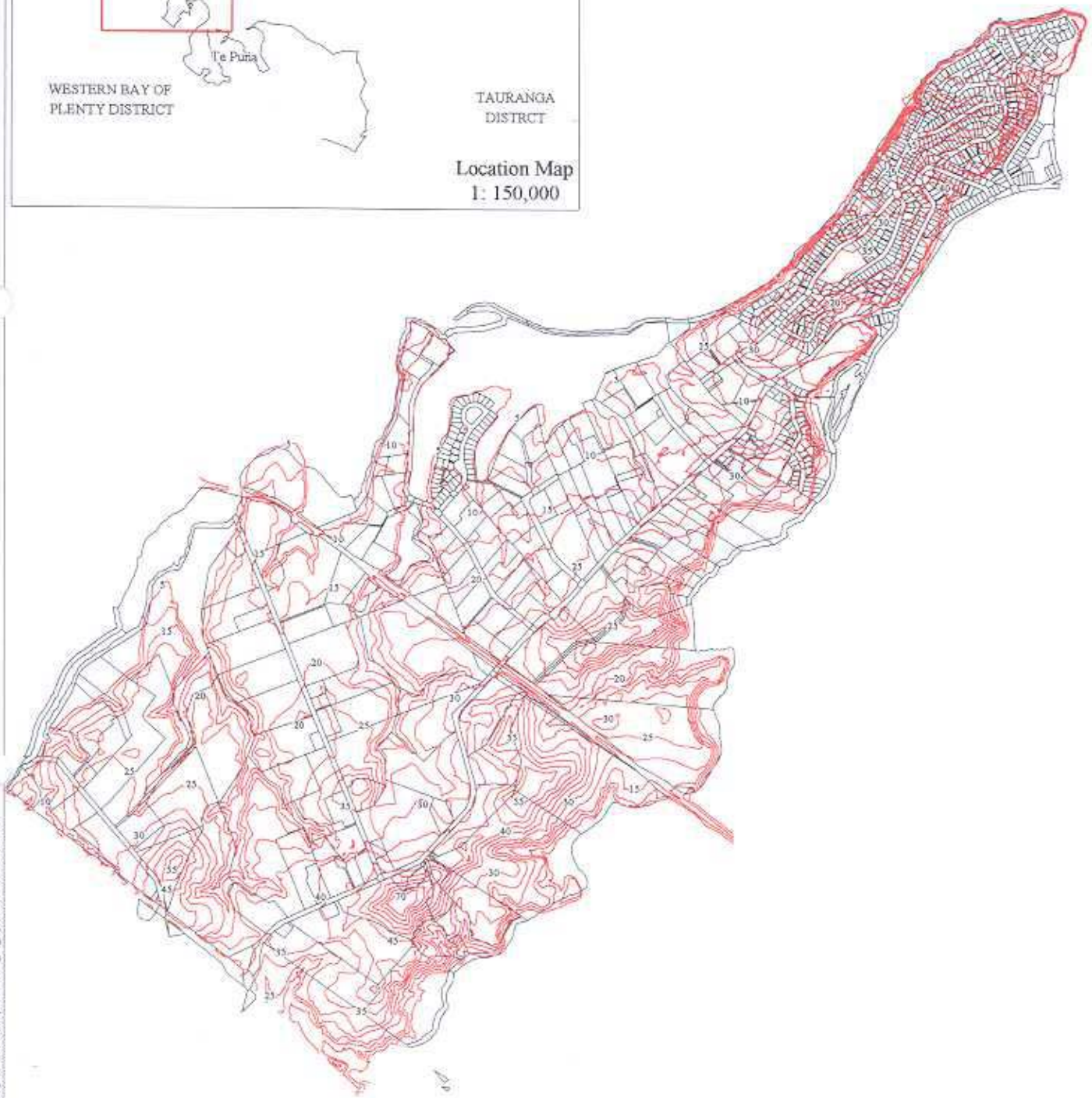
SP — Structure Plan being prepared for Omokoroa Peninsula

SWMP — Stormwater Management Plan - this document

TR28	Bay of Plenty Regional Council. *Erosion And Sediment Control Guidelines For Earthworks* (TR28). Guideline 1.
USSCS	United States department of Agriculture Soil Conservation Service (now known as Natural Resources Conservation Service)
WBOPDC	Western Bay of Plenty District Council

FIGURES





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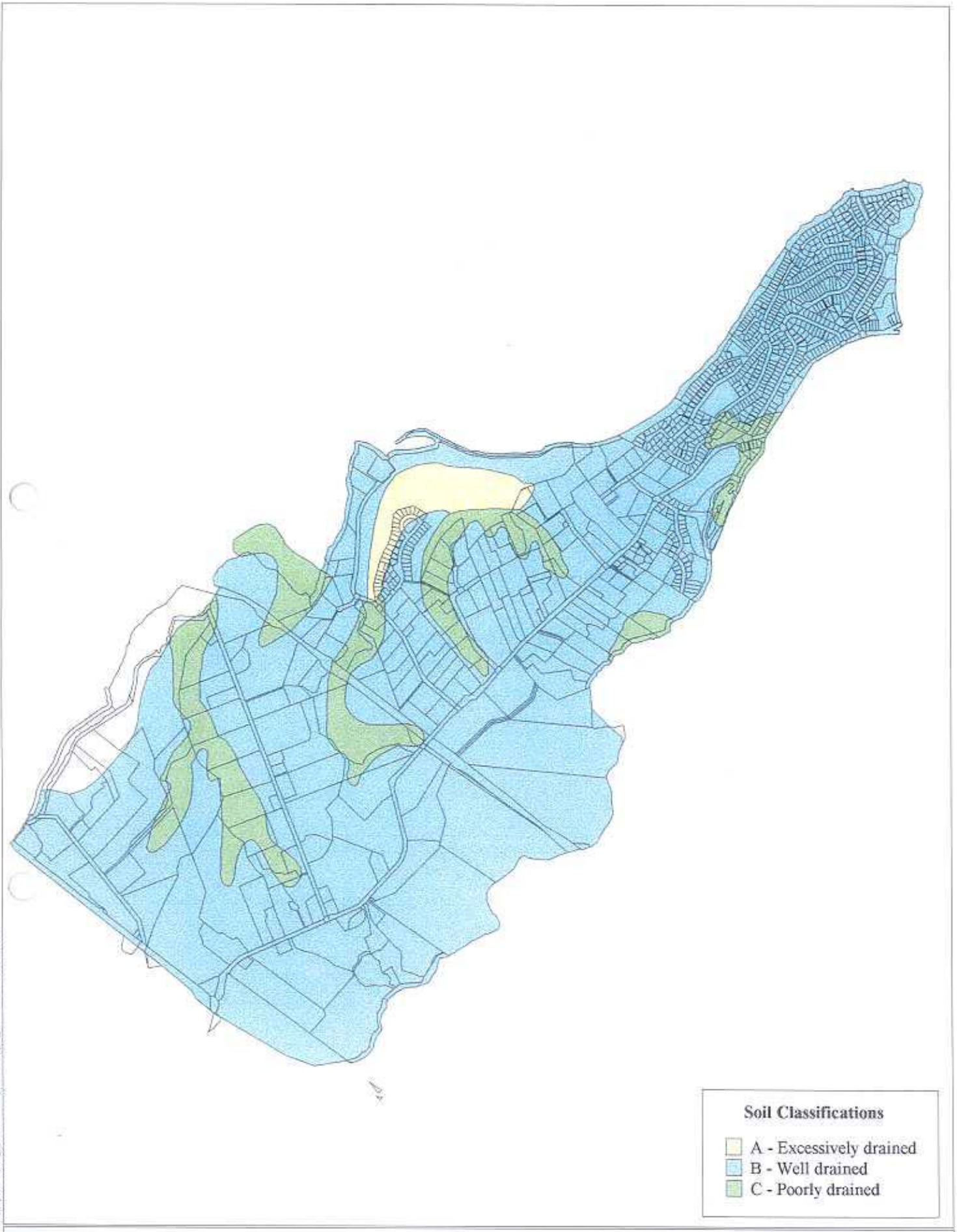

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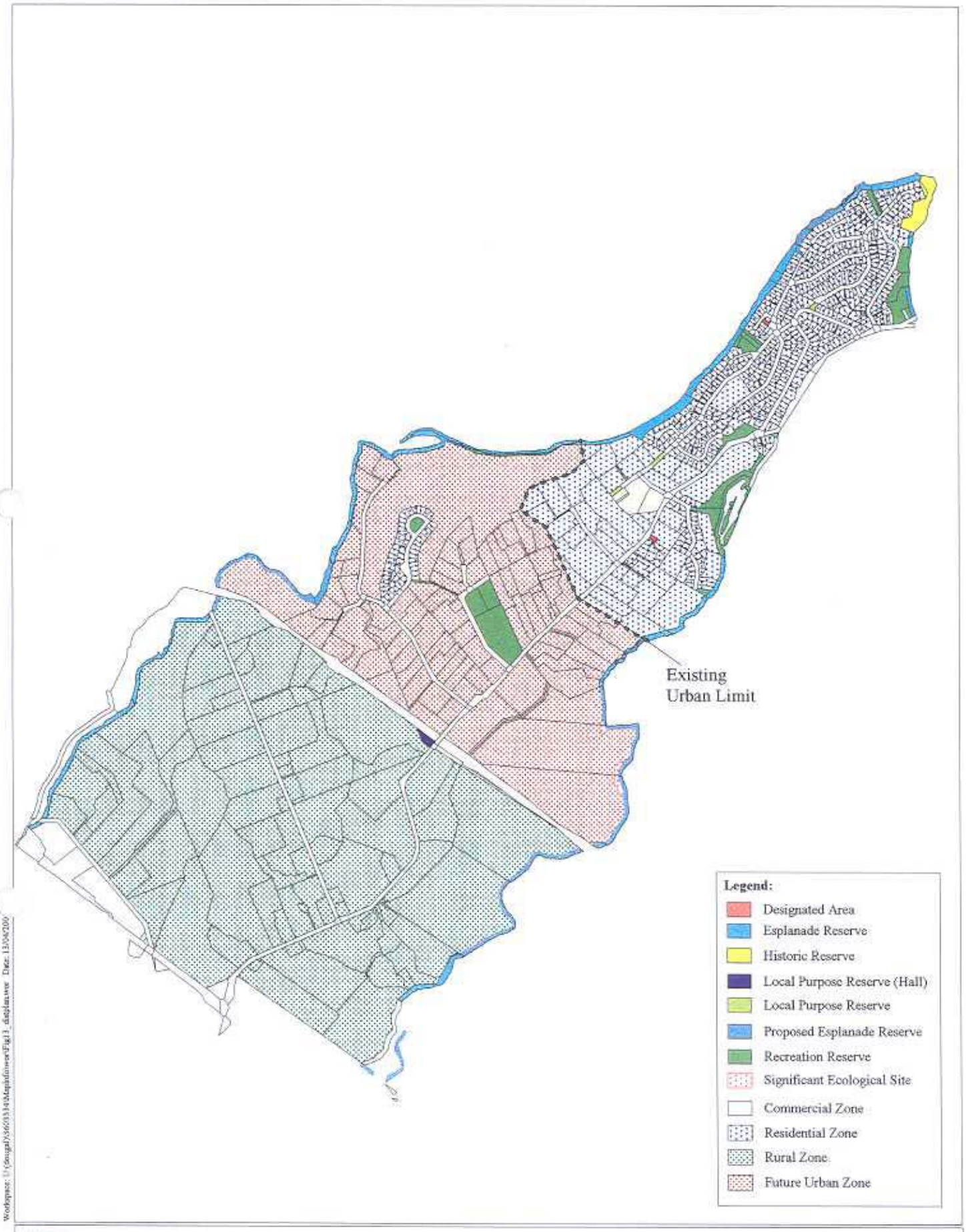
Soils
Figure 1.2



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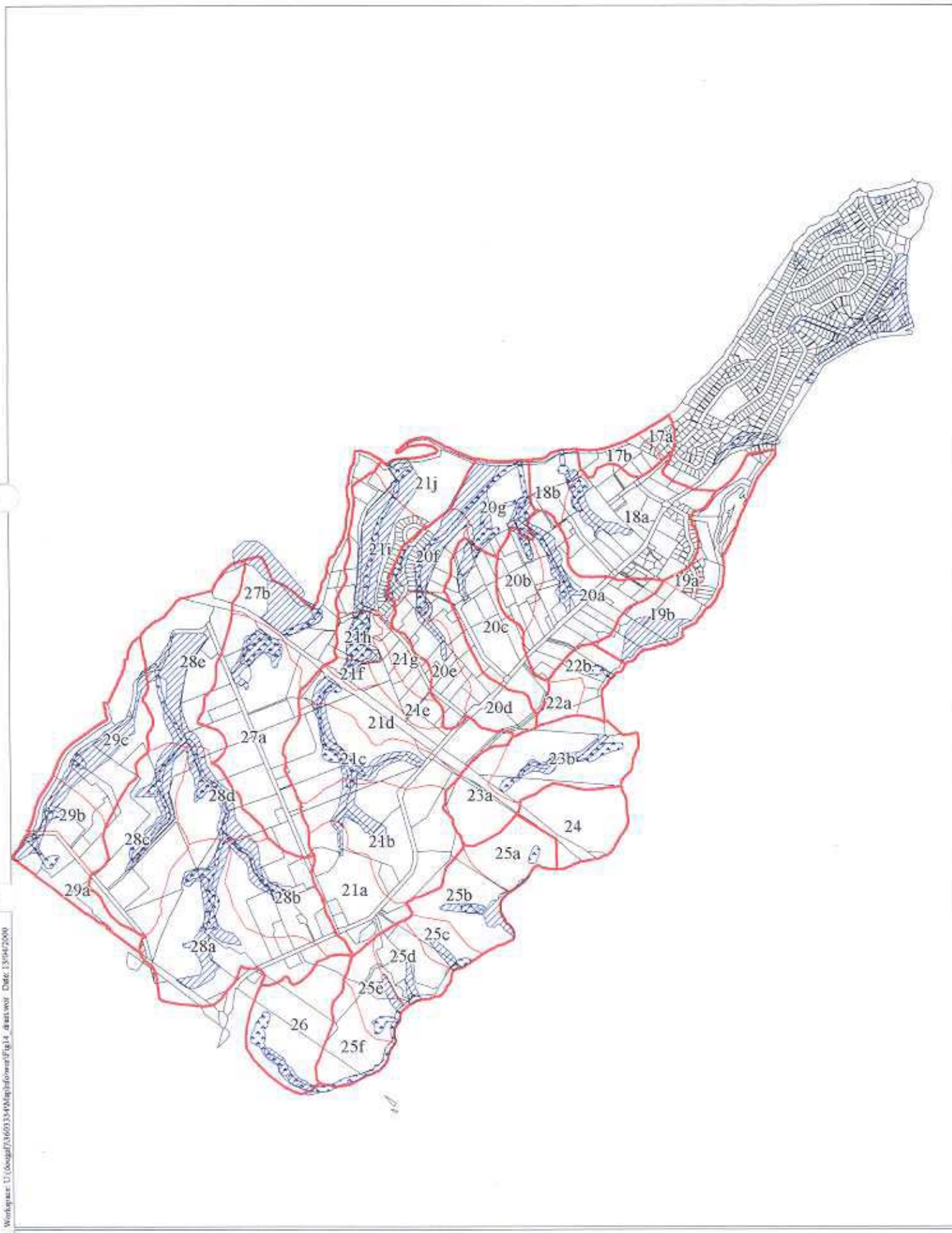
District Plan
Figure 1.3



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Legend:

- Catchment Boundary
- Subcatchment Boundary
- Flood Prone
- Drainage Path

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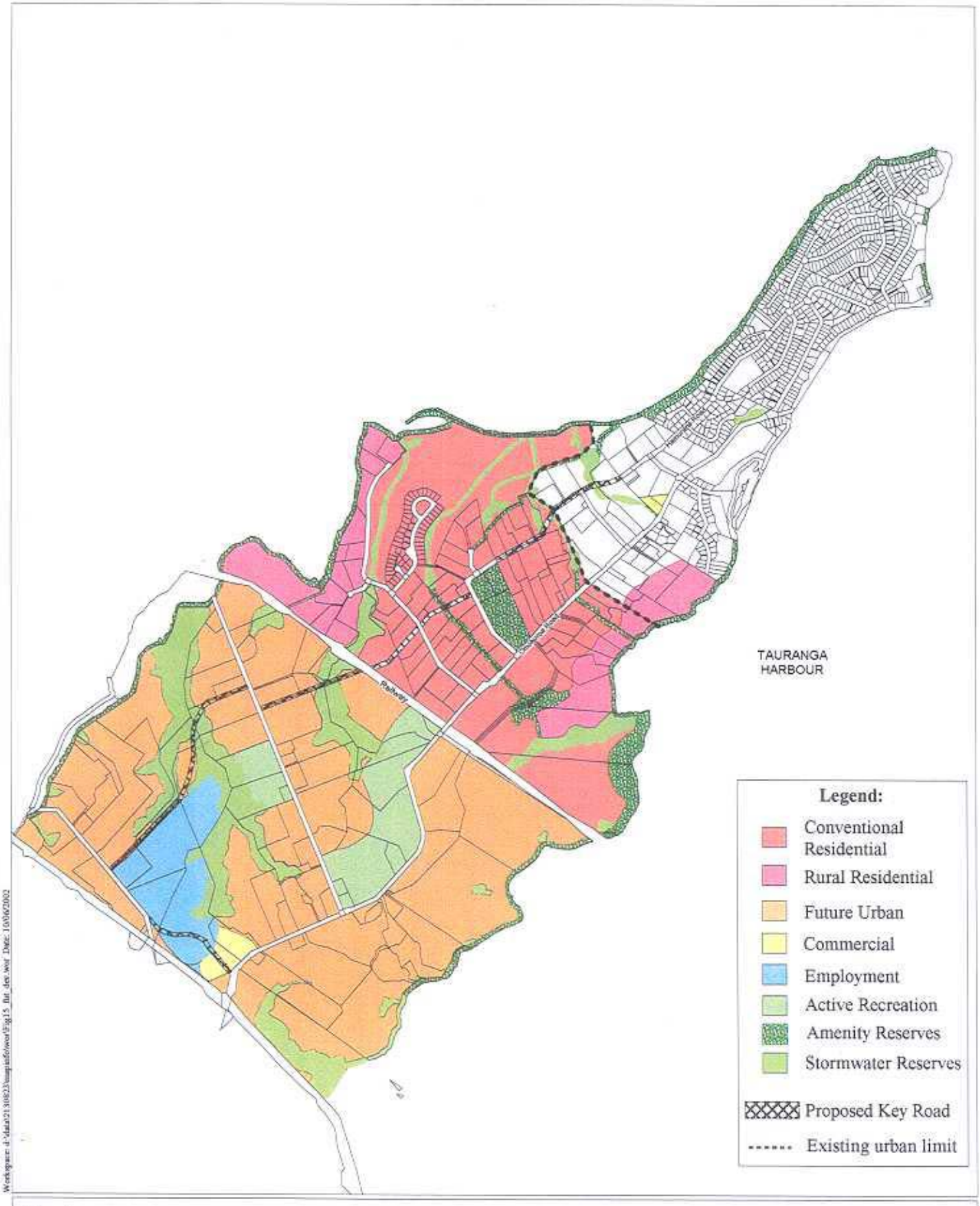
Natural Drainage System

Figure 1.4



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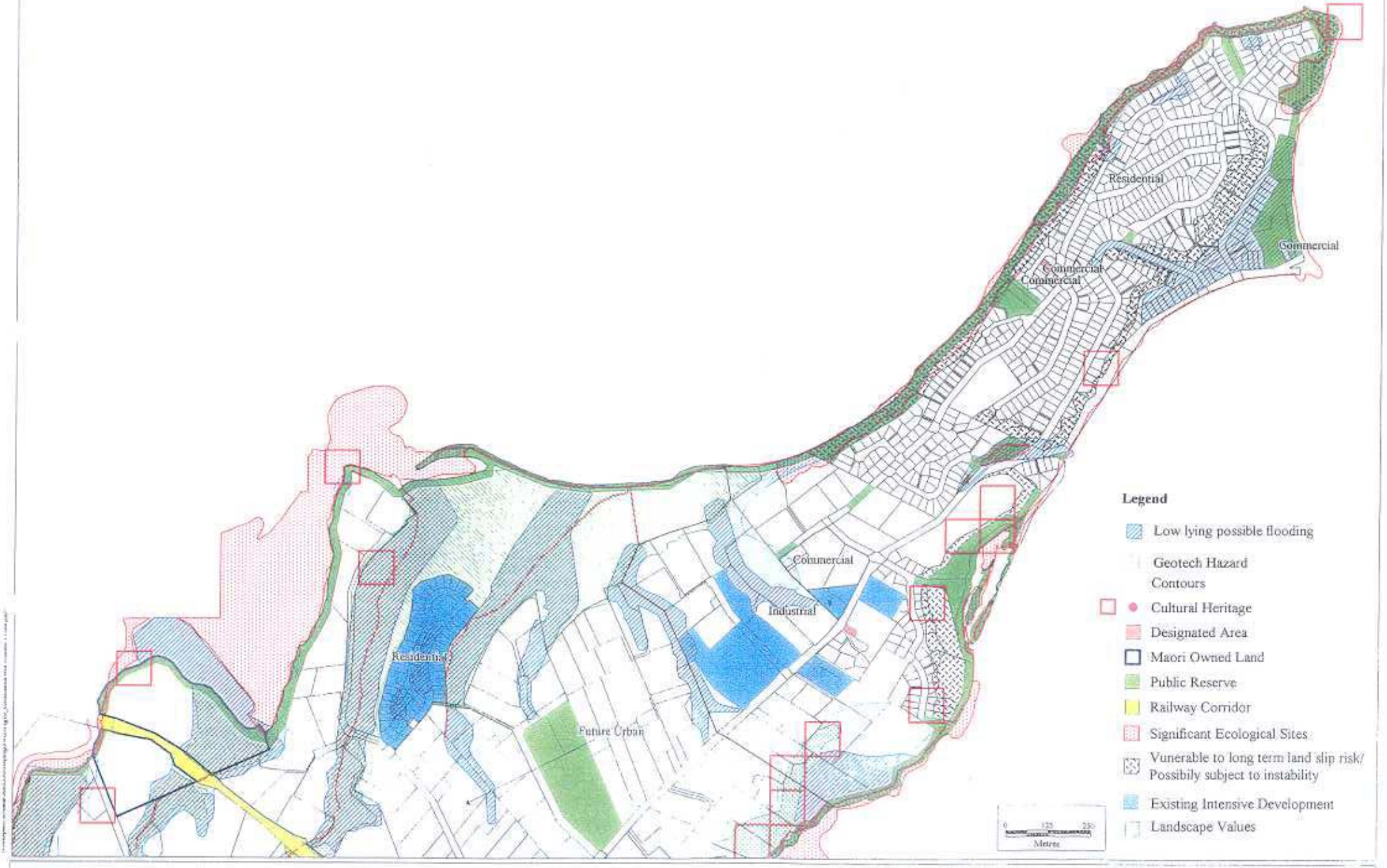
Future Development

Figure 1.5



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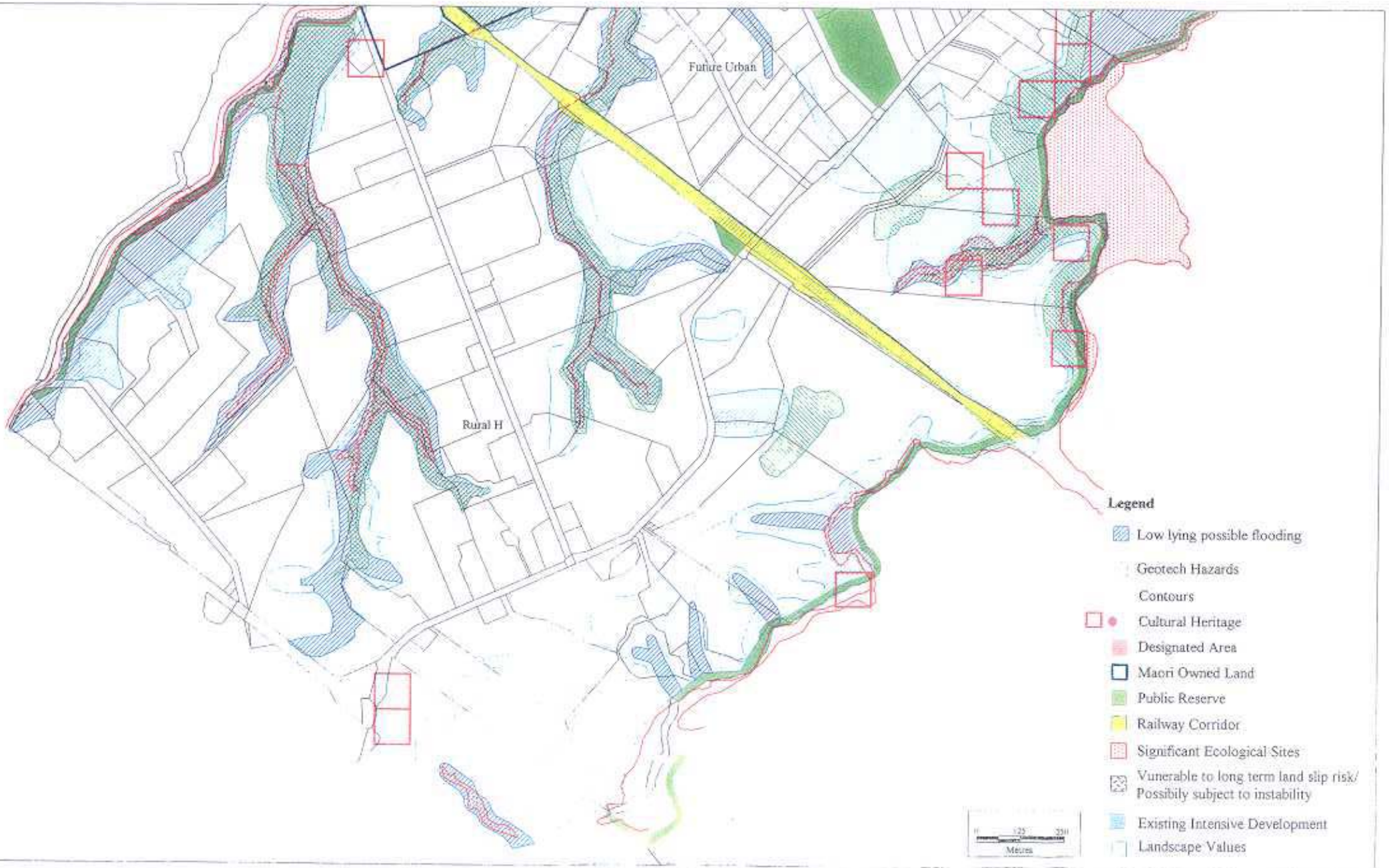
Omokoroa Constraints Plan 1
Figure 1.6



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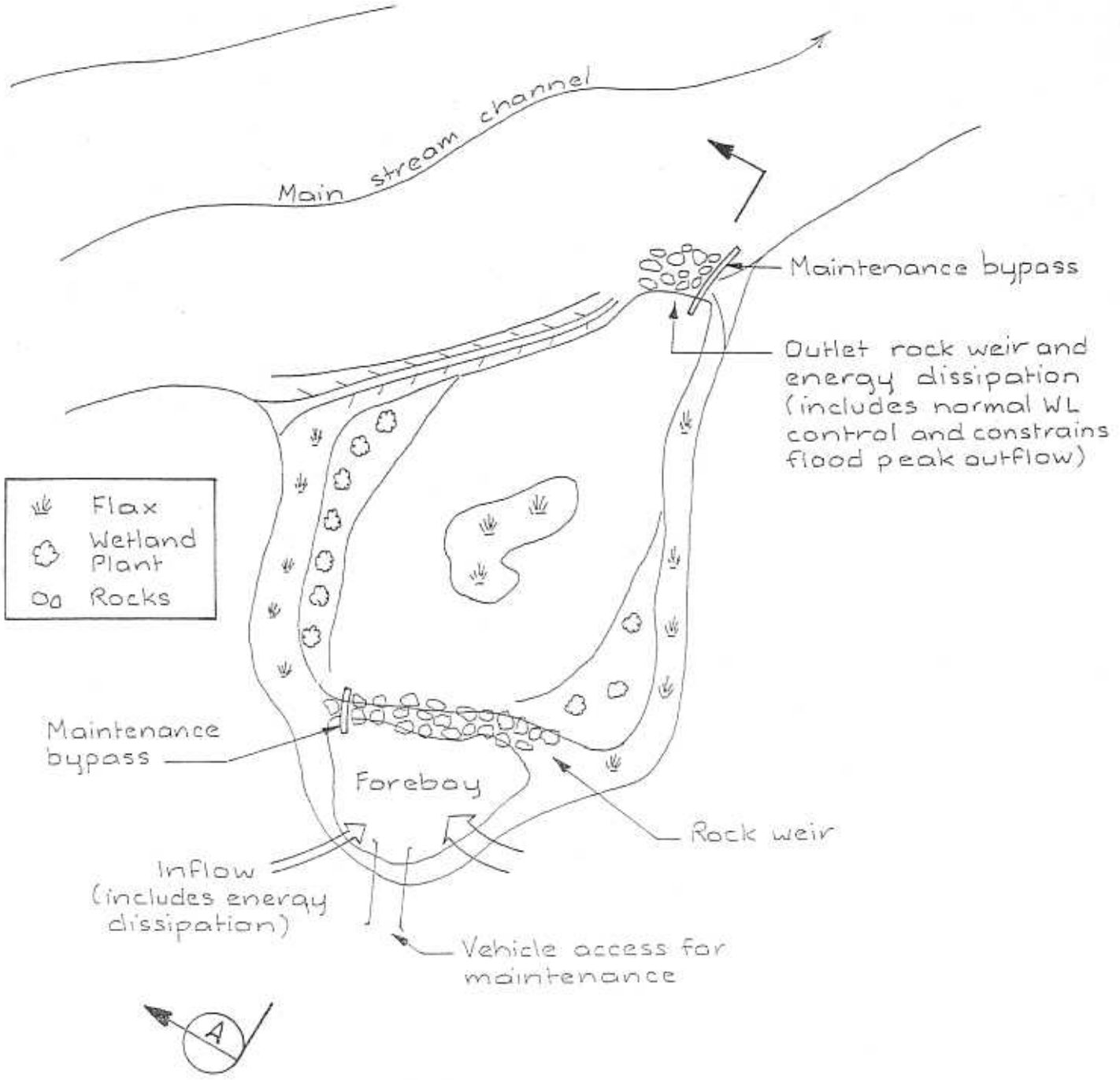
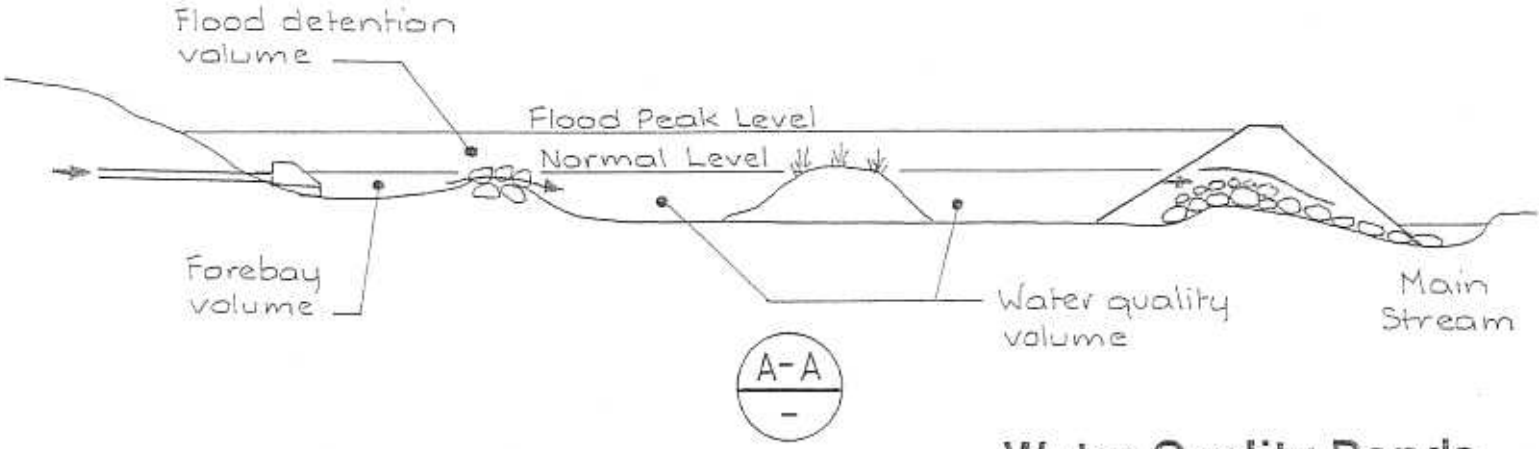
Omokoroa Constraints Plan 2
Figure 1.6





Water Quality Ponds, Forebays & Flood Detention Ponds

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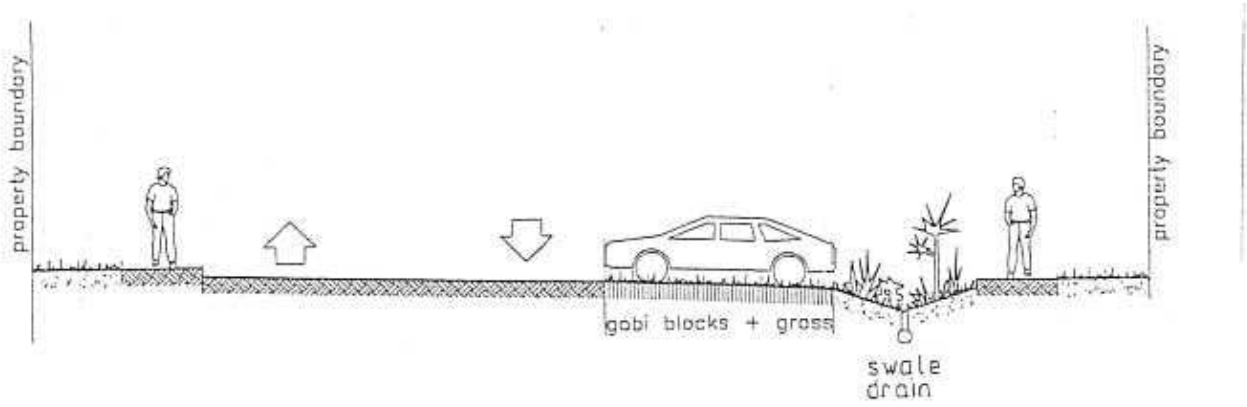
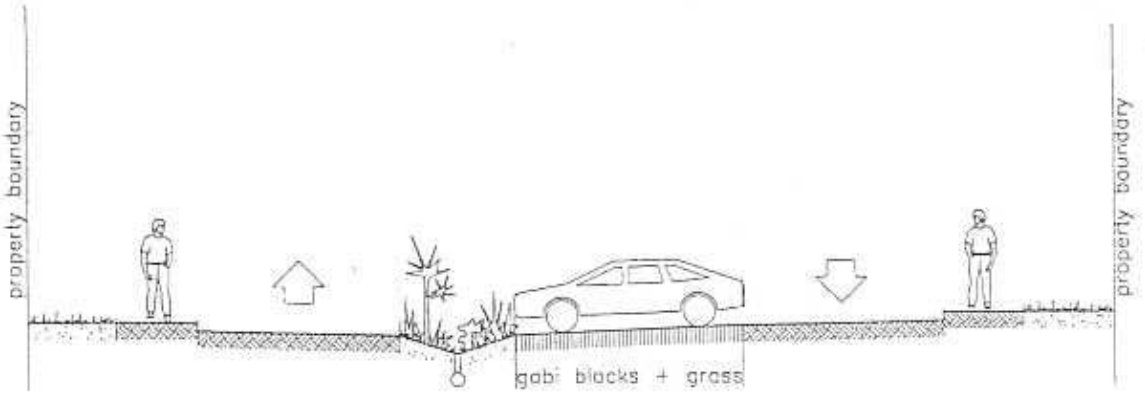
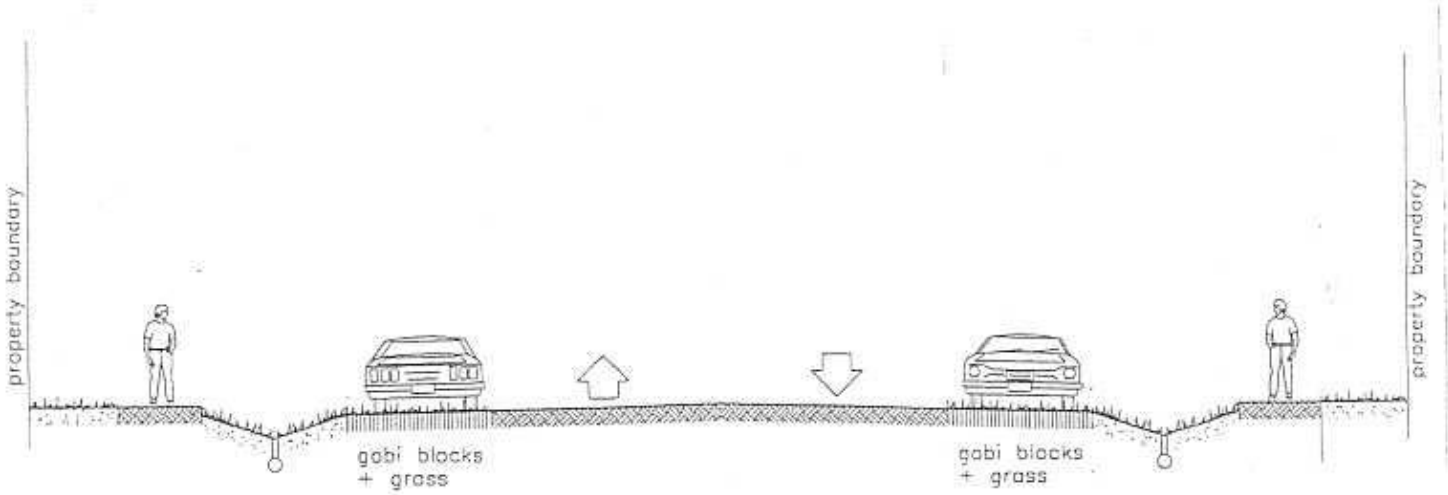
Figure 3.1







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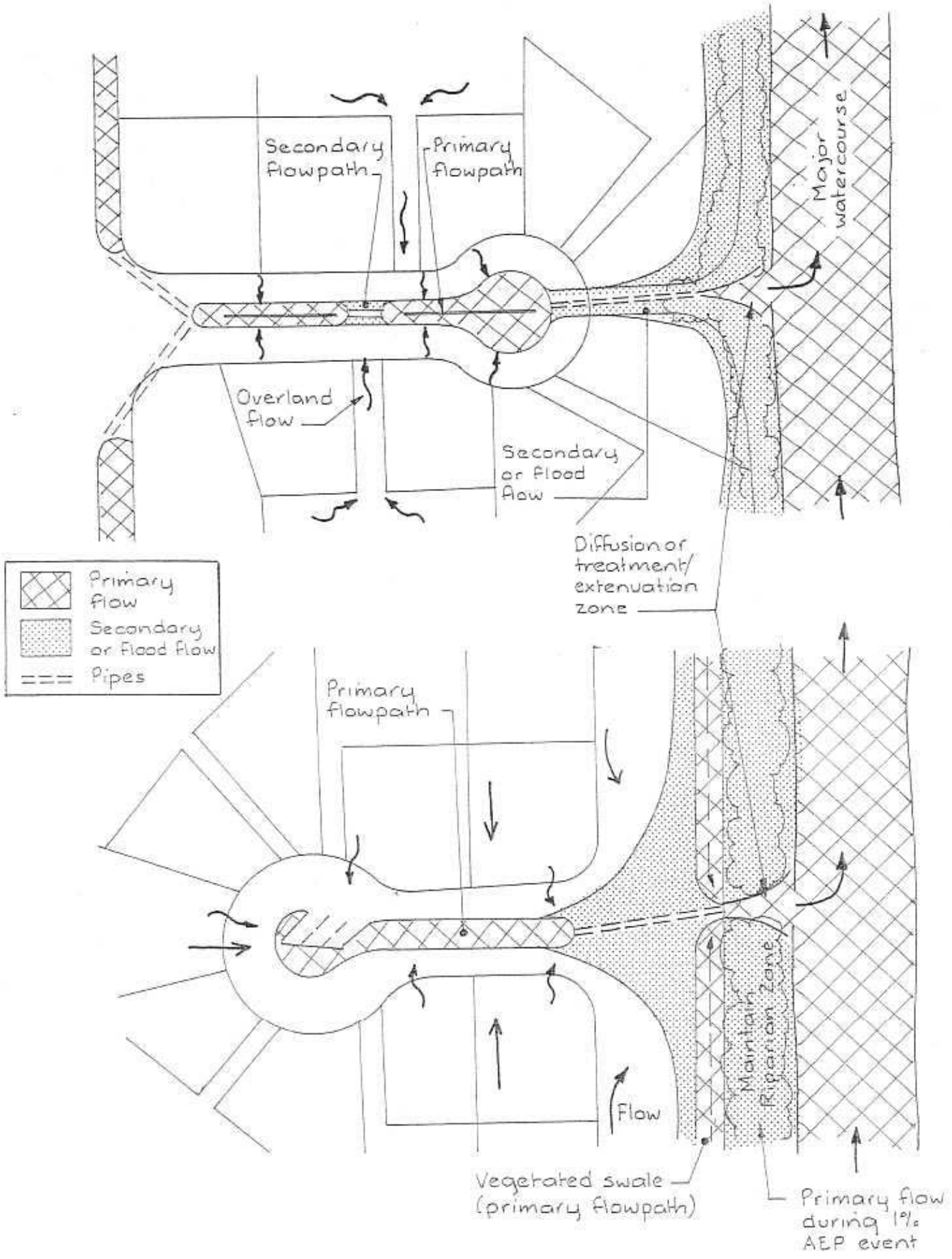
Low Impact Road Design

Figure 5.1



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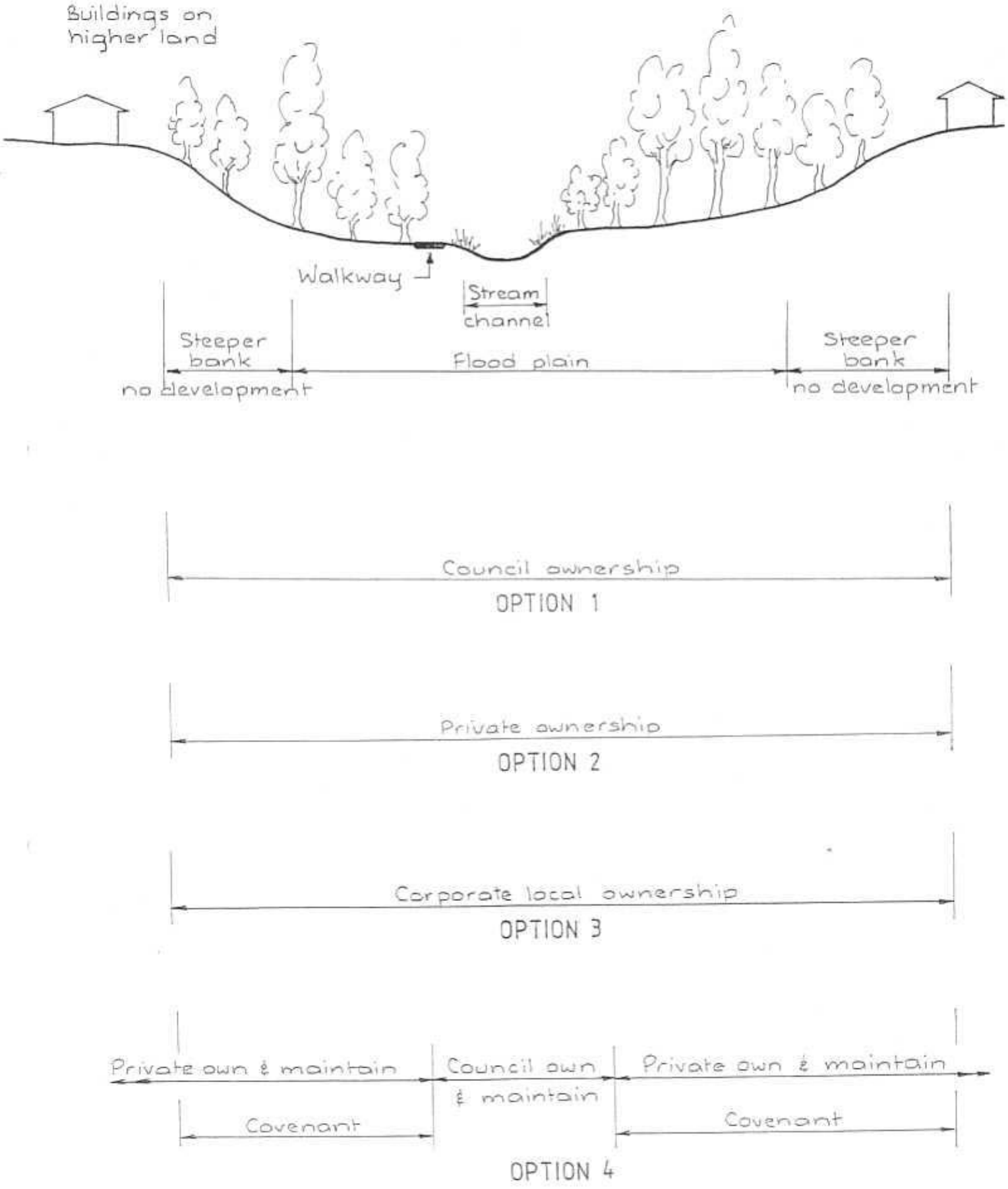
Low Impact Drainage Design

Figure 5.2



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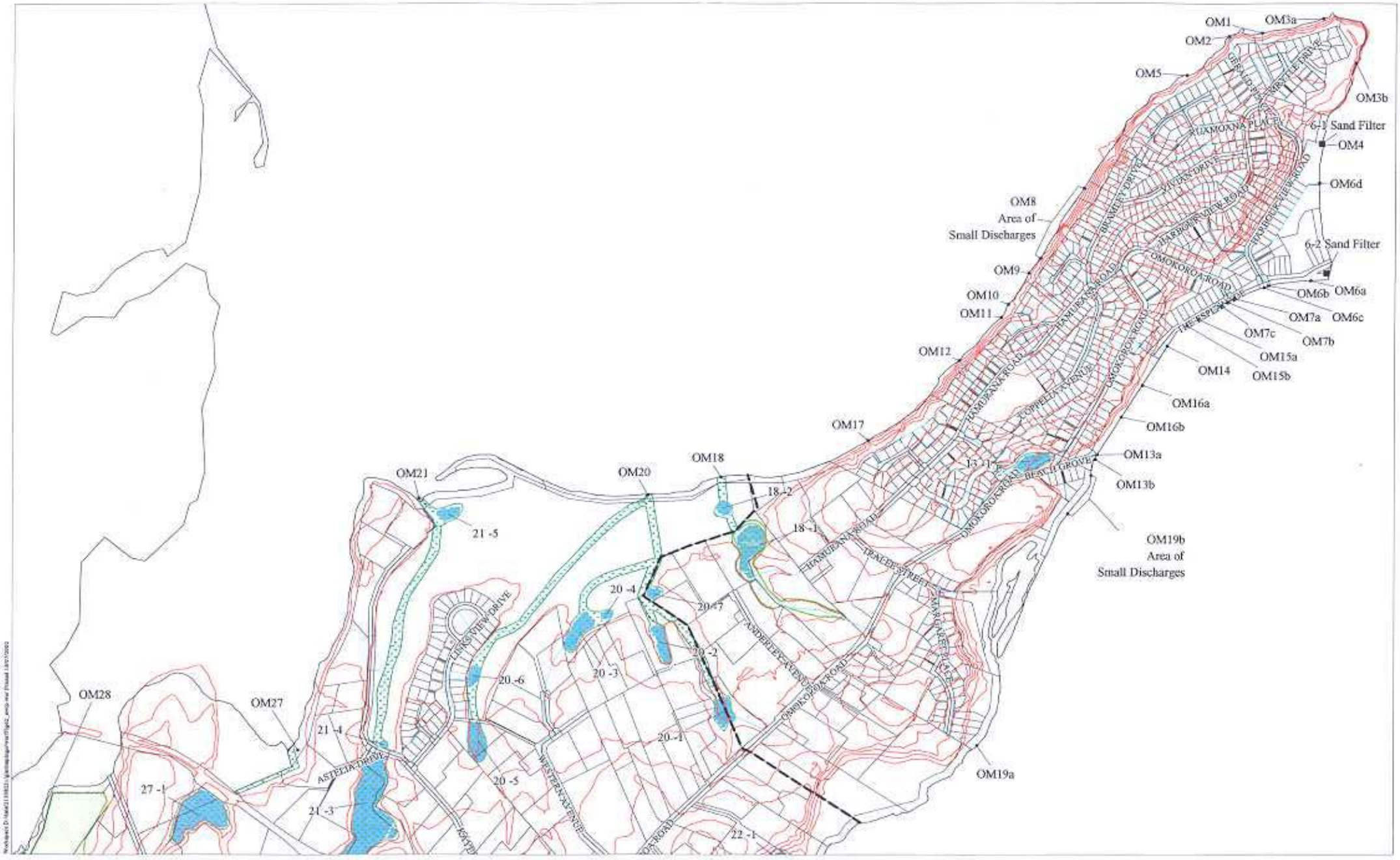
Protection Corridors

Figure 6.1



Stormwater Reserves

Council owned Stormwater Reserve

Contours

OM25a Discharge Points

Stormwater Quality Ponds

25-1 Stormwater Quality Pond ID Code

Stormwater Pipes

Sand Filter

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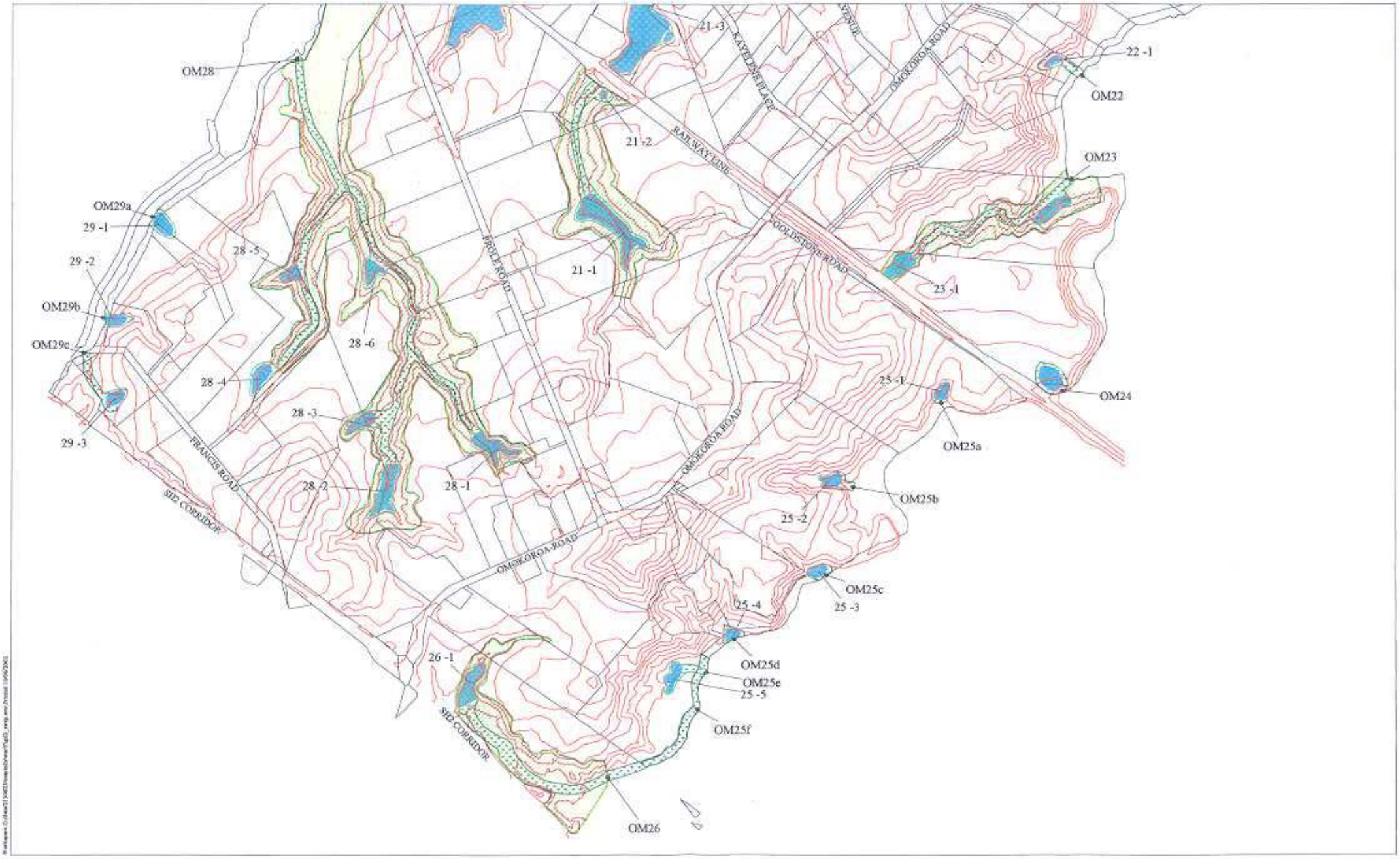
Omokoroa
SWMP Overview Plan 1
Figure 6.2



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Omokoroa
SWMP Overview Plan 2
Figure 6.2

APPENDICES

APPENDIX A
OMOKOROA STORMWATER MANAGEMENT PLAN IMPLEMENTATION METHODS

No.	*Provision*	*Mechanism*
1	The provisions of the WBOPDC Subdivision and Development Code of Practice is a means of compliance with the standards of the District Plan.	District Plan, Code of Practice
2	District Plan change to ensure that the provisions of this CMP and consent are applied comprehensively to all developments on the Omokoroa Peninsula.	District Plan
3	No building shall be located in the 100 year flood plain.	District Plan
4	Where there is little risk of the flooding of dwellings the 100 year flood will be allowed to pass through the catchment with minimal detention, but where the risk to dwellings is significant there must be adequate measures taken to protect the at risk areas.	Code of Practice
5	All developments must provide a stormwater management plan demonstrating: • that their primary stormwater drainage discharges to an approved drainage system, • how they will pass surface flows from above without causing erosion or flooding of buildings, • how surface flows will be captured, or pass safely downstream, • management of runoff peaks to downstream so they are no greater than from the pre-development catchment, or are fully managed through to the harbour receiving environment.	District Plan, Code of Practice, SWMP
6	The reduction of impervious areas should be promoted, particularly in the high-density areas. A maximum of 50% impervious area is recommended in high density and commercial areas, 35% in medium density residential areas, and 15% in rural residential and reserve areas.	District Plan
7	The 2 year and 100 year ARI flood peaks are not to be increased over the runoff rates for pasture. This can be achieved through a range of measures including low impact design, attenuation ponds etc. Where a developer cannot achieve this standard, or a combined approach is more effective, a DIF shall be levied towards provision by Council of a comprehensive solution. Pre-development levels are defined as those relating to a pasture catchment with natural streams (as distinct from the "existing" situation).	Code of Practice or District Plan

8	Catchments where the streams have ecological significance must have a minimum total volume of water quality and flood detention ponds equal to that required for the 100 year flood event. These catchments are OM23, OM26, OM27 and OM28.	SWMP
9	No soak pits are to be used in steeper areas or where there are sensitive soils. Those in use must be decommissioned and replaced with a discharge that does comply with the standards.	Code of Practice, works programme
10	Infiltration should be promoted by the use of swale drains in the flatter areas (1-5% average gradient).	Code of Practice
11	There shall be no top-of-cliff discharges. The single residential coastal outfalls should be combined to larger outlets. These outlets should be subject to specific design.	Design standards, works programme
12	All development areas of any size shall pass stormwater runoff through a treatment device before it is discharged to the sea. This could be those shown in Figure 6.2 of the SWMP, or equivalent devices installed by the developer to the Council's satisfaction.	SWMP
13	Best management practice for sediment and contaminant removal is to be required on all commercial and industrial sites and roads. This would require developers to show how the adverse effects of their developments are managed. 75% removal of sediment is the minimum requirement.	SWMP
14	All new subdivisions to treat stormwater for removal of sediment, to a standard of 75% gross removal (according to ARC TP10 methods or equivalent). This may be achieved by a combination of drainage design features (e.g. swales) and end-of-pipe solutions. Where an individual subdivision cannot achieve this, or a combined approach is more effective, a DIF shall be levied towards provision of a comprehensive facility by Council.	District Plan, Code of Practice
15	All stormwater treatment devices must have adequate access for maintenance purposes.	Code of Practice, District Plan
16	Stream and riparian areas are to be enhanced with protection works and planting.	Designation conditions, SWMP
17	All site developments (both subdivision earthworks and subsequent building excavations and earthworks) shall comply with the provisions of EBOP publication TR28, *Erosion and Sediment Control Guidelines for Earthworks*.	District plan
18	The education of the general public, property developers and contractors should be a focus for both Regional and District Council.	Council

19	All on-line structures with natural channel upstream to provide for fish passage. Council to incorporate cascading weirs or other suitable permanent fish passage (for eels and inanga) into the outlet works of all in-stream structures	Designation conditions, SWMP

APPENDIX B
COMPREHENSIVE STORMWATER DISCHARGE CONSENT ACTIVITIES AND WORKS COVERED BY THE CONSENT

Table B1 Stormwater Management Devices

Main Catchment	*Pond Number*	*Grid Reference*	*Area Served By Pond*	*Water Quality Volume*	*Flood Detention Volume*	*Total Pond Vol*	*Q2 Inflow*	*Q2 Outflow*	*Q100 Inflow*	*Q100 Outflow*	*Type of pond*
OM13	13-1	U14:788915	9	1,300	1,100	2,400	0.37		1.1		Main purpose SWQ, some Det - serves existing development
OM18	18-1	U14:780912	33.7	4,500	2,800	7,300	2.2	1.4	6.9	5.30	SWQ and Det
OM18	18-2	U14:779914	na	na	na	na					Enhance for SWQ
OM20	20-1	U14:778908	18	2,500	2,300	4,800	1.5	0.73	4.6	2.80	SWQ and Det
OM20	20-2	U14:777910	8.4	1,200	1,100	2,300	0.67	0.33	2.0	1.30	SWQ and Det
OM20	20-3	U14:775910	24.9	2,600	2,300	4,900	1.3	0.86	4.1	3.20	SWQ and Det
OM20	20-4	U14:776911	1.5	300	200	500	0.19	0.08	0.48	0.30	Frb - limited space
OM20	20-5	U14:772907	14	1,800	1,600	3,400	1.2	0.59	3.6	2.30	SWQ and Det
OM20	20-6	U14:772908	3	400	300	700	0.28	0.14	0.83	0.54	Frb or SWQ - serves existing development
OM20	20-7	U14:777911	2	400	300	700	0.26	0.10	0.64	0.38	Frb - limited space
OM21	21-1	U14:768899	65	7,500	5,000	12,500	3.4	1.8	11.2	7.00	SWQ and Det
OM21	21-2	U14:768903	17.2	2,200	1,200	3,400	1.3	0.66	4.0	2.50	Frb - limited space
OM21	21-3	U14:769905	105	4,000	8,000	12,000	4.3	2.7	14.2	10.20	SWQ and Det - in series with 21-1
OM21	21-4	U14:769907	7.6	1,000	400	1,400	0.64	0.31	1.9	1.20	Frb - limited space
OM21	21-5	U14:771913	na	na	na	na					Existing pond
OM22	22-1	U14:780904	3.5	400	200	600	0.27	0.16	0.86	0.62	Main purpose SWQ
OM23	23-1	U14:776898	5	400	300	700	0.31	0.26	1.10	1.00	SWQ and Det

OM23	23-2	U14:781899	10	600	400	1,000	0.47	0.41	1.8	1.60	SWQ and Det - off main stream
OM24	24-1	U14:781899	11.5	2,200	1,000	3,200	1.5	0.49	3.7	1.90	Main purpose SWQ
OM25	25-1	U14:777894	9	700	300	1,000	0.53	0.42	1.9	1.60	Main purpose SWQ
OM25	25-2	U14:774891	8	500	300	800	0.44	0.37	1.6	1.40	Main purpose SWQ
OM25	25-3	U14:774889	4.8	300	100	400	0.28	0.23	1.0	0.89	Main purpose SWQ
OM25	25-4	U14:771887	6	400	100	500	0.33	0.28	1.2	1.10	Main purpose SWQ
OM25	25-5	U14:770886	8	1,000	400	1,400	0.69	0.37	2.1	1.40	Main purpose SWQ
OM26	26-1	U14:764886	11.5	1,400	1,200	2,600	0.90	0.50	2.9	1.90	SWQ and Det
OM27	27-1	U14:764905	38.3	4,700	3,700	8,400	3.0	1.7	9.4	6.30	Main purpose SWQ
OM28	28-1	U14:764892	17.5	2,200	1,500	3,700	1.4	0.70	4.2	2.70	SWQ and Det
OM28	28-2	U14:761891	28	3,400	2,300	5,700	2.1	1.2	6.5	4.40	SWQ and Det
OM28	28-3	U14:761893	5.5	900	300	1,200	0.54	0.29	1.6	1.10	SWQ and Det
OM28	28-4	U14:758894	12	2,100	1,600	3,700	1.3	0.51	3.6	2.00	SWQ and Det
OM28	28-5	U14:759898	9	1,600	1,000	2,600	1.1	0.40	2.8	1.60	SWQ and Det
OM28	28-6	U14:761898	8	1,500	800	2,300	1.1	0.41	2.6	1.50	SWQ and Det
OM29	29-1	U14:755899	5	800	500	1,300	0.57	0.22	1.5	0.86	Main purpose SWQ
OM29	29-2	U14:753896	4	700	400	1,100	0.52	0.18	1.3	0.69	Main purpose SWQ
OM29	29-3	U14:753894	5.5	1,000	500	1,500	0.71	0.25	1.8	0.98	SWQ and Det
TOTAL			**2606.2**	**283,800**	**218,600**	**502,400**					

Locations of ponds are shown on Figure 6.2

SWQ	Stormwater quality improvement - these ponds will also contain a forebay area at each inflow point.
Det	Flood detention - must control the full range of flood between Q2 and Q100
Frb	Forebay - initial treatment before entering another pond, or prior to stream if space is limited.

Table B2 Stormwater Outlets

Outlet Point	*Grid Reference*	*Q100 Outflow (m^3/s)*	*Outlet Point*	*Grid Reference*	*Q100 Outflow (m^3/s)*
OM1	U14:794927	0.08	OM16a	U14:791917	na
OM2	U14:793927	0.44	OM16b	U14:790916	
OM3a	U14:796928	na	OM17	U14:783916	0.19
OM3b	U14:797926		OM18	U14:779915	5.0
OM4	U14:796924	0.40	OM19a	U14:786907	3.8
OM5	U14:792926	1.3	OM19b range	U14:789915 - U14:789913	
OM6a	U14:796920	1.4	OM20	U14:777914	9.1
OM6b	U14:795920		OM21	U14:770914	10.7
OM6c	U14:794920		OM22	U14:781903	2.1
OM6d	U14:796923		OM23	U14:781900	3.9
OM7a	U14:794920	1.3	OM24	U14:781894	2.7
OM7b	U14:793920		OM25a	U14:777894	8.7
OM7c	U14:793920		OM25b	U14:775891	
OM8 range	U14:788921 - U14:789923	na	OM25c	U14:774889	
OM9	U14:788920	0.32	OM25d	U14:771887	
OM10	U14:787920	0.41	OM25e	U14:771886	
OM11	U14:787919	0.34	OM25f	U14:770885	
OM12	U14:786918	0.32	OM26	U14:768883	1.9
OM13a	U14:790915	1.4	OM27	U14:767907	6.1
OM13b	U14:790915		OM28	U14:761907	11.8
OM14	U14:792918	0.57	OM29a	U14:755899	6.7
OM15a	U14:793919	na	OM29b	U14:753896	
OM15b	U14:792919		OM29c	U14:753895	

Locations of outlets are shown on Figure 6.2

Table B3 Sediment Pond Maintenance

Activity	*Frequency*
Forebay clearance of sediment and disposal to approved landfill	1 to 5 years
Main pond sediment removal and disposal to suitable landfill	0.5 to 2 years
Pond weed removal and planting maintenance	10 - 20 years

These above maintenance activities are required for all ponds in Table B1

Stream Clearance
Stream clearance and channel maintenance is required from the outlet of each pond to the discharge of the open channel to the shore area. There should be a comprehensive annual inspection, looking for erosion and weed growth. Twice per year weed removal and general vegetation management is likely to be required. Grassed areas (including swales) should be planted with appropriate seed mixes which require only annual mowing.

APPENDIX C
COST ESTIMATES FOR CAPITAL AND MAINTENANCE WORKS

Cost estimates have been prepared covering the implementation of the works required in the SWMP, and for annual operation and maintenance. The SWMP needs to be considered in the context of the whole process of urban growth in the peninsula. Many of the SWMP works are only required if and when the development occurs, at which time other services (roads, water supply etc) will also be required. The costs of this infrastructure will form the basis for determining Development Impact Fees (DIFs) which will be charged to developers in order to fund the principal infrastructure.

There are two separate issues to consider at the concept development phase:

- The cost of works as proposed for the SWMP, which reflect the development concept contained within the proposed Draft Structure Plan.
- The cost of works for a different approach to stormwater management, e.g. no stormwater reserves and narrow channel or even pipes. This might allow for more land to be developed, and potentially more lots, but at a higher development cost, including higher costs for some other services. Consideration of this matter belongs within the Structure Plan, not the SWMP.

As a comparison, an approximate estimate to pipe all the stormwater instead of retaining open channels and stormwater reserves is between $4 million and $5 million. In addition, in order to use the land that would be "released", significant earthworks would be required to address stability issues on the gully margins. This estimate is based on existing storm flows, and therefore assumes that all the ponds are also needed for stormwater quality improvement and flood peak attenuation. The alternative to this would be to increase the pipe sizes and costs. This approach of piping the main channels would also require that secondary flow paths be left undeveloped along the base of all main gullies.

A related issue is the cost of stormwater development within each subdivision, and linking the subdivisions to the stormwater reserves. The assumption of the current estimates is that each developer will be required to convey the stormwater to the primary drainage system, as defined by the stormwater reserves.

These estimates cover the following elements:

- Development costs for ponds for stormwater quality improvement and flood detention. These will be required whichever stormwater development concept is adopted. There is potential for the size of these ponds to be reduced where a developer incorporates within their development alternative means of detention and treatment.
- Estimates for the remedial works on the piped system, as outlined in the Bruce Henderson Consultants report. These have been taken directly from that report, except for the southern (development) catchments, which are covered by more comprehensive works.

- Estimates for limited water quality works in the existing urban area, where beneficial and practicable.
- Estimates for annual costs of operation and maintenance.

The capital cost estimates are set out in Table C1, and operating costs in Table C2.

Table C1 Capital Cost Estimates

Future Development Areas		
Catchment	***Total Pond Volumes (m^3)***	***Capital Cost Estimate***
OM-18	7,300	$ 300,000
OM-20	17,300	$ 930,000
OM-21	29,300	$ 1,200,000
OM-22	600	$ 70,000
OM-23	1,700	$ 160,000
OM-24	3,200	$ 160,000
OM-25	4,100	$ 390,000
OM-26	2,600	$ 140,000
OM-27	8,400	$ 330,000
OM-28	19,200	$ 940,000
OM-29	3,900	$ 280,000
Stormwater reserves	planting and enhancement	not estimated
reticulation to reserves	piped by developers	not estimated
TOTALS	**97,600**	**$ 4,900,000**

Existing Urban Area		
Catchment	***Works***	***Capital cost estimate***
OM-1 to OM-17	various pipe upgrades (ex BHCL report)	$ 864,000
OM-6, OM-13	ponds, 2,400 m^3, 2 sand filters	$ 190,000
OM1-17, 19-23, 26	catchpit insert bags in heavily trafficked areas	$ 40,000
All catchments	catchpit insert bags in lower trafficked areas	$ 58,000
TOTALS		**$ 1,152,000**

***** Note: these are abased on 50 year ARI pipes as per BHCL report. Under CoP these may be able to be reduced.

Table C2 Operating Cost Estimates

Catchment	*Activity*	*Operating Cost Estimate ($ / year)*
Existing urban	routine maintenance including catchpits	$12,000 (approximate)
Future development	pond clearing and maintenance, streams	$145,000
Future development	pipe system handed over by developers	not estimated
Catchpit inserts (heavily trafficked areas)	cleaning	$ 8,000
Catchpit inserts (lower trafficked areas)	cleaning	$ 12,000
TOTALS		**$ 177,000**

Table C3 Land area requirements

Development area	*Stormwater Reserves*	*Council owned Stormwater Reserve*	*Stormwater Quality Ponds*	*Total Area Required*
Existing urban area	1.3 ha	1.0 ha	1.0 ha	**3.3 ha**
Structure Plan (urban limit to railway)	3.3 ha	9.8 ha	5.0 ha	**18.1 ha**
Future development (railway to SH1)	36.7 ha	12.3 ha	5.6 ha	**54.6 ha**
TOTALS	**41.3 ha**	**23.1 ha**	**11.6 ha**	***76.0 ha***

Note: The above areas are net of any overlap in areas.

ENVIRONMENT B·O·P
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(0800 368 267)

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(0800 368 329)

Bay of Plenty Regional Council

File ref.

	SEEN		SEEN

Office Use Only

Application for a Resource Consent
Resource Management Act 1991 (s.88)

See notes to applicant (last pages of form) before Proceeding with application form.

Pursuant to section 88 of the Resource Management Act 1991, the undersigned hereby makes application for resource consent(s).

1 **Full Name of Applicant(s):**
(the name that will be on the consent) WESTERN BAY OF PLENTY DISTRICT COUNCIL

Surname:

First Names:

or

Company Name:

Contact Person: CHARLES TURNER

Postal Address: PRIVATE BAG 12803

TAURANGA

Residential Phone:

Business Phone: (07) 571 8008

Facsimile Number: (07) 543 3794

Email:

2 Details of Consultant

(or other person authorised to make application on behalf of applicant)

Company Name: BECA CONSULTANTS

Contact Person: CHRISTINE RALPH

Postal Address: PO BOX 903

TAURANGA

Business Phone: (07) 578 0896

Facsimile Number: (07) 578 2968

Email: cralph@beca.co.nz

Cell-phone: 025 505 973

All correspondence (including invoices for charges) relating to this application(s) should be sent to:

Applicant: ☐

Consultant: ☒

3 Name and Address of Owner/Occupier of the Site Relating to Application

(only include this information if different to the applicant)

Owner:

Postal Address:

Residential Phone:

Business Phone:

Occupier:

Postal Address:

Residential Phone:

Business Phone:

Continue on additional sheet at end of document if needed

4 Consent(s) being applied for from Environment B·O·P:

(You will need to fill in a separate form for each of the activities. If you have any queries, contact a Customer Services Officer at Environment B·O·P on 0800 368 267.)

Land Use

☒	Form 1	Beds of lakes and rivers (use, place, alter or remove structure in river, stream or lake; disturb bed of river, stream or lake (excluding shingle extraction); deposit substance in on or under bed of river, stream or lake).
☐	Form 2	Land disturbing activities (earthworks, quarrying, vegetation clearance / harvesting / burning)
☐	Form 3	Shingle extraction

Water (including coastal)

☐	Form 4	Take groundwater/surface water
☒	Form 5	Dam/divert/use water
☐	Form 6	Geothermal - take and discharge

Discharge (including coastal)

☐	Form 7	Discharge contaminant to air
☒	Form 8	Discharge contaminant or water to water
☐	Form 9	Discharge contaminant to land
☐	Form 10	Onsite effluent discharge
☐	Form 11	Discharge farm dairy effluent

Coastal (see point 4 of information sheet for explanation of the coastal marine area).

☒	Form 12	General (occupancy; disturb foreshore or seabed; plant foreshore or seabed; deposit substance, remove natural material, reclaim or drain; place, remove or alter structure).

5 Location Description of Activity:

Site Address: ENTIRE OMOKOROA PENINSULA

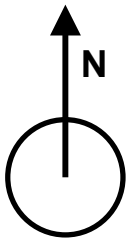
Legal description: (Legal description can be obtained from your certificate of title, valuation notice, or rate demand)

Map reference NZMS 260

Continue on additional sheet at end of document if needed

Site Plan

Please provide a site plan showing any works relating to the proposal, area surrounding the site including the names of current owners and occupiers of adjoining property. A lot map from the district council will assist in identifying potentially affected parties.



6 **In which District is the activity located:**

Whakatane District ☐

Opotiki District ☐

Rotorua District ☐

Kawerau District ☐

Western BOP District ☒

Tauranga District ☐

Taupo District ☐

Do you also require resource consent(s) from a district council? ☒ Yes ☐ No

Type of consent required:

Have these been applied for? ☒ Yes ☐ No

7 **Refer to relevant activity form.**
(From Question 4)

8 **Is this application to replace an existing or expired consent?**

☐ Yes ☐ No

If so, please state the number of that consent:

9 **Duration of Consent**

Please specify the duration sought for your consent(s):

years months

Start Date: / /

Completion Date (if applicable): / /

10 **DEPOSIT FEE**

A deposit fee of $500.00 (including GST) is payable with this application. A GST invoice marked 'PAID' will be issued on receipt of payment. Processing of the application will not begin until the deposit fee has been paid. Additional charges are usually incurred for the majority of consents that <u>are not minor</u>. Staff can give an indicated range of expected costs.

Checklist

☐ Complete all details applicable in this application form.

☐ Include an assessment of effects of the activity, as set out in this application form.

☐ Include a site plan.

☐ Supply written approval from all affected parties.

☐ Sign and date the application form.

☐ Pay the required deposit.

☐ Any information required by regional plan(s) or regulation(s).

☐ Include any other information you think relevant.

Important Note
Information Privacy Issues

The information you provide in this application is regarded as official information. It is required under the provisions of the Resource Management Act 1991 to process this application and to assist in the management of the regions natural and physical resources.

The information will be held by Environment B·O·P, Quay Street, Whakatane. This information is subject to the provisions of the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993.

Failure to provide this information will mean that Environment B·O·P will be unable to process your application.

I have read and understand all of the information contained on this application form including the requirement to pay additional costs that will be itemised.

Signature **Date** / /

Form 1 Beds of Lakes and Rivers

Question 7 Assessment Of Effects On The Environment (AEE)

Section 88 of the Resource Management Act 1991 requires all applications for resource consents to include an assessment of the actual or potential effects that the proposed activity may have on the environment and the ways in which any adverse effects can be mitigated. The Fourth Schedule of the Act lists the matters that should be included in such assessments and a summary is printed on the back of the application form.

You must fully complete this section or your application cannot be processed.

The information you supply should be detailed according to the scale, scope and effects of the proposed activity.

Applicants for small scale proposals having minor effects should be able to supply sufficient information by filling in the spaces provided. More complex proposals with more significant effects will need to address the following matters (in accordance with the Fourth Schedule) as a separate document.

If the AEE is presented in the format of a report, it must address the following matters, if appropriate.

If you are unsure how to complete this section please contact an Environmental Consents Officer at Environment B·O·P.

1 **Description of Activity** **(tick appropriate box)**

☒ Use erect/reconstruct/place/alter/extend/remove or demolish any structure or part of any structure in, on, under, or over the bed.

☒ Excavate, drill, tunnel, or otherwise disturb the bed

☒ Introduce or plant any plant or any part of any plant (whether exotic or indigenous) in, on, or under the bed

☒ Deposit any substance in, on, or under the bed

☐ Reclaim or drain the bed

☐ Other

Please describe the proposed activity in detail (dimensions, purpose, materials to be used, reason for the works)

Structures, disturbance, deposit substances in the beds of races for all the stormwater management devices – ponds in Table B1 of the Omokoroa Stormwater Management Plan subject to final design and the operation and maintenance generally as described in Table B3.

Please note the Stormwater Reserves are proposed to be designated in the District Plan.

There will be some riparian planting associated with the culverts and pond outlet structures. There may also be enhancement of riparian planting along watercourses in the stormwater reserves.

Please provide:

a) Structural plans, to scale on good quality paper of minimum A4 size. Show side view and plan view.

N/A. Subject to final design.

b) Design details and calculations.
Please describe how the construction/disturbance/removal will be carried out (eg machinery to be used, access to site, staging of works etc.)

N/A. Subject to final design.

c) A cross section of the proposed site. N/A.

d) Cross sections 50 metres upstream and downstream of the site. N/A.

NOTE: A cross section involves the following measurements:

- the width between the top of each bank.
- the width across the bed of the waterway N/A.

e) The height of each bank above the bed of the waterway.

N/A.

2 **Description of Site**

Describe the physical attributes of the sites eg topography, ecology, bed materials, wildlife habitats, cultural, scientific features. It would be useful to include photographs.

See AEE.

Please provide any hydrological data, if available. These include: stream flow and gradient, catchment size in hectares and catchment characteristics, e.g. steep, forested catchment or easy pastoral catchment.

See AEE.

3 **Assessment of Effects**

Describe the actual or potential effects that the proposed activity/operation could have on the environment

Effects of immediate activity/construction:

See AEE.

Effects of the completed works or structure on the riverbed both upstream and downstream:

See AEE.

Effects on fish passage:

See AEE.

Effects of the works/structure in extreme events (e.g. flooding). Please provide an assessment and any supporting calculations:

See AEE.

Any other effects:

See AEE.

What methods or actions will be used to reduce or prevent any identified environmental effects. e.g. grassing and planting of fill batters, metalling of approaches, stabilisation of abutments by crib walling.

See AEE.

Assessment of any alternative options considered and reasons why these are not proposed:

See AEE.

Details of any monitoring proposed:

See AEE.

4 **Persons likely to be directly affected:**

For your application to be considered for non-notification, you must gain the written approval of all persons who may be affected by the proposal. Please specify below those parties who may be affected (or interested by your proposal).

Persons who may be interested or affected and consultation undertaken

State any contact made with neighbouring land owners and occupiers and organisations such as the Department of Conservation, Eastern Region Fish and Game Council, local iwi and community groups. Where possible, record any comments made by these parties and outline your response to them. A list of people and organisations who you consider may be interested or affected should also be supplied wherever possible.

Note: Environment B·O·P can provide a form for the written approval of affected persons.

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Form 5 Dam / Divert / Use Water

Question 7 Assessment Of Effects On The Environment (AEE)

Section 88 of the Resource Management Act 1991 requires all applications for resource consents to include an assessment of the actual or potential effects that the proposed activity may have on the environment and the ways in which any adverse effects can be mitigated. The Fourth Schedule of the Act lists the matters that should be included in such assessments and a summary is printed on the back of the application form.

You must fully complete this section or your application cannot be processed.

The information you supply should be detailed according to the scale, scope and effects of the proposed activity.

Applicants for small scale proposals having minor effects should be able to supply sufficient information by filling in the spaces provided. More complex proposals with more significant effects will need to address the following matters (in accordance with the Fourth Schedule) as a separate document.

If the AEE is presented in the format of a report, it must address the following matters, if appropriate.

If you are unsure how to complete this section please contact an Environmental Consents Officer at Environment B·O·P.

Part A: To Dam Water
Part B: To Divert Water

Part A — To Dam Water

1 **Is the dam:** ☐ **existing** ☒ **or proposed?**

If you are constructing a new dam in a watercourse, a Land Use Consent is also required. Use application form number 10.

* **Note:** The stormwater reserves are proposed to be designated in the District Plan.

2 **What is the purpose of the dam? (e.g. recreation, stock water, irrigation, etc.)**

Damming of water for the purposes of the stormwater detention ponds as listed in Table B2 of the Omokoroa Stormwater Management Plan subject to final design and the operation and maintenance generally as described in Table B3.

3 **What is the name of the watercourse to be dammed?**
(If the stream is unnamed give the name of the watercourse it is a tributary of.)

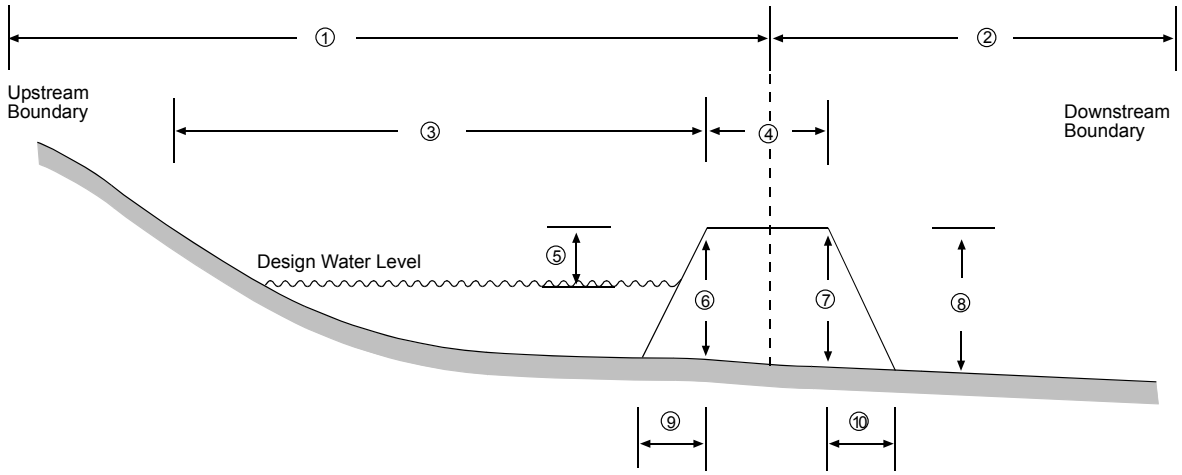
N/A. See AEE.

Proposed Dam Dimensions – long section

N/A. Subject to final design. Refer to AEE Figure 3.1 for conceptual layout

Fill in dimensions using metric measurement

①	②	③	④	⑤
⑥	⑦	⑧	⑨	⑩



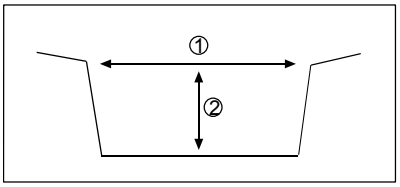
Proposed Dam Dimensions — cross section

N/A. Subject to final design.

Fill in dimensions using metric measurement

a. Length of dam (from bank to bank)

b. Give dimensions of dam spillway



①	Length of spillway
②	Depth of spillway

c. Type of spillway e.g. open channel/piped spillway (include dimensions of pipe)

4 Please show the location of your dam or weir on your map. Include design plans and details with this application. Complete the dimensions details on the enclosed page. Make up sheet for 'Proposed dam dimensions" as attached.

See AEE. Indicative locations are shown in Figure 6.2.

5 **Construction**

What materials will be used to construct the dam?

See AEE.

6 Dimensions of storage and catchment

See AEE. Proposed sizing is shown in Table 6.1.

Maximum storage capacity: m^3

Catchment area above the structure: km^2 or ha

7 **Does the dam also involve:**

Taking water?	☐	Yes	☐	No
Diverting water?	☐	Yes	☐	No
Discharging?	☒	Yes	☐	No

If you answered Yes to any of 8 above, a separate consent application may be required.

8 **Downstream users**

Will the proposed damming have a detrimental effect on the availability of water to downstream users?:

☐ Yes ☒ No

Please state why:

See AEE.

9 **Surrounding environment**

Within a reasonable distance up or downstream of the dam, are there any:

1	Obvious signs of biota? (e.g. fish, eels, bullies, insect life, crayfish)	☐ Yes	☐ No
2	Areas where food is gathered from the watercourse? (e.g. watercress, eels, wildfowl)	☐ Yes	☐ No
3	Significant wetlands? (e.g. large swamp areas)	☐ Yes	☐ No
4	Waste discharges? (e.g. cowsheds, piggeries, sewage treatment plants)	☐ Yes	☐ No
5	Recreational activities carried out? (e.g. fishing, swimming)	☐ Yes	☐ No
6	Areas of particular aesthetic or scientific value? (e.g. scenic waterfalls, rapids, archaeological sites)	☐ Yes	☐ No

See AEE.

10 **Adverse effects**

If you have answered yes to any of 9, 1-6, describe what adverse effects your proposed damming will have and the steps you proposed to take to reduce these:

See AEE.

(continue on another page if necessary)

11 **Fish by-pass**

Have you provided any means for fish to by-pass the dam? (e.g. fish ladder, elver tubes)

☒ Yes ☐ No

Please describe:

See AEE.

12 **Describe the bed of the watercourse immediately above and below the dam site:**
(e.g. is it gravelly, muddy or sandy?)

See AEE.

13 **Springs**

Are there any springs that might be flooded by the impoundment of water?

☐ Yes ☐ No

See AEE.

14 **Feeder stream**

Does the stream feeding the dam flow all year round?

☐ Yes ☐ No

See AEE.

15 **Dam failure**

What might be affected downstream in the event of a dam failure? (e.g. houses, roads, crops, bridges):

See AEE.

16 **Please attach your calculations which show that the dam and spillway design are adequate, including design flood flows, return periods, etc.**

See AEE.

17 **Will the pond formed cause flooding, loss of access or other problems to neighbouring properties?**

☐ Yes ☐ No

Please describe:

See AEE.

18 **Adjacent owners and occupiers**

List the names and postal addresses of all neighbours who share a boundary with your property:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

19 **Period of activity:**

Date of commencement: / / Date of completion: / /

Part B — To Divert Water – N/A.

1 **Is the diversion:**

☐ existing ☐ or proposed?

If the diversion relates to a new activity a land use consent may also be required.

If the diversion is in the coastal marine area a coastal permit to divert water is required. You can make the application on this form. A coastal permit to erect any structures and occupy the coastal marine area is required for a new diversion.

2 **Why are you diverting water?**
(e.g. stormwater control, river works, stream realignment, etc.)

3 **What is the name of the watercourse to be diverted?**
(If the stream is unnamed give the name of the watercourse it is a tributary of.)

4 **What is the rate at which water will be diverted?**

cubic metres or litres per second

5 **Will the diversion be:**

☐ intermittent ☐ or continuous?

If intermittent, what will be the maximum operating period?

hours per day

days per week

weeks per year

6 **Does the diversion also involve:**

Taking water? ☐ Yes ☐ No

Damming water? ☐ Yes ☐ No

Discharging? ☐ Yes ☐ No

Any Structures? ☐ Yes ☐ No

If you answered Yes to any of 6 above, a separate consent application may be required.

7 Where your diversion could have a significant adverse effect on the environment a more detailed environmental assessment is required in accordance with the Fourth Schedule of the Resource Management Act 1991.

7.1 Will the diversion have an effect on water availability to downstream users and/or affect access to neighbouring properties?

☐ Yes ☐ No

7.2 Within a reasonable distance up or downstream of the diversion are there any:

1	Obvious signs of biota (e.g. fish, eels, insect life, aquatic plants)?	☐ Yes	☐ No
2	Areas where food is gathered from the stream (e.g. watercress, eels, wild fowl, kaimoana)?	☐ Yes	☐ No
3	Wetlands (e.g. swamp areas)?	☐ Yes	☐ No
4	Waste discharges (e.g. from rural sources, industries, sewerage plants, e.t.c)?	☐ Yes	☐ No
5	Recreational activities carried out (e.g. swimming, fishing, canoeing)?	☐ Yes	☐ No
6	Areas of particular aesthetic or scientific value (e.g. scenic waterfall, rapids, archaeological sites)?	☐ Yes	☐ No
7	Areas or aspects of significance to iwi?	☐ Yes	☐ No

7.3 If you have answered yes to 7.1 and any part of 7.2 above, describe what adverse effects your diversion may have and the steps you propose to take to mitigate these. If the adverse effect is significant describe alternative locations or methods you have considered for undertaking the damming.

(continue on a separate page if necessary)

8 **Have you provided any means for fish to bypass the diversion**
(e.g. fish ladders, elver tubes, etc)

☐ Yes ☐ No

Please describe:

9 **Describe the bed of the watercourse in the vicinity of the diversion site**
(e.g. is it gravelly, muddy or sandy?)

10 **Will the diversion cause flooding or other problems to neighbouring properties?**

☐ Yes ☐ No

Please describe:

11 **Please attach your calculations which show that the diversion design is adequate, including design flood flows, return periods, etc.**

12 **Have you discussed your diversion with any potentially affected parties?**
(e.g. neighbours, water users, the Fish and Game Council, Department of Conservation, etc.)

☐ Yes ☐ No

13 **Persons likely to be directly affected:**

For your application to be considered for non-notification, you must gain the written approval of all persons who may be affected by the proposal. Please specify below those parties who may be affected (or interested by your proposal).

Persons who may be interested or affected and consultation undertaken

State any contact made with neighbouring land owners and occupiers and organisations such as the Department of Conservation, Eastern Region Fish and Game Council, local iwi and community groups. Where possible, record any comments made by these parties and outline your response to them. A list of people and organisations who you consider may be interested or affected should also be supplied wherever possible.

Note: Environment B·O·P can provide a form for the written approval of affected persons.

Name:

Address:

Name:

Address:

Name:

Address:

Name:

Address:

Name:

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Address:

Name:

Address:

Form 8 Discharge Contaminants or Water to Water

Question 7 Assessment Of Effects On The Environment (AEE)

Section 88 of the Resource Management Act 1991 requires all applications for resource consents to include an assessment of the actual or potential effects that the proposed activity may have on the environment and the ways in which any adverse effects can be mitigated. The Fourth Schedule of the Act lists the matters that should be included in such assessments and a summary is printed on the back of the application form.

You must fully complete this section or your application cannot be processed.

The information you supply should be detailed according to the scale, scope and effects of the proposed activity.

Applicants for small scale proposals having minor effects should be able to supply sufficient information by filling in the spaces provided. More complex proposals with more significant effects will need to address the following matters (in accordance with the Fourth Schedule) as a separate document.

If the AEE is presented in the format of a report, it must address the following matters, if appropriate.

If you are unsure how to complete this section please contact an Environmental Consents Officer at Environment B·O·P.

1 **Description Of Activity**

a) Where are discharged contaminants sourced from? (tick as appropriate)

☐ Sewage treatment plant, servicing

☐ Industrial premises, (specify type)

☐ Water treatment

☒ Other (specify) - Stormwater

If you ticked sewage treatment plant or industrial plant or industrial premises give description of type of process.

Discharge of treated stormwater to the Tauranga harbour as described in Table B2 of the Stormwater Management Plan subject to final design and the operation and maintenance of the same.

2 **Nature Of The Discharge And Sensitivity Of Receiving Environment**

a) Describe the contaminant:

including, where appropriate:
Temperature: °C pH:

Suspended Solids: g/m^3 BOD_5: g/m^3

Faecal Coliforms: n/100ml Enterococci: n/100ml

The chemical content, including heavy metals or toxic substances, nitrates, ammonia and dissolved reactive phosphorus:

See AEE.

b) Is the contaminant treated in any way before discharge? ☒ Yes ☐ No
If Yes, describe treatment

See AEE.

c) What is the name of the water body into which the discharge is made (e.g. at the discharge site name of stream, river, lake, bay, harbour)?

Tauranga Harbour.

See AEE.

Is this in the coastal marine area? (See note 4 on application form) ☒ Yes ☐ No

What is the water quality in the water body?

See AEE.

d) Discharge Rate Information: See AEE, Table B2.

Maximum flow rate: litres per second or cubic metres per second

Maximum daily flow: cubic metres

Average dry weather flow: cubic metres

Average wet weather flow: cubic metres

For non stormwater discharges, is the discharge: ☐ continuous ☐ or intermittent

What will be the maximum discharging period? hours per day days per week
weeks per year

e) Does the discharge also involve:

diversion of natural water	☐ Yes	☐ No
discharge to air	☐ Yes	☐ No
piping across a waterway or water body	☐ Yes	☐ No
any structure in waterway or water body	☒ Yes	☐ No

If you answered Yes to any of the above, a separate consent application may be required.

3 **Assessment Of Effects On The Environment**

Where your discharge could have a significant adverse effect on the environment a more detailed environmental assessment is required in accordance with the Fourth Schedule of the Resource Management Act 1991.

a) Comment on the possible effect the discharge may have on the quality of the receiving environment and users:

See AEE.

b) Within a reasonable distance downstream, down groundwater gradient or in the vicinity of the discharge are there any:

1	Obvious signs of biota (e.g. fish, eels, insect life, aquatic plants)	☐ Yes	☐ No
2	Areas where food is gathered	☐ Yes	☐ No
3	Water abstractions	☐ Yes	☐ No
4	Wetlands	☐ Yes	☐ No

5	Recreational activities carried out	☐ Yes	☐ No
6	Areas of particular aesthetic or scientific value (e.g. archaeological sites)	☐ Yes	☐ No
7	Areas or aspects of significance to iwi	☐ Yes	☐ No

If you have answered yes to any of the above, describe what effects your discharge may have and the steps you propose to take to avoid or mitigate these.

See AEE.

4 **Alternatives**

a) What alternative methods of disposal or discharge locations have you considered?

See AEE.

b) Why did you choose the proposed method of disposal and location point?

See AEE.

5 **Maintenance And Contingency**

a) How will the equipment controlling the discharge be operated and maintained to prevent equipment failure, and what measures will be implemented to ensure that the effects of any malfunction are remedied?

See AEE.

6 **Monitoring**

a) What, if any, monitoring do you propose to carry out to ensure that the discharge does not have any adverse effect?

See AEE.

7 **Persons likely to be directly affected:**

For your application to be considered for non-notification, you must gain the written approval of all persons who may be affected by the proposal. Please specify below those parties who may be affected (or interested by your proposal).

Persons who may be interested or affected and consultation undertaken

State any contact made with neighbouring land owners and occupiers and organisations such as the Department of Conservation, Eastern Region Fish and Game Council, local iwi and community groups. Where possible, record any comments made by these parties and outline your response to them. A list of people and organisations who you consider may be interested or affected should also be supplied wherever possible.

Note: Environment B·O·P can provide a form for the written approval of affected persons.

Name:

Address:

Name:

Address:

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Address:

Name:

Address:

Name:

Address:

Name:

Address:

Form 12 Application for a Coastal Permit

Question 7 Assessment Of Effects On The Environment (AEE)

Section 88 of the Resource Management Act 1991 requires all applications for resource consents to include an assessment of the actual or potential effects that the proposed activity may have on the environment and the ways in which any adverse effects can be mitigated. The Fourth Schedule of the Act lists the matters that should be included in such assessments and a summary is printed on the back of the application form.

You must fully complete this section or your application cannot be processed.

The information you supply should be detailed according to the scale, scope and effects of the proposed activity.

Applicants for small scale proposals having minor effects should be able to supply sufficient information by filling in the spaces provided. More complex proposals with more significant effects will need to address the following matters (in accordance with the Fourth Schedule) as a separate document.

If the AEE is presented in the format of a report, it must address the following matters, if appropriate.

If you are unsure how to complete this section please contact an Environmental Consents Officer at Environment B·O·P.

1 **Description of Activity**
Coastal Permit (Section 12—Resource Management Act)

Type of Permit(s) Sought (mark appropriate box(es))

- ☐ Reclaim/drain any foreshore or sea bed
- ☒ Erect/reconstruct/place/alter/extend/remove or demolish any structure or part of a structure fixed in/on/under or over foreshore or sea bed
- ☒ Disturb foreshore/sea bed including excavating/drilling/tunnelling
- ☒ Deposit any substance in/on or under any foreshore or sea bed
- ☐ Introduce or plant any exotic/introduced plant in/on or under the foreshore or sea bed
- ☒ Occupy part of the coastal marine area where the land is owned by the Crown or is vested in the regional council
- ☐ Remove sand/shingle/natural material from land owned by the Crown or land vested in the regional council within the coastal marine area
- ☐ Other

Please describe the proposed activity in detail (dimensions, purpose, materials to be used, reasons why it is needed)

Structures, occupation, disturbance, deposition of material for supporting structures in the coastal marine area for all discharge points on Table B2 of the Appendix B of Omokoroa Stormwater Management Plan subject to final design and the operation and maintenance of the same.

Please note that all Stormwater Reserves are proposed to be designated in the District Plan.

Please provide structural plans, to scale on good quality paper of minimum size A4. Show front view, side view and plan view, tidal levels – Mean High Water Springs and Mean Low Water Springs and sea bed levels.

Please describe how the construction/disturbance/removal will be carried out
(e.g. types of machinery, access to site, staging of the works etc):

N/A. Subject to final design detail.

Who will undertake and supervise the works?

N/A. Subject to final design detail.

Please describe any ongoing maintenance work
(e.g. type of machinery, materials to be used, length of time and frequency of the works):

N/A. Subject to final design detail.

2 Description Of Site

Site Description. Describe the topography, ecology, seabed materials, known wildlife habitats, cultural, historic, recreational, scientific, or scenic features and other physical attributes of the surrounding area and the seabed contours. Include photographs if possible.

See AEE.

Is there any known cultural/ecological/landscape importance of site? What consultation has been carried out to determine whether the site is significant? Possible sources of information are local iwi, Department of Conservation, Regional Coastal Environment Plan.

See AEE.

Please supply plans to scale on good quality paper of minimum size A4. Show the activity and site in relation to permanent landmarks, neighbouring structures, boatsheds, ramps, jetties etc., adjacent public roads, or public reserves and the legal description of any private land immediately landward of the site.

N/A. Subject to final design.

3 **Assessment Of Effects** that the proposed activity may have on the environment (in accordance with the Fourth Schedule to the Act). Please make this assessment as extensive as possible. The following questions give a guide to the type of information required.

Effects of immediate activity/construction
(e.g. discoloration of water, noise, public access etc)

What is proposed to lessen these effects
(e.g. timing of the works, swamp mats, filter cloth):

Post activity/construction effects
(erosion, sedimentation, visual, public access, navigation, cumulative effects etc)

What is proposed to lessen these effects
(e.g. lighting, navigation markers):

Effects on water quality of the area:

What is proposed to lessen these effects:

Visual effects

What is proposed to lessen these effects:

Effect on marine flora and fauna:

What is proposed to lessen these effects:

Any cultural effects:

Any other effects:

4 **Describe any alternative sites/methods and reasons why these are not proposed:**

See AEE.

5 **Describe details of any monitoring proposed:**

See AEE.

6 **Persons likely to be directly affected:**

For your application to be considered for non-notification, you must gain the written approval of all persons who may be affected by the proposal. Please specify below those parties who may be affected (or interested by your proposal).

Persons who may be interested or affected and consultation undertaken

State any contact made with neighbouring land owners and occupiers and organisations such as the Department of Conservation, Eastern Region Fish and Game Council, local iwi and community groups. Where possible, record any comments made by these parties and outline your response to them. A list of people and organisations who you consider may be interested or affected should also be supplied wherever possible.

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