4 Description and Rationale for 'Ruakaka Wastewater Strategy' and 'Proposed Scheme'

4.1 Introduction

As set out in Section 1.1 and elsewhere in this AEE, new wastewater treatment and discharge/disposal facilities are needed to handle the significant increase in wastewater flows and loads that will result from large increases in residential, business and industrial development. Construction of a new wastewater treatment plant (WWTP) is expected to commence from 2016 onwards. Funding is included in the 2009-19 LTCCP for construction of the new WWTP.

These predicted increases mean that the present oxidation pond treatment scheme will not have sufficient treatment capacity within approximately 5 years (depending on the rate of wastewater growth) and the capacity of the existing consented Zone 3 and Zone 6A, treated wastewater ground disposal system located on the existing treatment plan site will be reached possibly as soon as 2012.

In order to meet the predicted increased wastewater amounts the proposed new infrastructure and the discharges of contaminants to the environment need the new resource consents and other approvals as are set out in Section 1.5 of this AEE.

4.2 Area to be Served by the 'Proposed Scheme'

The 'Proposed Scheme' is outlined and its components are discussed in Section 4.5 following. The area to be served by the 'Proposed Scheme' includes:

- The existing residential, business and industrial areas presently served and the recently-connected Business Park on the corner of One Tree Point and Port Marsden Highway; and
- The area of South Ruakaka that is soon to be reticulated and connected to the existing Ruakaka Wastewater Scheme. These works are funded for in Councils 2009-2019 LTCCP in years 2011/12 and 2012/2013.
- Future residential, business, industrial, institutional and primary and local centre areas as included for in WDC's current District Plan and proposed in WDC's Marsden Point Ruakaka Structure Plan 2008 Plan 6 Land Use proposals. This plan is included as Figure 1.3 in this AEE. It is discussed in Section 1.3.4 above.
- WDC's current planning is for the Waipu Wastewater Collection System to be connected into the Ruakaka Scheme in 2026. The flows and load projections as summarised in Section 4.3 below include for this.
- WDC may also allow some rural residential/lifestyle lots to connect to the Ruakaka Wastewater facilities if they are within an economic distance of this infrastructure. Provisions in the Local Government Act allow WDC to permit such 'out of district' connections.

4.3 Predicted Wastewater Volumes, Flows and Loads

The growth projections have been assessed and periodically reviewed by WDC. Early work by consultants Harrison Grierson assessed future wastewater flows and loads from residential, business and industrial development. In the Stage 1 Study for this long-term consents project, consultants GHD / URS developed flow and load projections (Support Document 1).

At the commencement of the Stage 2 Study, MWH further refined the flows and loads projections and arrived at totals as set out in Table 4.1 below. This work is set out in the Stage 2 Study, Task 2A Report: Review and Development of Stage 1 Options, Future Wastewater Quantity and Quality Projections (Support Document 4, October 2007).

The MWH October 2007 evaluation concluded that a 'High' Residential Growth (usually residential) 'High' Business/Industrial scenario was appropriate to base the Project technical, scientific and consenting studies on. Table 4.1 is based on this scenario and includes for Waipu wastewater being conveyed to Ruakaka at year 2025. This scenario is considered to represent the appropriate situation, i.e. the precautionary (highest growth) case approach on which the 2047 (35 year) environmental effects study has been undertaken. All flow and loading figures have been rounded. The volume/flows given in Table 4.1 are the Average Dry Weather Flow (ADWF).

Table 4.1 Combined Wastewater (ADWF)[2] Volume and Load Characteristics

High Growth: Usually Resident	2021	2026	2031	2036	2041	2046	2056
High Business							
Volume/Flow[2] (m^3/d)	12902	17713	18563	19413	20263	21113	22813
BOD (kg/day)	2123	3038	3272	3505	3739	3973	4440
TSS (kg/day)	2426	3455	3710	3965	4220	4475	4985
TKN (kg/day)	385	568	623	679	734	789	900
TP (kg/day)	78	114	124	134	144	155	175

Note: The early 2011 projections prepared in October 2007 have now been shown to be a gross over-estimate in respect of the then projected short-term development. Accordingly, these are not included in the above table. This matter is addressed below in the Revised Assessment of Flows and Load Projects, as given in Table 4-2.

The rationale of using the above scenario for the 2047 environmental effects study is based on the assumption that the increase in peak holiday residential domestic wastewater discharge will offset the reduction in business/industrial activities generating wastewater over the peak (Christmas – New Years) holiday period. Evidence from other business/industrial catchments in New Zealand confirms this assumption. From a treatment plant concept sizing and cost estimating viewpoint this scenario should also be used. For hydraulic components of the infrastructure the Peak Wet Weather Flow (PWWF) figures will govern.

Task 2A of Stage 2 comprised the confirmation of the output of Stage 1 Flows and Loads assessment and refinement, as appropriate, as to the wastewater flows and loads This update was undertaken to take account of a significant reduction in the short to medium term growths anticipated in the Ruakaka One tree point Area as a consequence of a range of global and national economic factors.

These factors have required the previous projections to be revised downwards. It is expected that over the long-term 50-60 years the overall total flow rates will rise to those projected in the November 2007 report. However over the likely consent period of 35 years the population and business growth projections and thus the expected flows will be reduced. The Task is to ensure that accurate and robust information is used in subsequent Stage 2 tasks. This Task will also provide summary information that can go forward to the Stage 2 Assessment of Effects on the Environmental (AEE) Document for the Treatment and Disposable/Discharge Scheme finally selected for which new resource consents are to be sought. The AEE will use both the original projections and the revised projections depending on the application.

The outline of the scope of the update task is:

- To confirm and present the revised wastewater source flow data in an appropriate way. Such summaries and presentations are to be in suitable form for subsequent tasks.

The wastewater quality and quantity projections have been evaluated for the Ruakaka/One Tree Point wastewater catchments area covering approximately 3,600 ha compared with the 2,700 ha in the

[2] Average Dry Weather Flow (ADWF)

November 2007 report. This increase has come about as a consequence of the District Council adopting a revise Marsden Point- Ruakaka Structure plan late in 2009. This has lead to the addition of further land to the Study area to the east and west of One Tree Point Rd. The population and wastewater projections provided are based on information provided by WDC, previous consultant's reports and engineering standards and guidelines. The projections are developed at intermediate stages from 2011 to 2061. A planning projection window has been established on a basis of 'Low', 'Medium', and 'High' growth rates, while the catchment area maximum development capacity is represented as the maximum of the projection window.

This update also takes into account the addition of land as earlier mention to the east and west of One Tree Point Rd and either side of Takahiwai Rd out to the where the Takahiwai Stream flows into the harbour.

These revised figures are shown (and rounded) in Table 4-2 below. The Campbell Consulting Update of Future Quantity Projections Document dated 14 September 2010 is included as an appendix to the Task 2A Stage 2 Future Wastewater Quantity and Quality Projections MWH Report (Support Document 4).

Table 4-2 shows the combined (residential and business/industrial) wastewater flows on an ADWF basis for two key scenarios. These are:

- The 'Expected Residential Growth' – Usually Resident Population and 'Medium' Business.
- The 'High' Residential Growth – Usually Resident – 'High' Business Scenario. This scenario is considered to represent the appropriate situation i.e. precautionary 'worst case' approach on which the 2046 environmental effects study should be undertaken. While 'High' business/industrial scenario has been used throughout the table from 2006 on.

The rationale for using this scenario for the 2046 environmental effects study is based on the assumption that the increase in peak holiday residential domestic wastewater discharge will offset the reduction in business activities generating wastewater over the peak (Xmas) holiday period. Evidence from some business/industrial catchments in New Zealand confirms this approach. The residential flow increase represents a 1/3 reduction in industrial flows and it is reasonable to assume that the majority of business/industry will shut down for the peak holiday period.

From a treatment plant process concept sizing and cost estimating viewpoint this scenario should similarly be used, whereas for hydraulic components of the infrastructure the peak wet weather figures will govern using the 2056 figures and beyond and in terms of key hydraulically sized items such as an ocean outfall, should that be included in the Proposed Scheme.

Table 4.2 Combined Residential and Business / Industrial Medium and High Growth Scenarios – (ADWF)

Expected Growth: Usually Resident	2011	2016	2021	2026	2031	2036	2041	2046	2051	2056	2061
Medium Business Flow (m^3/d)	645	1,886	2,864	4,304	5,711	7,118	8,524	9,953	11,367	12,782	14,196
High Growth: Usually Resident	**2011**	**2016**	**2021**	**2026**	**2031**	**2036**	**2041**	**2046**	**2051**	**2056**	**2061**
High Business Flow (m^3/d)	687	2,931	4,534	7,668	10,279	12,888	15,529	15,792	16,061	16,739	16,974

The revised projected Average Dry Weather Flow (ADWF) for year 2046 / 47 for the 'High' Residential Growth using Residual High Business scenarios is 15,792 m^3/day. This has been rounded up to 16,000 m^3/day, or 185 L/s. This increases to a Peak Wet Weather Flow (PWWF) in 2046/47 of 740 L/sec using the ADWF to PWWF rate of 1:4.

Section 8.5.1 further elaborates on these projected flow rates and volumes for which the 35 year consents are sought. That section of the AEE also records the higher flow rates and volumes that were previously arrived at following the Table 4.1 assessment (refer above) and on which the earlier part of the oceanographic modelling was undertaken.

4.4 'Ruakaka Wastewater Strategy'

4.4.1 Background

At their meeting on 13 August 2008 Council's then Works and Services Committee resolved to put in place a 'Ruakaka Wastewater Strategy'. Appendix A includes the WDC's Reporting Officer's Paper to that meeting and the Committee's resolutions.

Section 2.4 above sets the purpose for the strategy approach adopted by WDC and Section 2.3 references the importance of the Project Objectives and other drivers in determining the 'Ruakaka Wastewater Strategy' and 'Proposed Scheme'.

4.4.2 'Ruakaka Wastewater Strategy' Components

The 'Ruakaka Wastewater Strategy' is based on an integrated and holistic approach to future wastewater management that meets a wide range of objectives and drivers. (Refer to Sections 2.3, 2.4, 2.5 and 17.7).

On this basis the 'Ruakaka Wastewater Strategy' includes the following key components or sub-strategies all of which integrate together to provide the overall strategy approach. These components and their interconnections are shown diagrammatically in Figure 4.1. The components are:

Component 1 –Sustainable Approaches to Wastewater Input Reduction and Control

These approaches include:

Water Conservation Measures and Water Demand Management

The context of water conservation measures in terms of the 'Ruakaka Wastewater Strategy' is that water conservation measures in the household, business and industry can result in less wastewater production. The following comments set a terms of reference and some initiatives that WDC already have in place in terms of water conservation measures that will be effecting (reducing) the amount of wastewater generated when assessed on a per capita basis.

A Report commissioned by the Ministry for the Environment by the Whangarei District Council in April 2009 found that per capita water consumption in the Whangarei District was one of the lower figures of the 14 New Zealand cities and communities surveyed. Lower water use normally reflects in lower domestic wastewater volumes per person. Assuming this is a District wide trend the Ruakaka area would be included as a lower water using therefore probably lower wastewater producing area. The permanent and holiday population dynamics would however effect such a conclusion.

Although WDC does not currently have a formal policy on water conservation they do have procedures, particularly at times of drought, to provide advice to customers on the way consumption can be reduced. Notwithstanding this, WDC currently have an initiative being undertaken in Onerahi trialling a public education programme and associated leaflet detailing how water can be conserved. Depending on the outcome this could be the trail blazer for a district-wide water conservation public education programme.

Whangarei District has for the last 30 years had a fixed water rate and water metering, in fact the original water meters that were installed are now at the end of their useful life and consequently a water meter replacement programme is run on an annual basis. Water metering and fixed unit rate charging have been proven to reduce household water use and accordingly domestic sewage (wastewater) production.

In terms of water conservation measures, WDC's Water Supply Bylaw 2005 has a section on the prevention of waste. This includes the following two points:

> *"1. The customer shall prevent and not intentionally allow water to run to waste from any pipe, tap or other fitting. It is an offence to let water run to waste and may result in disconnection or restriction of the supply and/or prosecution.*
>
> *2. The customer shall not use water or water pressure directly from the supply for driving lifts, machinery, eductors, generators, condensers or any other similar device; unless specifically approved."*

A further water demand management technique undertaken by WDC is water pressure management and water leakage control. Pressure management decreases the pressure in customer taps and plumbing fixtures and accordingly has the effect of reducing the volume of wastewater, as compared to higher pressure supplies.

All the above procedures have a direct result on the volume of wastewater produced, particularly from the domestic contribution.

Environmental and Engineering Standards

WDC adopted a new Environmental Engineering Standard which became operative on 1 July 2010. Section 5 of the standards deals with the requirements for wastewater including the design and construction requirements. The standard sets out details of design requirements, approved materials, construction methodologies, supervision requirements and overall approval. The Council has Environmental Engineering Officers who deal with all new wastewater systems that are provided as part of subdivisions or developments. In addition the Infrastructure and Services Department has employed a Development Engineering Officer to monitor the application of the standards. That person has a Clerk of Works role to focus on the quality of the vested assets Council receives from developers.

Trade Waste Controls

An updated Trade Waste Bylaw was adopted by WDC in 2008 consistent with the New Zealand Standard Bylaw. WDC has also recently extended its resources applied to wastewater input management employing a dedicated Pollution Prevention Officer who would spend about 90% of his time on trade waste tasks. As is common within the sector a risk analysis approach is taken in assessing new trade waste applications as is the review of existing consents. WDC is undertaking Continuity / Business Risk Planning and consequently the wastewater activity is establishing its areas of risk. These are likely to include the area of trade wastes. Trade Waste Management is further discussed in Section 4.6.4.

In Section 4.3 wastewater flow (volume) and contaminant load projections are discussed. The projected ADWF at year 2046/47 that would allow for a 35 year resource consent is 16,000 m^3/day. This in the volume applied for in Permit (Consent) Number 7 for the ocean outfall discharge.

Infiltration and Inflow (I&I) – Wet Weather Flow Management

WDC has run an active district programme of infiltration/inflow detection and control dating back to the early 1990's. WDC has undertaken a lot of modelling and review investigations recently on how to manage inflow and infiltration going forward, particularly within the Whangarei City catchment. The main lesson learnt there is that a multi- pronged approach is the best way to deal with wet weather flows. A combination as appropriate of the following is now WDC's approach looking forward:

- Ensure that appropriate construction standards are set and maintained for both the private and public sections of the wastewater system to reduce the likelihood of inflow and infiltration.
- For existing systems undertake periodic site inspections of private sewers to identify areas of inflow and infiltration and require the property owner to rectify faults

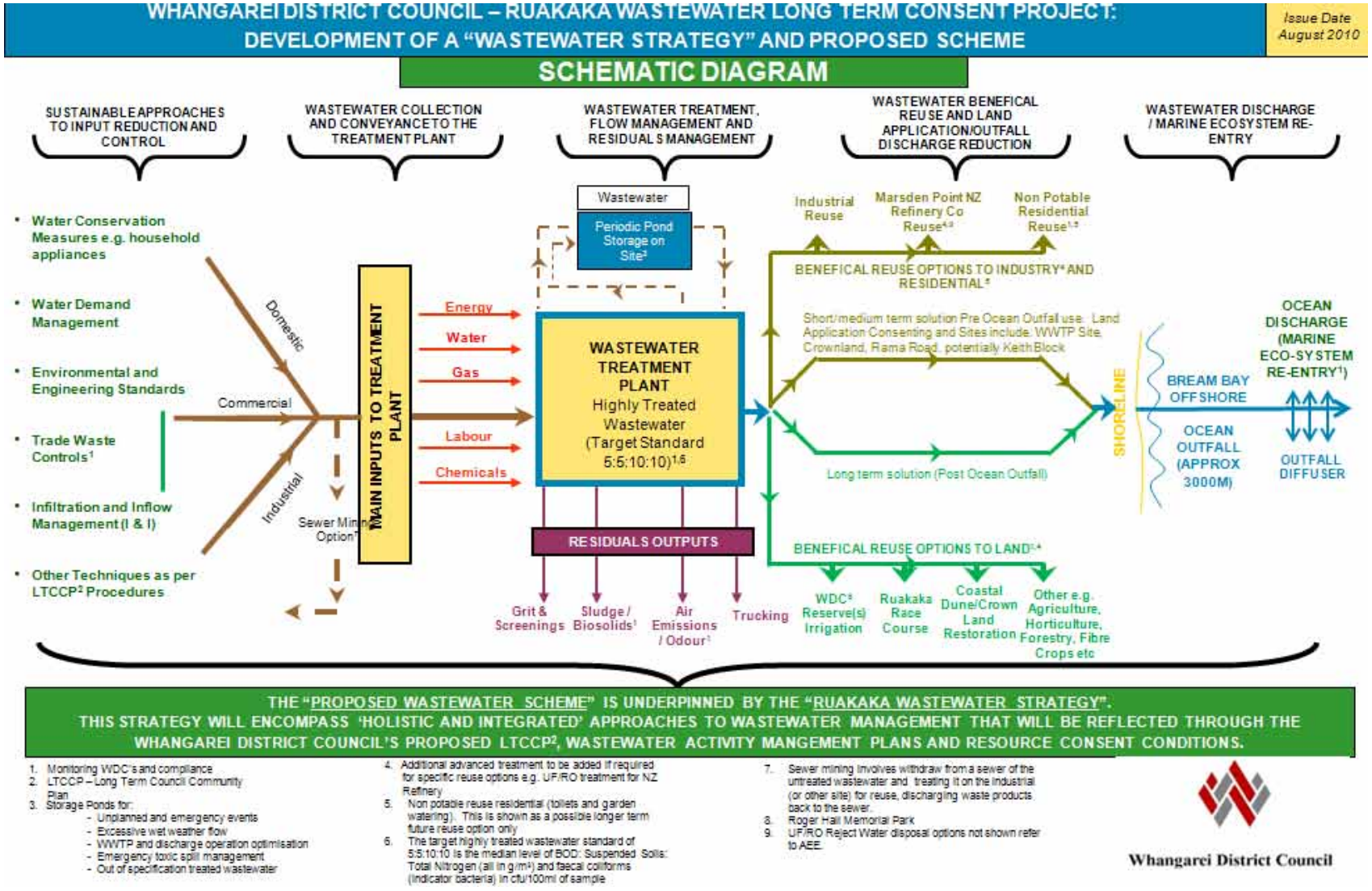
- Undertake remedial work of public sewers where pipe condition and inspection indicates significant faults in the system
- Provide additional storage capacity at key pump stations to attenuate wet weather flows within the network
- Provide additional pumping and rising main capacity to get the wastewater to the treatment plant
- Upgrade the treatment plant capacity to treat all wastewater that is received at the plant.
- Other techniques as per WDC's LTCCP Procedures.

Component 2 – Wastewater Collection and Conveyance to the Treatment Plant Site

This includes:

- The existing Ruakaka reticulated collection area.
- New recent residential subdivisions and business park areas.
- The current planned and funded for in the 2009-19 LTCCP Ruakaka South new reticulation. As noted in Section 4.6.3, this area may have a low collection pressure system for which each property would have a grinder pump discharging into a small bore low pressure pumping conveyance system.
- New subdivision and business/industrial areas as they are developed.
- New infill development connections to the (then existing) collection system.

Figure 4.1 Development of a the Ruakaka 'Wastewater Strategy' and 'Proposed Scheme'



Component 3– Wastewater Treatment, Flow Management and Residuals Management

The key areas of this component include the following:

- The existing WWTP, and proposed (from around year 2016/17 depending on growth rates) a new WWTP that will achieve high standard of treatment.
- The efficient and as far as practical sustainable management of inputs to the new WWTP.
- The sustainable management of residuals from the new WWTP including sludge and biosolids, with if practicable and marketable, the beneficial reuse of biosolids.
- Risk and flow management of the WWTP and treated wastewater discharge and reuse systems using a range of techniques including the two contingency ponds (present oxidation ponds) for flow storage when unexpected events occur.
- The staging of the overall development of the 'Proposed Scheme' including the categories of this Strategy.

Component 4 – Treated Wastewater Beneficial Reuse

- Beneficial reuse of highly treated wastewater at the Marsden Point Oil Refinery by the New Zealand Refining Company.
- Subsurface irrigation of WDC's Roger Hall Memorial Reserve.
- Other possible industrial and irrigation beneficial reuse options (refer Figure 4.1).

Component 5– Eco-system Re-entry of Treated Wastewater

- Adoption of an eco-system re-entry approach for treated wastewater disposal/discharge. This term is used for the overall approach of disposing/discharging treated wastewater into the receiving environment, be it land or Bream Bay following an eco-system re-entry (assimilation) approach.

Treated Wastewater Disposal onto Land – Land Application (eco-system re-entry)

- Progressively using a number of land application areas, denoted as 'zones' including WDC's Rama Road Block for the short- to medium-term disposal of wastewater.

Treated Wastewater Discharge through an Offshore Ocean Outfall (eco-system re-entry)

- The medium- to long-term onwards (from approximately 2026 onwards, depending on wastewater growth) use of the offshore ocean outfall discharging approximately 3,000 m out into Bream Bay.

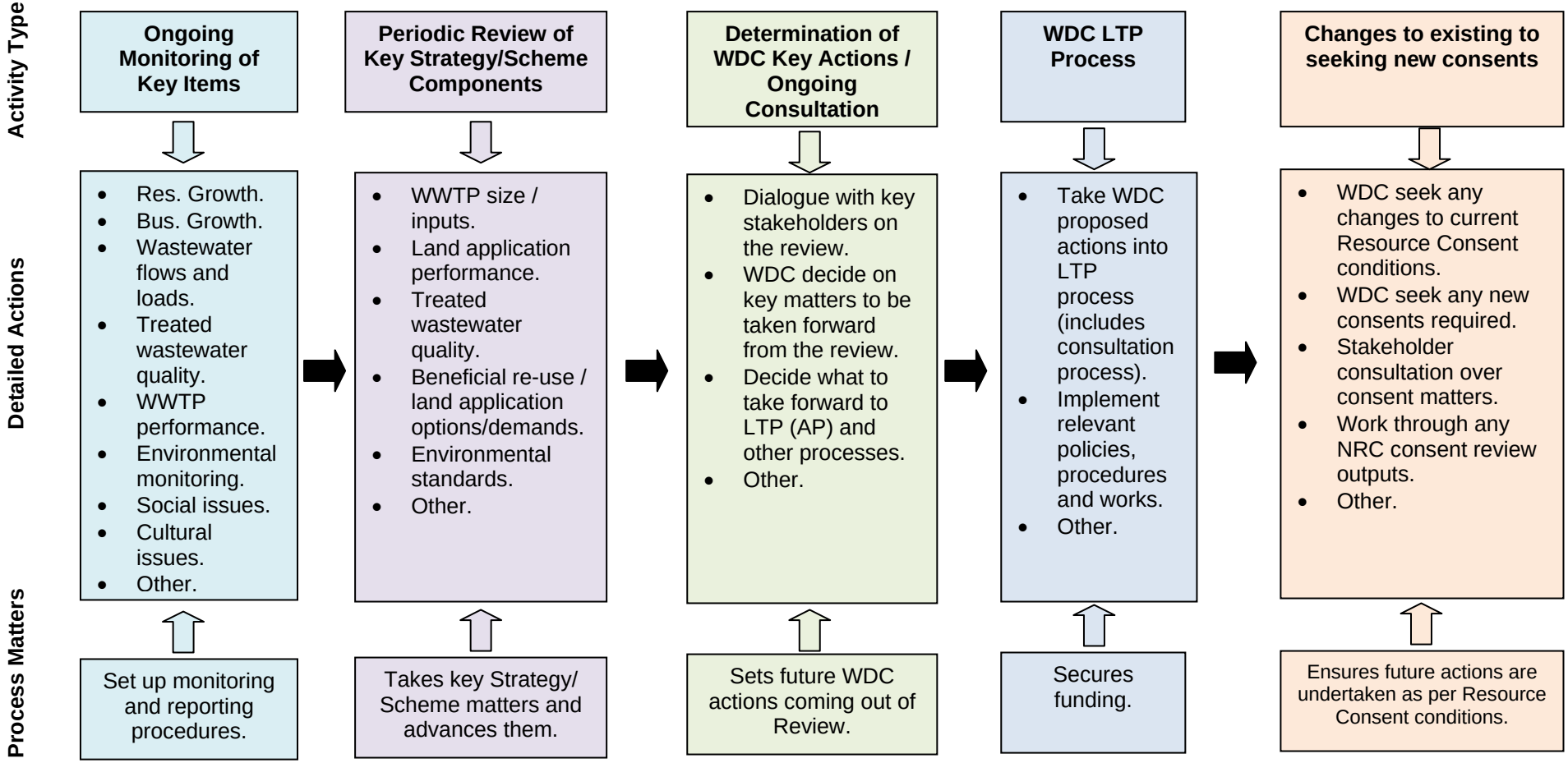
4.4.3 On Going Development and Periodic Review of the Ruakaka Wastewater Strategy

Section 2.4 of this AEE sets out the purpose of the strategy approach, and Sections 4.4.1 and 4.4.2 above develop the components of the Ruakaka Wastewater Strategy. Fundamental to the ongoing development and review of this Strategy, is the approach of periodic review and updating.

WDC propose that rigorous Development, Technology and Environmental / Montoring Review Conditions be included in appropriate resource consents. In this respect, WDC have suggested as part of the consent applications the approach that such review conditions should contain as set out in Section 19.2.1 of this AEE. These conditions would input into the preparation periodically of the Ruakaka Wastewater Strategy and Scheme Review Report. Figure 4.2 below diagrammatically shows the suggested review and related LTP and resource consent processes. This figure should be read in conjunction with the offered review conditions referred to above.

Figure 4.2 Ruakaka Wastewater Strategy and Scheme Implementation – Activities to be Undertaken within the Duration of Consents

Activities driven (in part) by key Resource Consent Condition(s) requiring periodic Development, Technology and Environment / Monitoring Review and preparation of a **'Ruakaka Wastewater Strategy and Scheme Review'** Report.



4.5 'Proposed Scheme'

4.5.1 Background

Stage 1, and the first part of the Stage 2 Project, leads to the identification of the 'Preferred Scheme'.

Further investigation and consultation on the 'Preferred Scheme' then lead into the development and definition of the 'Proposed Scheme' and associated 'Ruakaka Wastewater Strategy'. This has been an extensive process that began in 2007. Figure 2.1 and Figure 2.2 schematically show this process.

The sequence of alternatives (options) investigated and the progressive decision making process and the decisions themselves are summarised in Section 6. Table 6.1 includes a listing of all the Support Documents that address the range of alternatives (options) assessed in determining the 'Proposed Scheme' for which these resource consents and other approvals are sought.

A key feature of the 'Proposed Scheme' is the staged approach to providing infrastructure and treated wastewater beneficial reuse and discharge/disposal facilities in a manner compatible with growth (increase of wastewater volumes) that is predicted to take place. The staged approach will lead to prudent WDC expenditure and funding arrangements. This approach means that the offshore ocean outfall (a high capital cost component) may not be needed until approximately 2026. This will depend on the rate of wastewater growth as is highlighted above. Section 4.8 following includes details of this staged approach.

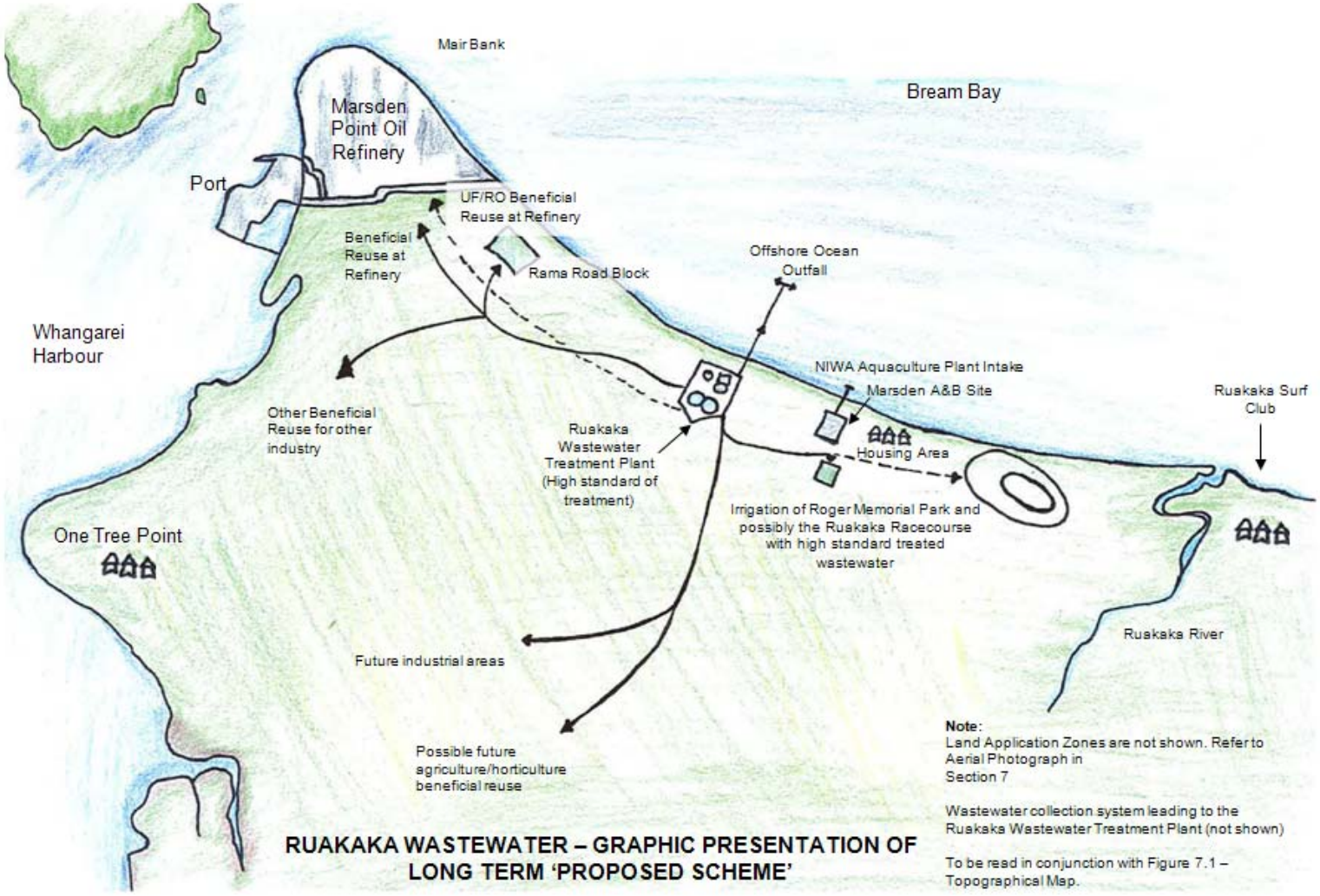
4.5.2 'Proposed Scheme' Outline and Components

The 'Proposed Scheme' is illustrated in the following figures:

- Figure 4.1 Development of a the Ruakaka 'Wastewater Strategy' and 'Proposed Scheme';
- Figure 4.3 Graphical Presentation of Long-Term 'Proposed Scheme';
- Figure 4.4 Proposed Ruakaka Wastewater Treatment Plant – Indicative Layout;
-
- Figure 4.5 Sequencing Batch Reactor Process Flow Diagram – Intermittent Decant Aerated Lagoon (IDAL) WWTP
- Figure 4.6 Schematic of the SBR Wastewater Treatment Process; and
- Figure 4.8 Short- and Medium-Term Beneficial Reuse and Disposal Schematic.

The 'Proposed Scheme' includes the following key components of infrastructure and wastewater management operations. Each of these components is briefly elaborated on below. Respective Support Documents, particularly the Task 2I Report (Support Document 40), includes detailed discussion about the treatment plant and other components, and Support Document 37 covering the ocean outfall construction.

Figure 4.3 Graphical Presentation of Long-Term 'Proposed Scheme'



The key components of the 'Proposed Scheme' are:

Component 1 – Wastewater Inputs Management

Sustainable approaches to input reduction and control include the following. These all form part of the 'Ruakaka Wastewater Strategy' as outlined in Section 4.4 above where each is briefly discussed.

- Water Conservation Measures e.g. household appliances.
- Water Demand Management.
- Environmental and Engineering Standards.
- Trade Waste Controls.
- Infiltration and Inflow Management (I&I Management).

Component 2 – Wastewater Collection System

- Wastewater collection and conveyance system to the Ruakaka Wastewater Treatment Plant itself. This includes the installation of the proposed Ruakaka South Wastewater collection scheme for which final government subsidy approval is currently awaited. This scheme is to be based on a pressure sewer individual and household grinder pump arrangement. This type of sewerage scheme has the advantage that wet weather flows are minimised as compared to conventional gravity sewer systems. This is a positive approach in terms of infiltration and inflow management and the corresponding reduction of potential future wet weather flows.

Component 3 – Continued Use of the Existing Oxidation Pond, Wetland Treatment Plant and Ground Soakage System until around 2016 depending on growth rates

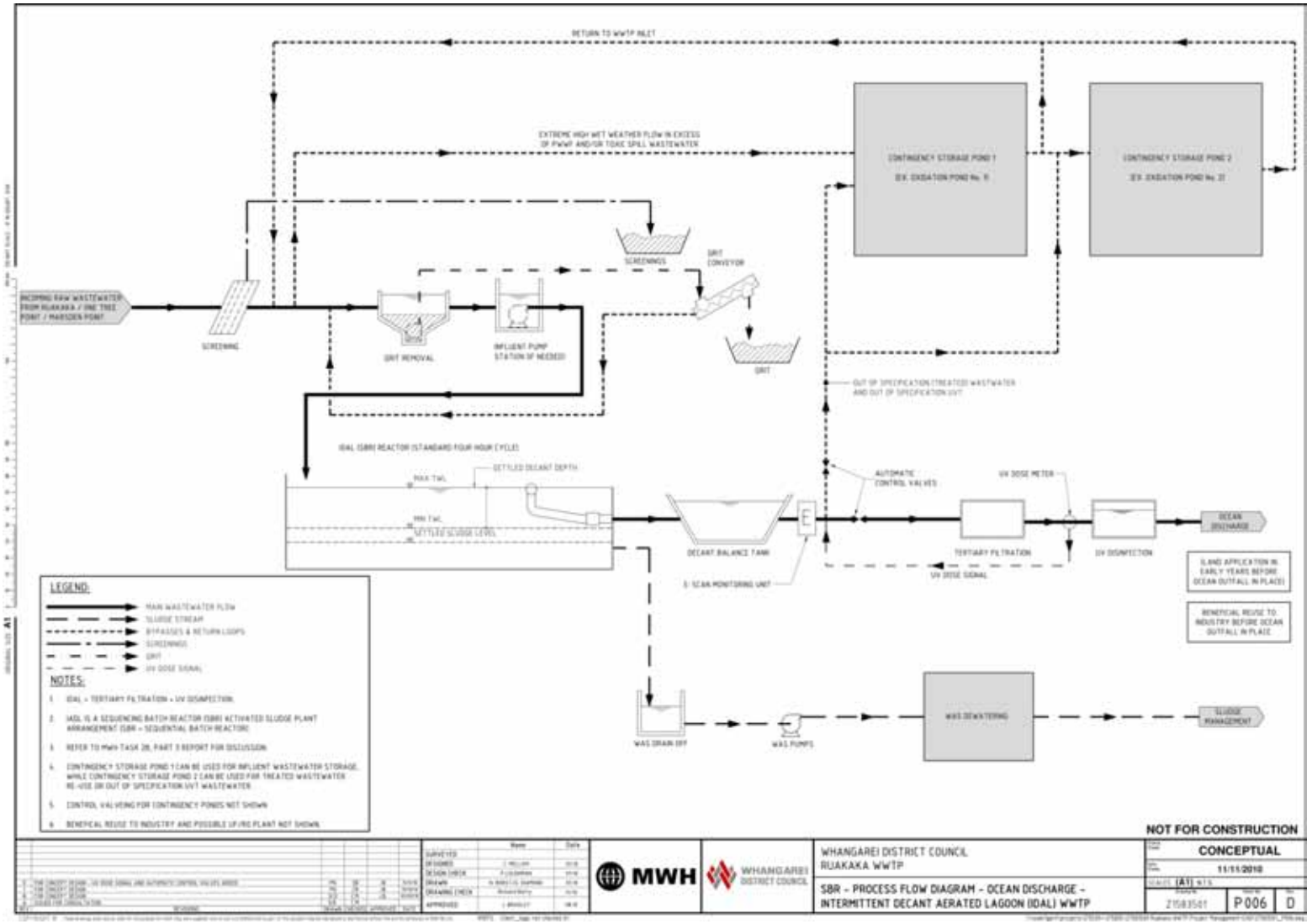
- The existing Wastewater Treatment Plant will, for the short-term until around 2016 remain as the existing oxidation ponds, wetland and ground soakage facilities.

Component 4 – Wastewater Treatment – a New High Standard of Wastewater Treatment

- For the medium- to long-term a new state of the art compact WWTP will be constructed on existing WWTP site. The 2009-19 LTCCP shows funding for this in the 2014-17 financial years.
- The new WWTP will produce a high standard of wastewater treatment. WDC's target standard of treatment is set at 5.5.10.10. These numbers refer to concentrations of Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Total Nitrogen (TN) and Faecal Coliforms (FC). BOD, TSS and TN are set as median concentrations in mg/l (g/m^3) and FC as median number of organisms per 100/ml of sample.
- Details and the staging of the construction of the WWTP are set out in the latter sections of this Report. Support Document 40 – the Task 2I Report discusses these components in some detail. Further background discussion on treatment processes is included in Support Documents 6, 11, 12, 14, 16, 18 and 23.

Figure 4.4 Proposed Ruakaka Wastewater Treatment Plant – Indicative Layout

Figure 4.5 Sequencing Batch Reactor Process Flow Diagram – Intermittent Decant Aerated Lagoon (IDAL) WWTP



Key treatment processes include:

Headworks

This will consist of a screenings and grit removal system at the inlet to the treatment plant.

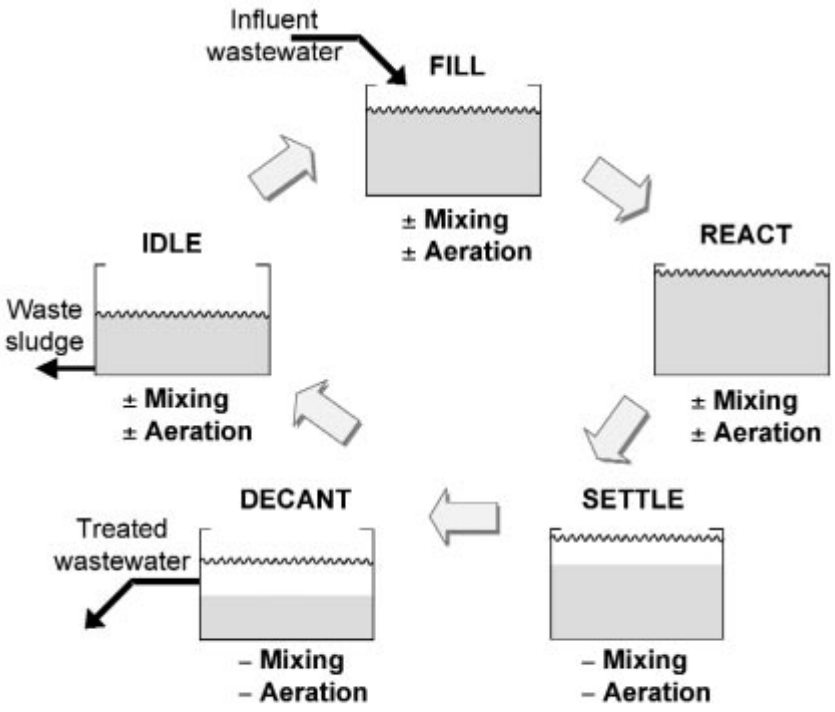
SBR Bioreactor

WDC's preference, as set out in the Officers' Report to the Works and Services Committee on 30 July 2008 is for a SBR type plant (refer to Appendix A). This represents a specific type of activated sludge process. SBRs are essentially variable volume activated sludge units in which aeration, sedimentation and decanting of treated wastewater occur in a single bioreactor. Consequently, there are no dedicated secondary clarifiers or associated return sludge facilities.

Whilst there are a number of potential arrangements for SBR systems, an intermittent decanting aerated lagoon (IDAL) has been considered for this evaluation. Such an arrangement accommodates variable wastewater inflows well, as will occur in Ruakaka during, for example, holiday periods.

Figure 4.6 is shown below to describe schematically the operation of an SBR treatment process.

Figure 4.6 Schematic of the SBR Wastewater Treatment Process



Major Phases of the SBR operational cycle

Alternatively, a continuous flow activated sludge treatment plant, together with the proposed downstream filtration and disinfection steps, would meet the same high standard of treated wastewater that WDC has decided on, as set out above. In this respect WDC have decided to keep the final selection of the treatment process open at this stage as is set out in Section 4.10 following.

Tertiary Filtration

Tertiary filtration may be provided to reduce the solids being passed through to the disinfection stage. It has been shown in the treatment plant indicative layout and process diagram and allowed for in the

treatment schematic. While the filter would effectively act as protection for the UV plant, further treatment process design is required to confirm whether filtration is needed.

This is typically achieved by either cloth disk filtration, in which the liquor is passed through a fine pore cloth media, or sand filtration, where fine sand is used to trap the solids. After passing through the filter the wastewater would normally contain a median suspended solids level of 5 mg/l or less.

Disinfection

UV (ultra violet irradiation) disinfection will be utilised to provide the pathogen reduction required to achieve the water quality required by the receiving environment. UV lamps are grouped together in banks, and then laid into channels through which the filtered effluent passes. In the initial stages it is proposed to construct two channels, with more channels being constructed and more lamps installed as required.

The water quality fed to the UV plant will be of a high standard with respect to UV transmittance and suspended solids. This will ensure that the disinfection system operates efficiently.

A UV dose rate of 30mWs/cm^2 has been used in the cost estimating and public health microbiological risk assessment (Stage 2 – Task 2E MWH Report, Quantitative Public Health Risk Assessment – August 2010 (Support Document 36)). This dose rate has been determined as an appropriate dose to meet the median faecal coliform standard to 10 organisms/100 ml of sample.

Sludge Management

For Stage 1 of the development, waste activated sludge from the SBR, at around 0.3% – 0.5% dried solids content will be discharged into one of the existing oxidation ponds.

During Stage 2 of the WWTP development, when flow to the works is expected to increase significantly, mechanical equipment will be provided for thickening of the sludge to around 5-6% dry solids. It is envisaged that the thickened sludge will either be transported to the Whangarei City WWTP for treatment and disposal, or thickened to around 20% dry solids on site and taken to landfill.

By November 2010 a new landfill located at Purewa, near Portland will be operative in the District. This landfill is expected to receive sludge from all the wastewater treatment plants in the District. The company (a 50:50 Joint Venture between WDC and a private sector partner) which owns and operates the landfill has yet to develop any specific approach to the beneficial reuse of the sludge so the current expectation is that sludge be incorporated into the landfill along with other solid waste.

Air Discharge Including Odour Management

Other than potential odour discharges associated with the operation of the proposed WWTP, there will be no significant air discharges from the proposed WWTP plant other than from the on-site standby electricity generator. The Task 2I Report (Support Document 40) includes a section on odour management for the proposed WWTP. Support Document 40 is underpinned by the Odour Management Report, Support Document 38.

Odour management will be undertaken by use of inlet works covers and sludge processing with biofilter treatment and sound operation and maintenance techniques. Section 12 of this AEE covers the assessment of environmental effects of the discharges to air. It also includes the results of the odour modelling undertaken as part of this Project.

Noise Management

The WWTP design and operation will ensure that noise levels from the equipment are within the Whangarei District Plan noise requirements. The aeration equipment blowers are normally the most significant noise source. In line with normal practices these will be housed in a noise insulated building.

Contingency Wastewater Storage Management

The use of the existing oxidation ponds, once the new WWTP is commissioned, as contingency storage ponds provides a unique opportunity for management of excess wet weather inflows and out-of-consent (treated) wastewater. The operational philosophy associated with the use of these two storage ponds is briefly summarised in Section 4.6.2 below, and elaborated on, in detail, in the Task 2I Report (Support Document 40).

Component 5 – Land Application of Treated Wastewater for the Short- and Medium-Term

A sequenced approach to use of the following land areas is proposed. The sequencing is discussed in Section 4.8. Figure 4.9 shows the location of these various areas and zones. Figure 4.10 indicates the sequencing of the use from a consenting viewpoint. Land included in the 'Proposed Scheme' consists of:

- The Wastewater Treatment Plant site (Zone 3).
- The Wastewater Treatment Plant site (Zone 6A).
- The WDC-owned Rama Road Block.
- Zone 5, the Keith Block.
- Crown Land Zones (6B, 7) concessions.

Note: The Crown Land Zones 6B and 7 are contingency areas that may be used only if other land areas and the NZRC beneficial reuse proposed do not provide sufficient disposal capacity before the ocean outfall is commissioned. These are subject to resource consents and concessions that will have expiry dates of 2018.

Figure 4.10 shows the location and zones of these areas and Figure 4.11 shows the proposed sequence of their use.

Component 6 – Beneficial Reuse of Treated Wastewater

This includes beneficial reuse to industry and possibly in the medium to longer-term future, non-potable residential reuse, and also beneficial reuse options to land. The 'Ruakaka Wastewater Strategy' diagram (Figure 4.1) shows the following categories:

- The New Zealand Refining Company (as stated above);
- Other industrial reuse;
- Non-potable residential reuse;
- WDC's reserves irrigation, the Roger Hall Memorial Park initially;
- Ruakaka Racecourse irrigation; and
- Agricultural, horticultural, forestry.

The possibility of groundwater recharge or supplementing inflow to WDC's Wilson's Dam water supply has also been considered as a long-term possibility should, in the future, providing such a technique meet health authority and other requirements.

For the Marsden Point Refinery, a very high standard of wastewater treatment is required in order that it can be beneficially reused. This would be achieved by the use of an Ultra-Filtration (UF) and Reverse Osmosis (RO) plant. It is proposed that a UF/RO plant be located at the Ruakaka Wastewater Treatment Plant site, although an alternative location is at the Refinery site. Such a plant would be installed as an additional process after the existing treatment plant or the proposed new SBR type plant.

Figure 4.8 and Figure 4.9 schematically shows the arrangement of the UF / RO plant and the waste streams (reject wastewater) from them. The concept being developed allows for 2,000m^3 /day of treated wastewater to be diverted to the UF / RO plant. This plant would produce 230m^3 /day RO reject wastewater. The RO reject water is high in salt content and accordingly needs special consideration in terms of its disposal onto land at either the Rama Road Block or the WWTP site, Zone 3.

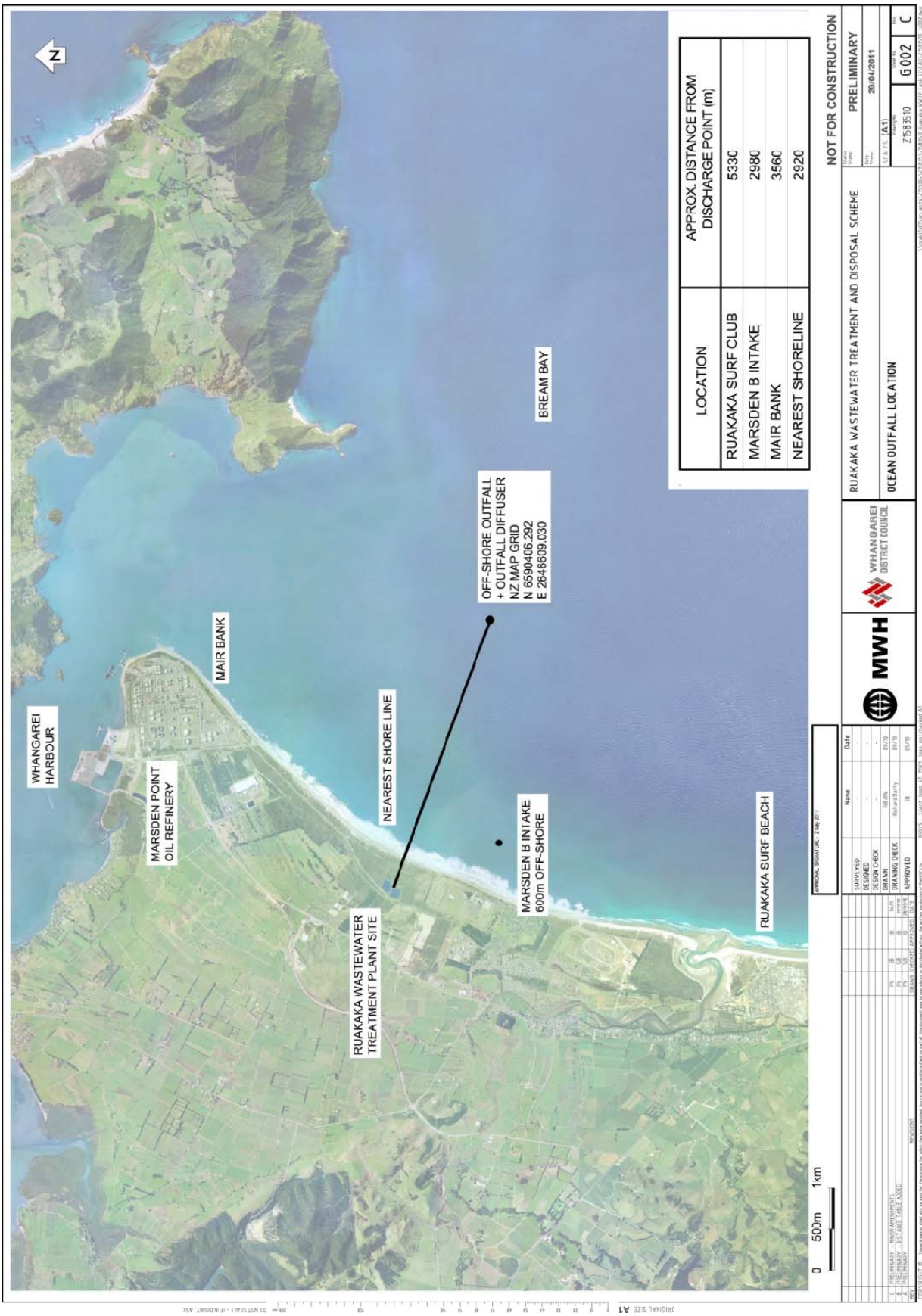
It is intended that subject to a satisfactory ongoing agreement with New Zealand Refining Company that reuse water would continue to be supplied to the refinery after the outfall is operational.

Component 7 - Offshore Ocean Outfall System

This key future component of the 'Proposed Scheme' consists of an outfall of approximately 3,000m in length located in Bream Bay offshore from the Ruakaka WWTP site. Initial concept sizing is for an outfall diameter of around 900mm OD. The outfall would be completed with the discharge diffuser, which would discharge into water with a mean depth of approximately 8.4m. The OCEL Reports (Support Document 37) discusses constructability, construction methods and material types. The ocean outfall system incorporates three key parts, namely:

- Pumping Facility (if required);
- Land line from the WWTP to the surf zone; and
- Offshore Ocean Outfall.

Figure 4.7 Proposed Ocean Outfall Location – Location 22



4.6 Wastewater Operation and Management Procedures

4.6.1 General Management

The 'Proposed Scheme' and in particular the new WWTP will be based on modern design and construction technique. This will be particularly evident in the proposed new wastewater treatment plant.

Important parts of the 'Proposed Scheme' management include:

Corporate Objectives

Achieving the WDC's Vision, Mission, Goals and Key Principles under the various Strategic Plans and other documents including the Waste and Drainage Wastewater Strategy, LTCCP, Wastewater Asset Management Plan, and the Wastewater Business Continuity Plan.

Financial Reporting

Effective monitoring and reporting of the scheme expenditure streams.

Consent Compliance

Ensuring a high level of compliance with the resource consent(s) and all its requirements are achieved. A high level of importance is attached to effective communication with Officers of the Northland Regional Council. Associated with this will be managing trade wastes in accordance with the Trade Waste Bylaw and issued trade waste consents.

Asset Management

Plant and network assets are constructed, maintained and renewed to meet the levels of service as set out in WDC's Wastewater Asset Management Plan.

Strategic Planning

Forecasting and capital works staging to maintain levels of service into the future.

Neighbourhood Relations and Interactions

Complaints Register.

Health and Safety

Staff training

Laboratory Activities

Undertaken both at WDC's Whangarei City laboratory and contracted out for certain non-standard tests.

Community Relations

WWTP open days and education

Other management items, are being encompassed within WDC's Waste and Drainage Wastewater Strategy 2010 (refer Section 1.3.6) and other Council policy and procedural documentation.

4.6.2 Wastewater Treatment Operational Philosophy

The new WWTP will also make use of the existing oxidation ponds as contingency storage, for storage under high flow or abnormal events and out of specification treated wastewater. To implement this, two ponds will be emptied, desludged and retrofitted (but not lined) to become contingency storage ponds.

Figure 4.5 illustrates this schematically.

The use of the contingency storage ponds will enhance the operational reliability and flexibility of the WWTP and provides measures to mitigate against either planned maintenance, unexpected high flow events or abnormal influent wastewater characteristics.

The operational philosophy needs to be developed so that procedures under varying operating conditions can be followed. Such conditions will include:

- Normal conditions (diurnal dry weather conditions);
- Extreme wet weather conditions;
- Abnormal conditions in the incoming wastewater inflow;
- Planned maintenance;
- Out of specification treated wastewater;
- Storage of final treated wastewater for reuse; and
- Emergency conditions (i.e. true emergencies under the provisions of the RMA).

The operating conditions are broadly described in the Task 2I Report (Support Document 40). That Report provides an assessment of the development and risks that are identified and measured to manage and mitigate those risks.

Table 7-1 in the Task 2I Report shows the contingency pond storage volumes and estimated storage duration under a range of ADWF and PWWF daily inflow volumes within a 35 year duration. These range from 7.6 days for the Stage 1 – 3000m^3/day ADWF to around 2.5 days for an ADWF of 16,000m^3/day, and 1.3 and 0.7 days respectively for PWWF. It is noted however that PWWF is in effect a peak rate and should not last long. A full day at a PWWF rate would be most unusual in a wastewater collection system like at Ruakaka.

Figure 4.5 shows the operational links between the E.SCAN automatic monitoring unit and also the automatic UV dose monitoring equipment that is available to divert out-of-specification treated wastewater to the contingency storage ponds.

4.6.3 Inflow / Infiltration (Wet Weather Flow) Management

Inflow/Infiltration management is an important component of the 'Ruakaka Wastewater Strategy' as highlighted in Section 4.4 above.

As with any reticulated wastewater system, the Ruakaka system must be capable of coping with groundwater infiltration and surface water inflow that occur during winter conditions and rainfall events. WDC investigations indicate that wet period peak flows of approximately two times average dry weather flows in the existing Ruakaka collection system.

As much of the existing scheme is relatively new and significant portions of it are yet to be built (following WDC's Engineering and Environment Standards (refer Section 4.4.2 above) then high peak wet weather flows (PWWF) are not expected. The concept of using the oxidation ponds as contingency storage ponds in the future provides robust off line high wet weather flow storage ponds if needed.

Aging collection infrastructure will become even more important as the area grows, the base sewer flow increases and the sewer system ages. Both the reticulation system and the WWTP will be designed to cope with predicted peak wet weather flows.

With respect to the Ruakaka wastewater sewer system this has been successively constructed since the late 1970s but with much of the network constructed over the last ten or so years. As such it has had the benefit of improved construction techniques and material particularly uPVC pipes with rubber ring jointing.

WDC is considering the use of a pressure sewer system with individual household grinder pumps for the reticulation of the Ruakaka South area. This would entail each property having a separate pump and chamber discharging into a pressure small bore main. Such systems limit the flow into the public system by virtue of the capacity of the on-site pump. This significantly reduces the likelihood of stormwater entering the sewerage system from individual properties. The flows from the individual pump stations can be monitored to establish whether stormwater is being discharged into the sewer also. Furthermore the public sewer is more secure as the system is pressurised thus not requiring manholes which can be another source of stormwater infiltration. A pressure sewer is usually constructed from continuous lengths of PE pipe so the likelihood of stormwater infiltration due to root or other damage or general pipe deterioration is greatly reduced.

A further factor to reduce the stormwater inflow problem is to require all new subdivisions to have a formal stormwater system to deal with the increased stormwater flows from the land. This will decrease the likelihood of future property owners resorting to illegal discharges to the sewerage system.

4.6.4 Trade Waste Management

Trade waste is wastewater discharged into the wastewater system from premises which are by their flow or strength significantly different from domestic wastewater. Section 4.4.2 above highlights how this is a key sub-component of the 'Ruakaka Wastewater Strategy' in terms of more sustainable wastewater inputs management.

The management of trade waste is important, not only in terms of community wellbeing, including employment and economic vitality of the Bream Bay area, but also the minimisation and mitigation of actual and potential adverse effects of the trade waste discharge on the surrounding environment.

WDC has a Trade Wastes Bylaw (2008) which places limits on the undesirable contaminants of a trade discharge and specifies prohibited compounds as well as setting down the charging formulae. The Trade Wastes Bylaw, as elsewhere in New Zealand, is enacted for the following reasons:

- To protect the health and safety of staff;
- To protect the environment (and ensure Resource Consent Compliance) by controlling the composition of wastewater discharged to the WWTP and then to land, re-use and the Bream Bay ocean environment; and
- To protect the integrity of the conveyance system and the WWTP itself.

The Bylaw is prescriptive by nature and defines what is acceptable or prohibited. It includes procedures for assessing new Trade Waste applications and also for ensuring waste minimisation and cleaner technology are considered and implemented where appropriate. Contingency Management Plans are also a requirement of the Bylaw.

4.6.5 Energy Management

Energy management and the associated carbon footprint considerations are nowadays a major design and operational component of wastewater schemes. Furthermore, in terms of Section 7 of the RMA in seeking resource consents (permits) for the 'Proposed Scheme', WDC is required to have particular regard to:

- *"The use and development of renewable energy"* and

- *"The efficiency of the end use of energy".*

In Section 17.5 of this AEE, Energy Considerations are further discussed in the context of these RMA matters.

Design and operational aspects of the new WWTP will include the following procedures which will each be targeted at energy efficiency:

- Variable speed pumping to, and within the WWTP, especially for the ocean outfall pumping station if this is required.
- Automated dissolved oxygen control of the bioreactors (SBR or other type of actuated sludge basins). This ensures the optimum aeration (dissolved oxygen) for the microbiological activities without over aerating which wastes energy.
- Maximising the use of gravity flow in the overall Wastewater Scheme. As previously noted it may be possible in final design of the WWTP and ocean outfall system when required to eliminate the need for an outfall pumping station.
- Use of night rate electricity where possible.
- Flow pacing and other techniques to optimise energy demand of the UV disinfection system.
- Use of State of the art control and automation systems.

As recorded in Section 4.5.2 above, sludge management will form part of the new WWTP from Stage 2 onwards. It will involve transport of thickened sludge to the WDC's Whangarei City's WWTP for treatment (stabilisation) and landfill disposal and/or in the future beneficial biosolids reuse.

Anaerobic digestion of sludge is undertaken at this plant with the biogas used as a treatment plant energy source with the excess biogas being flared off. The sludge from the WWTP will therefore also be anaerobically digested at the Whangarei City plant. Anaerobic Digestion falls into the renewable energy category which WDC must (under the RMA) have particular regard to. In the future when the Ruakaka WWTP is of sufficient size WDC may decide to undertake anaerobic digestion or another sludge treatment means at that site instead of transporting dewatered sludge to the City plant.

4.6.6 Sustainable Wastewater Management

In terms of WDC's Vision and Mission and Strategies, it is not only appropriate, but also necessary that WDC moves forward in terms of designing and implementing more sustainable wastewater technologies and management procedures. These include not only the sustainability of the treated wastewater discharge (eco-system re-entry) into the environment, but also the resource efficiency and sustainable management of all inputs and outputs. The Project Objectives and the 'Ruakaka Wastewater Strategy' each focus on sustainability and integrated approaches as outlined in the respective sections of this AEE (Sections 2.2, 2.3, 2.4, 2.5, 4.4, 4.5, 16, 17 and Appendix C).

4.6.7 Financial Management

The 'Ruakaka Wastewater Scheme' (both the present and proposed) will continue to represent a major capital investment on behalf of the community. Accordingly, WDC must have an appropriate long-term investment security associated with that Wastewater Scheme. The present 'Ruakaka Wastewater Scheme' already represents a major piece of strategic public infrastructure. Accordingly this requires certainty about its consented future to enable sound investment and operating decisions to be taken with a clear long-term focus.

Furthermore, this Wastewater Scheme is being developed to cater for the significant growth that is expected and planned for the Ruakaka and surrounding Bream Bay area. The provisions of the Local Government Act 2002 require local authorities to fund depreciation, and this further strengthens WDC's position for the need to ensure financial security of major key infrastructural assets such as the 'Proposed Scheme'. Financial security is in part achieved by having long-term resource consents.

WDC share of the new treatment plant costs are set out in WDC's 2009-19 LTCCP. The proposed ocean outfall is also included in this LTCCP period. However on current predictions it would not be constructed until around 2026. Section 4.9 below summarises the estimated costs for the 'Proposed Scheme'.

4.6.8 Risk Management

Prudent wastewater management includes the activities of risk assessment and management and adoption of appropriate mitigation measures. Local government statutes and procedures further require such measures are put in place.

Risk Management consideration in terms of the RMA, are encompassed by the interpretation of 'effects'. The interpretation includes:

> *"any potential effect of a high probability"* and *"any potential effect of a low probability which has a high potential impact."*

Taking into account all of the above, it is appropriate that this Project include a comparative risk assessment. Such an assessment was undertaken for each of the four, Stage 1 shortlisted generic options as is reported in the Task 2G Report (Support Document 22). This assessment was further developed in the Task 2I Report (Support Document 38) where for the 'Proposed Scheme' the assessment evaluated some 40 possible hazard threats, or risks, giving each a 'likelihood rating', a 'consequence rating', and a current (on completed scheme) risk identification.

Risk management/mitigation measures were then identified for each of these hazard/risk types. Each of the hazard/risk types were also grouped under the source of generic risk grouping which included 'Environmental', 'Economic', 'Social', 'Cultural' and 'Other'. The 'Other' category included factors such as predicted growth in wastewater generation not eventuating.

The above-referenced appraisal is considered to be consistent with the interpretation of risk based 'effects' under the RMA.

The output of the risk assessment has been used in the determination of procedures to avoid, remedy and mitigate measures associated with potential and actual adverse effects of the 'Proposed Scheme'.

4.6.9 Extreme Wet Weather and Abnormal Conditions

Section 4.6.2 and Figure 4-4 above sets out a range of wastewater treatment and contingency storage ponds operational procedures.

In terms of unexpected, out of (consent) specification treated wastewater, the EScan automatic wastewater quality monitoring equipment is a relatively recent innovation to wastewater treatment plants that allows immediate detection and flow diversion of out-of-specification wastewater quality. The existence of the two oxidation ponds and their availability for contingency storage is seen by WDC to be a desirable feature of the continual use of the existing Ruakaka Wastewater treatment plant site. These facilities provide a significant hazard and risk management (refer Section 4.6.8 above) facility that provides a range of mitigation measures associated with the WWTP operation and treated wastewater discharge.

4.7 Resource Consent (Permits) and Other Approvals Sought Including Consent Durations

In all, nine new resource consents (permits) are required and three Concessions to discharge treated wastewater onto Zones 6B and 7 and to cross Crown Land with pipelines, one to the Rama Road Block and the other from the WWTP site to the ocean outfall itself.

Table 1.2 in Section 1.5 sets out the existing consents and the new resource consents being applied for. This table is included at the front of this AEE and further included in Section 5. The consent application forms are also included in the front of this AEE for completeness.

In Section 4.8, Figure 4.9 sets out the sequencing of the new resource consents being applied for in order that staged implementation of the 'Proposed Scheme' can take place. Figure 4.11 indicates the consent durations being applied for and a timeframe of when each of the consents would be given effect to.

4.8 Staged Development of the 'Proposed Scheme'

4.8.1 Introduction

As introduced in Section 4.5.1 above, WDC have devised a staged sequence of provision of the necessary infrastructure works and associated resource consents phasing in (and out). This allows a planned and financially prudent approach to the progressive development for the long-term management of the increasing amounts of wastewater. The 'Proposed Scheme' includes for staging as envisaged to cover a 35 year period and beyond.

This staging can be grouped into two principal areas, namely:

1) The staging, by using modular construction of the new WWTP once the existing oxidisation pond system reaches its capacity expected to be around 2015/16. This however could be later such as 2020 depending on the rate of increase in wastewater flows.

   Section 4.8.2 below sets out volume/daily flow staging allowances of the WWTP as they have been established to date and Section 4.8.4 discusses the WWTP staged development as is currently proposed.

2) The staging of the development of reuse and disposal facilities.
   - The phasing (or staging) of land disposal of treated wastewater by progressively using more zones (areas) of land including the Rama Road block until the consented capacity of all land blocks (with or without Crown land contingency zones 6B and 7) is reached and the ocean outfall is brought into use. Current predictions are that the ocean outfall would be required around 2026. Figure 4.7 illustrates the location, Figure 4.10 illustrates the staging areas and Figure 4.11 diagrammatically provides the sequence of use.
   - The provision of reuse water primarily to the NZRC is subject to agreements being signed and minimum dialy volumens being available to the Refinery. The Refinery has the ability to take flows of up to 4,000 m^3/day of reuse water. The current considerations have been based on 2000 m^3 /day. Treatment capacity will be provided in modules to match the demand.
   - Section 4.8.5 discusses the timing of the ocean outfall system.
   - To facilitate the above staged modular approach to the WWTP installation and land disposal reuse and ocean outfall discharge of treated wastewater there needs to be a sequence of timing for the resource consents being applied for. This sequence must ensure that appropriate lapse durations are known and lapse dates set.
   - Section 4.8.3 below discusses this sequencing of consents required for the staged implementation of the 'Proposed Scheme'. Figure 4.9 diagrammatically shows these.

The staged development of the 'Scheme' will be guided by the ongoing development and review of the Ruakaka Wastewater Strategy and Scheme. Section 4.4.3 above sets out the overall approach to the ongoing development and review of the Strategy and Scheme over time and the links to WDC's 'proposed Development, Technology and Environmental / Monitoring Review Conditions as generally set

out in Section 19.2.1 of this AEE. This approach is contingent upon NRC as Consent Authority issuing appropriate resource consent conditions.

Figure 4.8 Short- and Medium-Term Beneficial Reuse and Disposal Schematic

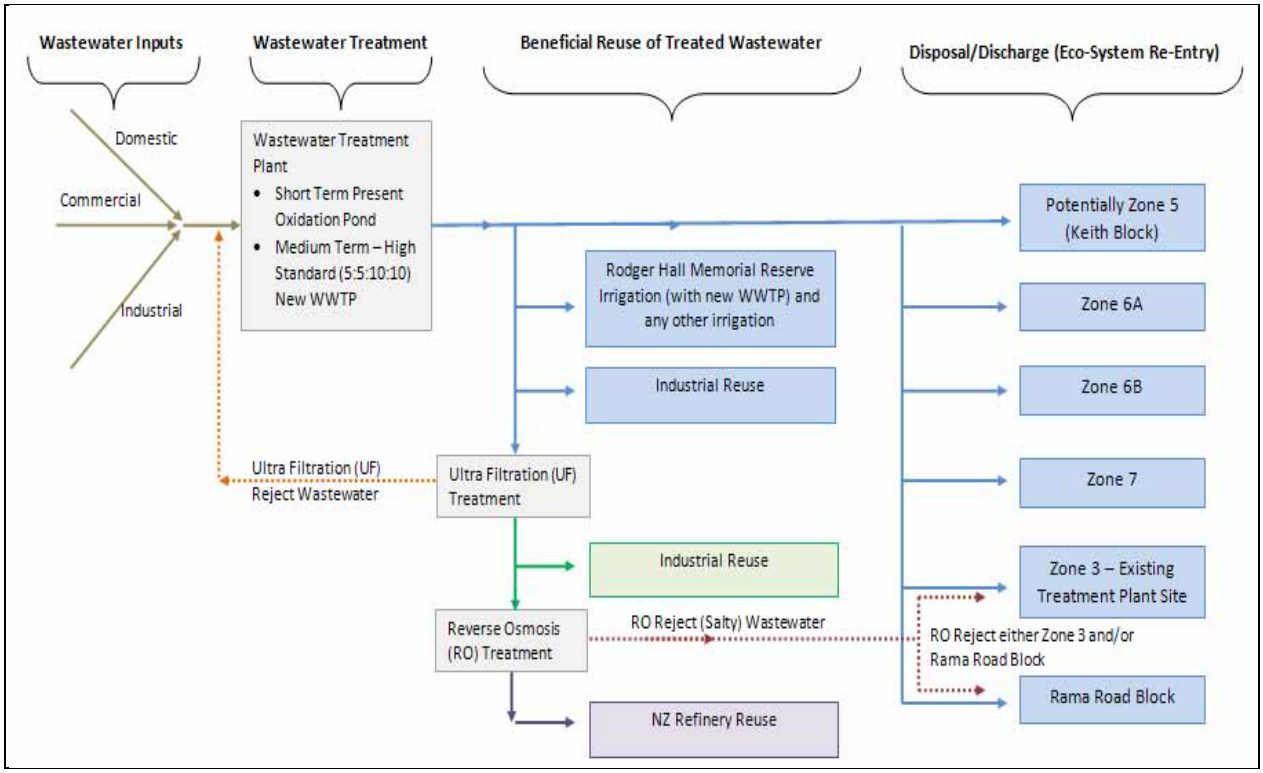
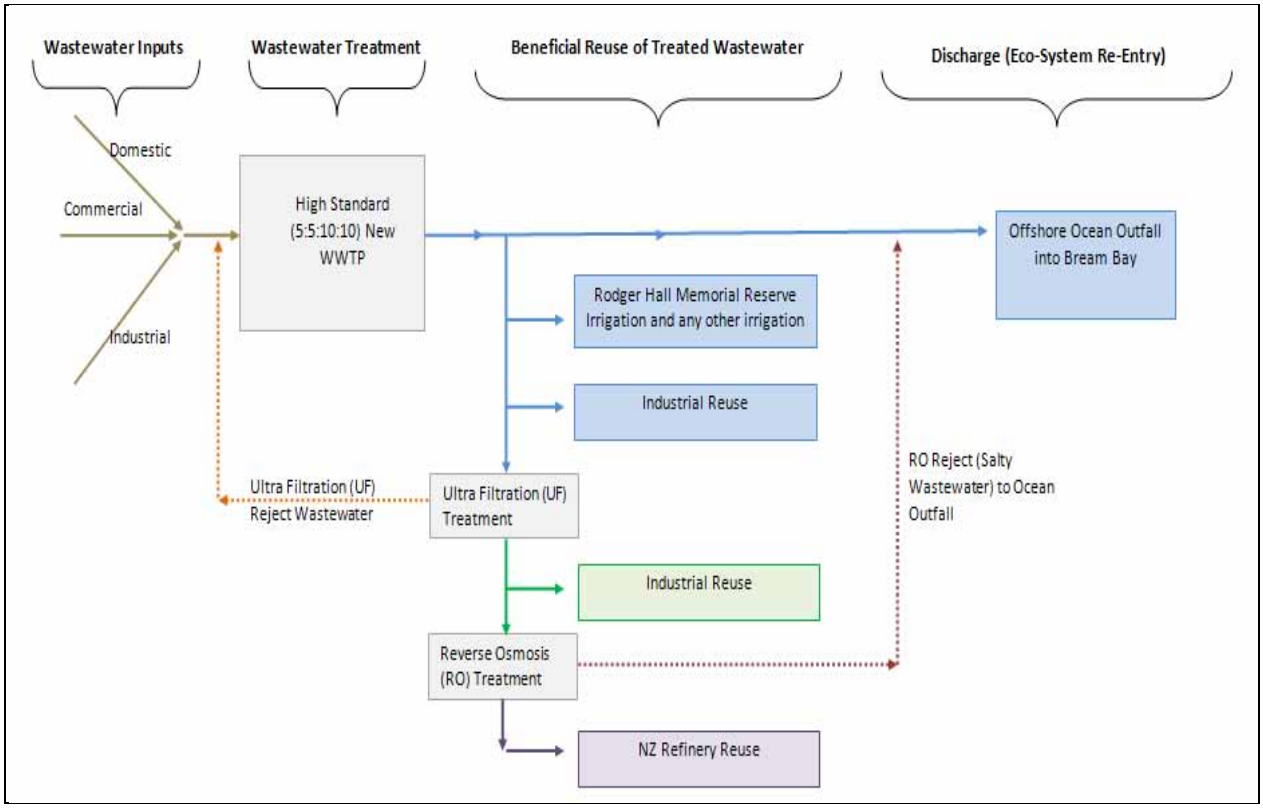


Figure 4.9 Long-Term Beneficial Reuse and Discharge Schematic



4.8.2 Modular Staging of Development

The flow/volume staging of the development of the Wastewater Treatment Plant is set out in MWH Supplementary Information Part 2 Report (Support Document 14) and shown in Table 4.3.

Table 4.3 Development of Flow

	Total Flow as Average Dry Weather Flow (m^3/day)	Indicative Date when plant capacity provided
Stage 1	3,000	*2016-2021*
Stage 2	6,000	*2021-2025*
Stage 3	12,000	*2031-2041*
Stage 4	18,000	*2051-2061*
Stage 5	24,000	*Beyond 2061*

(Expressed in terms of average dry weather flow (ADWF) in m^3 /day.)

Note: The indicative dates are based on the medium residential and business growth rates as detailed in Table 4.2. If the high growth rates eventuate then additional plant capacity will need to be provided earlier than those indicated.

In Section 4.3 Wastewater flow (volume) and contaminant load projections are discussed. The projected ADWF at year 2046/47 that would allow for 35 year resource consents is 16,000 m^3/day ADWF. This is the volume applied for in Permit (Consent) Number 7 for the ocean outfall discharge. Comparison with Table 4.3 above shows that this would occur mid way between the Stages 3 and 4 of a modular WWTP expansion.

4.8.3 Sequencing of Resource Consents

As introduced in Section 4.8.1 above WDC's staged and phased approach to the progressive development of the 'Proposed Scheme' requires a sequencing approach to resource consents. This approach needs to cover both consent durations and the time of exercise of consents.

Figure 4.11, Figure 4.12 and Figure 4.13 have been developed to indicate the background to and WDC's suggested timing/duration for the new consents. These figures should be read in conjunction with Table 1.2, the summary table showing the resource consents which the WDC are applying for.

Figure 4.10 Overview of Wastewater Land Application Zones and Areas

Aerial Photograph Showing the Wastewater Land Application Zones and Areas

Source: WDC Aerial Photograph

Refer to Schematic Diagram Detailing Wastewater Land Application Staging Through to Ocean Outfall Implementation for staging of zones and areas.

Figure 4.11 Schematic Diagram Detailing Wastewater Land Application together with NZRC Reuse Sequencing Through to Ocean Outfall Implementation

This diagram shows one scenario however the actual implementation will depend on a number of factors including the rate of growth and the form of any agreement reached with NZRC.

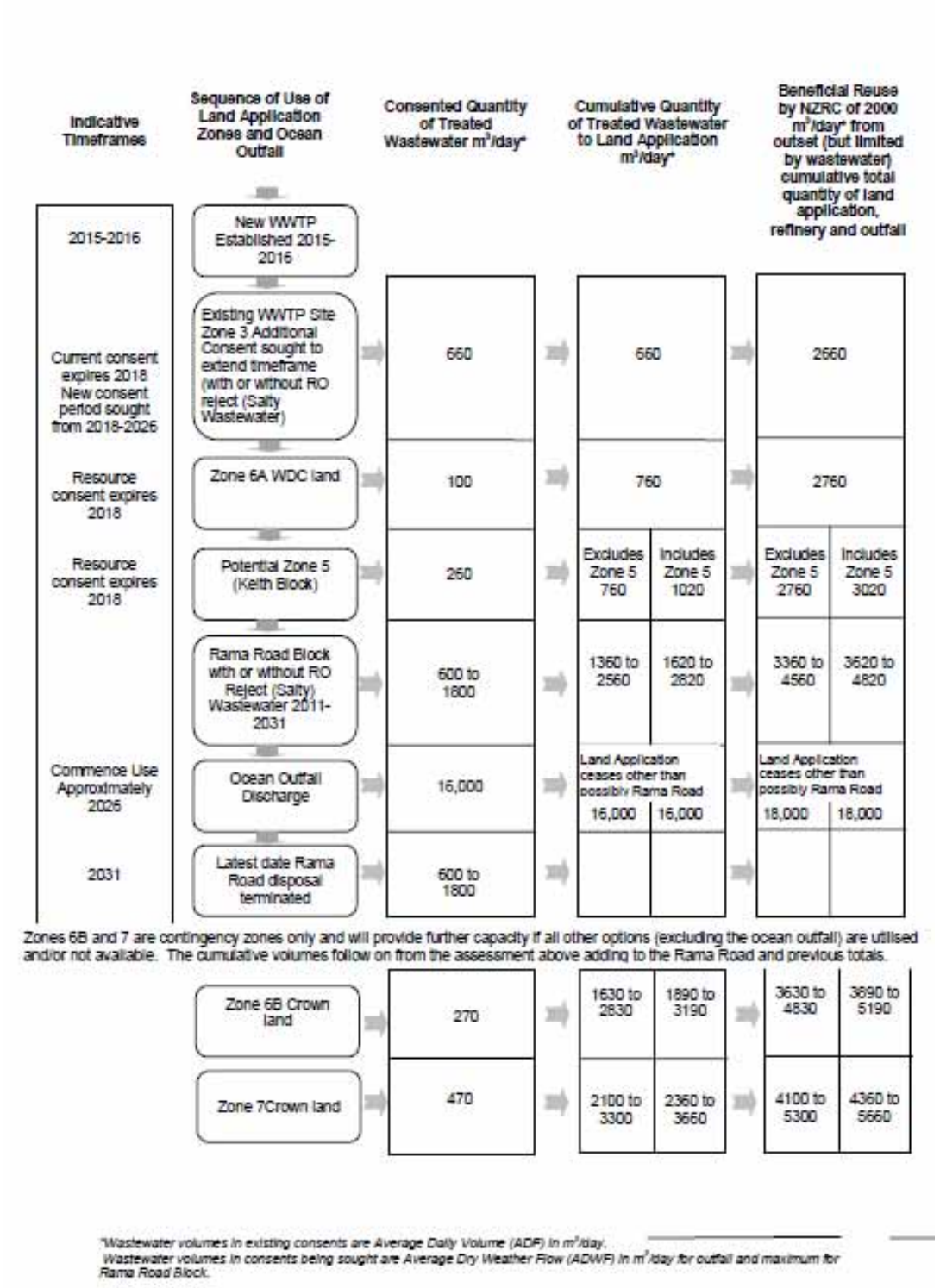


Figure 4.12 Wastewater Growth Prediction and Sequence of Use of Consents

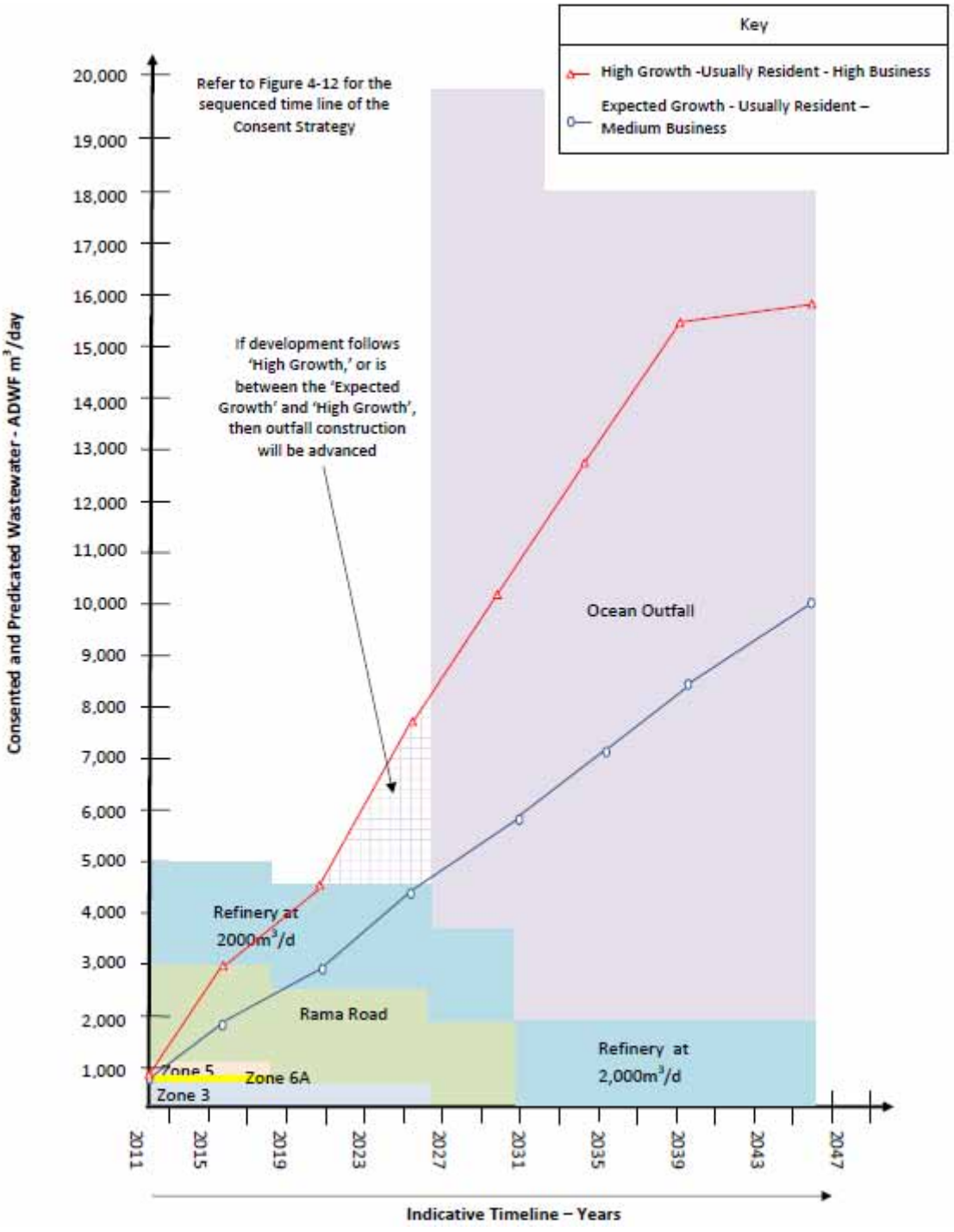
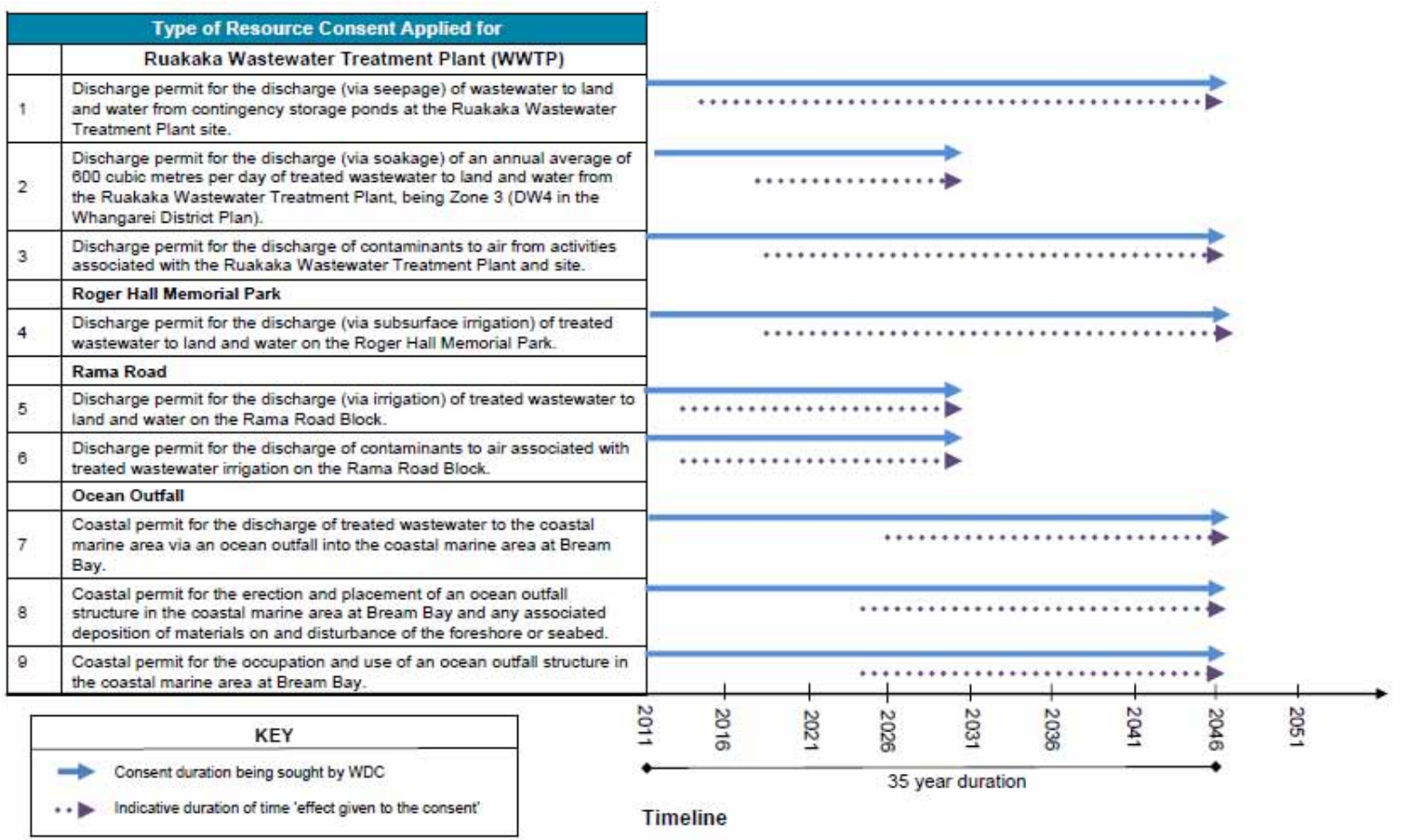


Figure 4.13 shows consent durations and times when it is expected each of the consent(s) would take effect. This figure has been developed from Figure 4.10 and Figure 4.11, which shows the land application sequencing of treated wastewater disposal through to the use of an ocean outfall.

Figure 4.13 Consent Durations Applied and Given Effect To



Note: Chart is based on consents issued in 2011. Consent durations will govern – not dates

4.8.4 New Wastewater Treatment Plant Construction Staging of Development

Figure 4.3 shows the WWTP staging of the SBR units as they relate to the five stages, as set out in Table 4.3.

As previously indicated WDC have determined that an SBR activated sludge type plant would be appropriate, and it is presently favoured. Other treated process arrangements such as a continuous flow activated sludge plant could as previously discussed also be used and also staged.

Stage 1
Initial construction will provide the necessary inlet works, two 1,500m^3/day SBR units devoted to Stages 1a and 1b, tertiary filters (if required) and the UV disinfection, as shown in Figure 4.4. Waste sludge will be pumped to the oxidation pond.

Stage 2
Stage 2 will provide two further 1,500m^3/day SBR units which together with Stage 1 will complete the first of the four 6,000m^3/day modules (i.e. Stages 2 to 5 inclusive) together with a sludge treatment building of sufficient size to accommodate the needs of the ultimate development and mechanical equipment and appropriate storage to provide for thickening of sludge to 5-6% dry solids.

Any upgrade of the inlet works, tertiary filtration and disinfection required will be undertaken. Waste sludge will be mechanically thickened to 5-6% dry solids and either be transported to the Whangarei WWTP for further treatment and disposal, or dewatered on site to 20% dry solids and taken to landfill.

Stages 3 to 5 will each add an additional module of 6,000m³/d to the plant to give a plant of around 24,080 m^3/day ADWF capacity. Any upgrade of the inlet works, tertiary filtration and disinfection required will be undertaken. As previously set out the 2046/47 (35 year) ADWF is projected to be around 16,000 m^3/day.

4.8.5 Ocean Outfall Timing

The long-term operating requirements of the outfall will need to be sized from the outset. The design issues relating to the treated wastewater surge tank, possible pumping station and discharge will be investigated to provide sufficient flexibility of operation.

Although the modular construction of the treatment plant is possible, the ocean outfall in contrast will have to be constructed to accommodate the long-term development. Accordingly by not having to construct this until around 2025/26 based on present wastewater growth predictions further refinement of its sizing can be left until that time.

The preliminary assessment of the hydraulic profile shows that the treated wastewater may need to be pumped to the ocean outfall rather than a total gravity system. The WWTP geometry and head available to feed the outfall will determine if gravity flow can be used.

A surge tank is required to allow adequate cleansing velocities to feed the outfall once sufficient storage is available.

4.8.6 Beneficial Reuse Facilities

The requirement for facilities to treat the wastewater beyond the 5:5:10:10 standard for beneficial reuse (such as storage and/or additional treatment units) will be driven by demand. At this stage it is anticipated that a UF/RO plant is likely to be required to provide reuse water to NZRC.

4.9 Estimated Costs and Financial Planning

A number of Support Documents (2, 5, 11, 12, 14, 19, 22, 23, 26, 38 and 40) include indicative capital, operating and lifecycle (Net Present Value (NPV)) costs for both individual components of the 'Proposed Scheme' and the total 'Proposed Scheme'.

As an update of much of this formation the following estimated cost and financial planning is presented in summary form below. This information highlights the scale of the expenditure proposed for the 'Proposed Scheme' and the order of WDC's costs to date leading up to the lodgements of the nine resource consents and other approvals being applied for. All indicative cost information excludes GST.

New WWTP and Land Application Facilities

WDC's LTCCP 2009-2019 sets out the following Prospective Capital Expenditure Programme for the One Tree Point/Ruakaka WW Project. This covers consenting costs, WDC's share of the upgrade of the existing treatment plant, the first stage of a new treatment plant and, the associated land application for this 10 year financial planning period.

Capital Expenditure Years	$million dollars
Years 2009-12	$9.409
Years 2014-15	$2.882
Years 2015-16	$12.175
Years 2016-17	$14.505
Years 2017-18	$5.222
Total	$44.274

This is a rounded total of approximately $44.3 million. These are inflation adjusted figures to the prospective year of expenditure. As previously indicated, the current programme is to construct the first stage of a new WWTP in 2014-16. The proposed ocean outfall is not included in the above figures as the construction is outside this 10 year period (expected to be constructed around 2025/2026).

Ocean Outfall System

The OCEL consultants latest capital cost estimate (Support Document 38) is $24.8 million for a float and sink option. This is based on an August 2010 estimate that has been built up using actual costs from similar and relatively recent New Zealand outfalls. This excludes an outfall pumping station that may be required.

- **Costs to Date and Project for this Resource Consent Project**
  WDC Indicative costs for resource consent statutory process (excludes extensive hearings) $1.7 million.

- **Total Capital Cost Estimate for 'Proposed Scheme' ($ million excluding GST)**

WWTP (Stage 1)	$16.0
Land application areas including land purchase	$12.3
Ocean Outfall System (HDD option)	$25.8
Outfall Pumping Station (if needed)	$2.2
Resource Consent Project/Consents	$1.7
	$58.0 million

  The ocean outfall system estimate is based on WDC's preferred method of Horizontal Direct Drill (HDD) of the land section. This is the higher cost option as compared to an open trench method.

- **Estimated Annual Operation and Maintenance Costs of the 'Proposed Scheme'**
  The annual operating and maintenance costs (O&M) will progressively increase over time as the wastewater flows and loads and successive items of new infrastructure are installed and

commissioned. Cost estimates undertaken throughout the Project include the following figures which are given as an indication of the increasing range of expected O&M costs.

For the Stage 1 3,000m^3/day new WWTP and land disposal system the costs are estimated to be around $640,000 pa excluding depreciation and GST. This also excludes O&M costs of the collection system.

The 50 year projections of O&M costs, based on typical today's costs has been estimated in the region of $2.4 million. This excludes depreciation and GST and the collection systems O&M costs.

4.10 Infrastructure Procurement Procedures

WDC's current approach to the future procurement of the main infrastructure items of the 'Proposed Scheme' is:

The New Wastewater Treatment Plant
For the new Wastewater Treatment Plant (WWTP) (required to produce the high standard 5.5.10.10 treated wastewater quality), WDC / BBLOA have decided to leave the final treatment process selection open until nearer the time of arranging its procurement. This allows Council to either decide to go down a 'Design Build' (DB) route or follow a 'Conventional Consultant Design' approach.

By taking this approach WDC / BBLOA can gain the advantage of consulting and contracting/equipment supply markets at the time as well as take advantage of any technology advances in the intervening period.

This approach is sometimes referred to as 'an envelope of effects' or 'black box' approach in that consents are sought without identifying the (precise) treatment system that an application plans to use.

Section 4.3discusses sustainable approaches to wastewater management includes a generic model that highlights an integrated holistic approach that includes the wastewater treatment plant as a 'Black Box'.

In following this approach WDC is well aware it will need to demonstrate to NRC, as consent authority, that proven treatment technologies are available to meet the suggested treated wastewater quality and air management envelopes.

WDC consider that through the extensive assessment of treatment alternatives (as summarised in Section 6) it has been clearly demonstrated that while an SBR treatment process is WDC's preferred system at the present time, there are a range of alternative activated sludge and other processes that would meet the 5.5.10.10 high standard of treated wastewater.

The Ocean Outfall System

As this is not likely to be required until around 2025/26 if the growth patterns result in the medium residential and business growth projections (refer Section 4.3). If the high growth, usually residential high business revised projections occur (as set out in Table 4.2) then an earlier commissioning of the ocean outfall will be required.

The design and construction of the ocean outfall system involves engagement of specialist's designer and construction firms, WDC plan to procure the outfall by a competitive design and build approach. This approach which has been used for most of the recently constructed outfalls in New Zealand allows Council to take advantage of the contracting market at the time.

This approach is also called a Management Plan approach whereas consents are issued based on the consent holder providing to the consent authority a detailed management plan of the proposed outfall type and construction methodology before physical works commence. This approach is included in

Section 9 of this AEE and set out in detail in the OCEL Ocean Outfall Report (Support Document 35). Discussions have been held with Officers of NRC about using this Management Plan approach.

4.11 Rationale for 'Ruakaka Wastewater Strategy' and 'Proposed Scheme'

In determining the 'Ruakaka Wastewater Strategy' and 'Proposed Scheme' for which the new resource consents and other approvals are to be sought, it has been paramount to WDC and the Project team to strive to meet the Project Objectives (refer Section 2.2 above) and also meet WDC's other key Strategies and drivers as set out in Sections 1.3, 2.3, 2.4, 2.5, 5 and Appendix C of this AEE Report.

The common components of the 'Ruakaka Wastewater Strategy' and the 'Proposed Scheme' have been grouped as below. These groupings are then assessed against the Project Objectives and other WDC Strategies and drivers in terms of the rationale for each of the component groupings.

The 'Proposed Scheme' has been formulated after extensive technical investigations (particularly into land disposal options), consultation, environmental effects studies and an overall long-term integrated approach to sustainable wastewater management.

A planning horizon and RMA effects assessment through to the year 2047 has been used in assessing the Ruakaka's projected wastewater requirements and the effects on the environment in order that 35 year resource consents can be considered. Longer term, 60 years and beyond considerations have also been used in investigating some of the long life infrastructure components and Ruakaka WWTP site sustainability.

1. The 'Ruakaka Wastewater Strategy' that underpins the Proposed Scheme, provides a sound and forward thinking approach to the sustainable management of Ruakaka's Wastewater in the short, medium and longer term.

Rationale in terms of Project Objectives:

- *Adopts a 'best practicable option' approach.*
- *Provides an economically sustainable wastewater approach which will match a range of growth rates in the area.*
- *Adopts appropriate technology.*
- *Provides flexibility to adopt appropriate (future) technology.*
- *Adopts a strong thrust for beneficial reuse of wastewater.*
- *Optimises economic use of existing infrastructure.*

Rationale in terms of other WDC Drivers:

- *Meets Council financial planning through its LTCCP and Annual Plan Process.*
- *Provides for the planned residential business and industrial growth of wastewater in a timely and staged manner allowing construction of an offshore outfall to be delayed until wastewater volumes and/or other factors so require it.*
- *Is consistent with and supports WDC's Waste and Drainage Wastewater Strategy's Vision, Mission, Goals and Key Principles.*

2. Planned beneficial reuse of treated wastewater for NZ Refining Company, other industries and the Roger Hall Memorial Park irrigation initially, and other reuse options in the future.

Rationale in terms of Project Objectives:

- *Promotes efficient use and development of natural resources and sustainable reuse of wastewater products.*
- *Provides services to the existing and growing community.*
- *Promotes more sustainable solutions such as treated wastewater reuse where provide.*
- *Receives tangata whenua support as evidenced through WDC activities working in partnership with tangata whenua.*

Rationale in Terms of other WDC Drivers:

- *Meets WDC and Bream Bay Landowners Association (BBLOA) requirements.*
- *Complements WDC Water Supply Conservation and Demand Management procedures.*
- *Provides for environmental, social, cultural and economic wellbeing of the District and Northland Region.*
- *Will assist to meet Council's vision for the District of "to be a vibrant, attractive and thriving District by developing sustainable lifestyles based around our unique environment, the envy of New Zealand and recognised worldwide".*
- *Provides from a wastewater perspective for the long-term growth of Ruakaka in terms of WDC's latest Structure Plan for the area.*
- *Encourages a forward looking urban wastewater management strategy through enabling more efficient use and reuse of resources in land use planning.*
- *Meets the WDC's Key Principles of Reduce and Reuse-Recycle, Recovery included in their Waste and Drainage Wastewater Strategy.*

3. Use of the existing designated Ruakaka Wastewater Treatment Plant and Disposal site for the new, medium and longer term treatment plant.

Rationale in terms of Project Objectives:

- *Ensures optimum economic use of existing infrastructure.*
- *Provides in part an economically sustainable future 'Proposed Scheme'.*
- *Provides flexibility to adapt appropriate technologies.*
- *Promotes efficient use and development of natural and physical resources.*

Rationale in terms of other WDC Drivers:

- *Consistent with WDC's District Plan and Ruakaka Area Structure Plan.*
- *Provides for the planned residential and business growth of wastewater.*
- *Assists meet the 'delivering secure infrastructure to Northland', sub-strategy in the Sustainable Economic Development for Northland Strategy.*

4. Provision of a high standard of treated wastewater from the new Ruakaka WWTP.

Rationale in terms of Project Objectives:

- *Protects the natural environment and ensures soil and water quality is not compromised.*
- *Ensures a high level of compliance with water quality standards and guidelines and Regional and District planning requirements.*
- *Achieves the greatest practicable protection of public health.*
- *Applies appropriate technology to protect public health and meet environmental standards.*

Rationale in terms of other WDC Drivers:

- *Protection of public health and the environment which are Goals in the WDC's Waste and Drainage Wastewater Strategy.*
- *Meets BBLOA's objective of installing a modern treatment plant that will meet a high standard of wastewater treatment.*
- *Supports a vibrant and growing local economy.*
- *Although not land disposal, will support tangata whenua's position that if a discharge is to the marine environment that it would need to be of the highest standard.*
- *Compatible with WDC's Whangarei City wastewater treatment plant's high quality of treated wastewater in terms of producing a high standard of treated wastewater.*
- *Encompasses WDC overall approach of maintaining and enhancing the natural and built environment and the protection of Bream Bay.*

5. Provision of a long (approximately 3,000m long) offshore ocean outfall for the discharge (ecosystem re-entry) of the high standard treated wastewater. This component would be implemented when wastewater growth so determines, and when other reuse options and land application procedures are unable to accommodate the total wastewater flow at all times. Current projections are based on the expected growth, usually resident / medium business model for the outfall to be required around 2025/26,

Rationale in terms of Project Objectives:

- *Protects the natural environment.*
- *Ensures a high level of compliance with recreational, ecological and water quality standards and guidelines.*
- *Ensures the greatest practicable protection of public health.*
- *Provides an economically sustainable future 'Proposed Scheme'.*

Rationale in terms of other WDC Drivers:

- *Provides an economically sustainable future 'Proposed Scheme' which will match anticipated growth in the area.*
- *Consolidates the urban area through limiting sprawl and thereby optimising infrastructure development.*
- *Assists in delivery secure infrastructure to Northland in accordance with the Sustainable Northland Economic Strategy.*

- *Consistent with WDC's approach to ongoing development and review of the Ruakaka Wastewater Strategy and the linkage to the suggested resource consent review conditions.*

- *Overall consistency with the WDC's Waste and Drainage Wastewater Strategy.*

6. Staged modular development of the wastewater treatment plant matching wastewater growth.

Rationale in terms of Project Objectives:

- *Provides economically sustainable 'Proposed Scheme' matching expenditure to growth.*

- *Allows sufficient flexibility to adopt appropriate technology and more sustainable solutions in the future.*

Rationale in terms of other WDC Drivers:

- *Assists in delivery secure infrastructure to Northland in accordance with the Sustainable Northland Economic Strategy.*

7. Increasing use of land application on up to five different areas (zones 3, 6A, 6B, 7 and WDC's Rama Road Block) until the point when the amount of wastewater to be disposed off exceeds the sustainable and consented capacity of these sites or when the consent expires.

Rationale in terms of Project Objectives:

- *Provides an economic sustainable future 'Proposed Scheme' where infrastructure provision and associated expenditure is (in part) matched against growth.*

- *Ensures optimum economic use of existing infrastructure.*

- *To assist in meeting the tangata whenua objectives for land disposal.*

Rationale in terms of other WDC Drivers:

- *Provides economically sustainable 'Proposed Scheme' matching expenditure to growth.*

- *Encourages a forward looking urban water management strategy.*

- *Enables sustainable growth and development in accordance with this Goal in the Waste and Drainage Wastewater Strategy.*

8. Provision of a Wastewater Scheme (the Proposed Scheme) underpinned by the 'Ruakaka Wastewater Strategy' that through its periodic review as development proceeds and staged formulation has flexibility to take advantage of future technological and environmental changes should it be appropriate to do so.

Rationale in terms of Project Objectives:

- *Promotes sufficient flexibility to adopt appropriate technology and more sustainable solutions in the future.*

- *Promotes widespread community awareness and concern for land and water based resources and taonga.*

Rationale in terms of other WDC Drivers:

- *Encourages a forward looking urban water management strategy through enabling more efficient use and reuse of resources in land use planning.*

- *Consistent with WDC's approach to ongoing development and review of the Ruakaka Wastewater Strategy and the linkage to the suggested resource consent review conditions.*

- *Consistent with the Key Principle in the WDC's Waste and Drainage Wastewater Strategy of integrated wastewater management, funding and future planning.*

9. Provision of a future Wastewater Treatment Plant (WWTP) that has facility to store excessively high wet weather flows and out of specification treated wastewater in the contingency storage ponds.

Rationale in terms of Project Objectives:

- *Provides protection to the natural environment.*

- *Ensures high level of compliance with water quality standards and guidelines and planning instruments.*

- *Ensures optimum use of existing infrastructure.*

Rationale in terms of other WDC Drivers:

- *Provides a forward looking urban wastewater strategy.*

- *Assists in achieving a sustainable, environmentally responsible District.*

- *Consistent with the Key Principles of the WDC's Waste and Drainage Wastewater Strategy of the well managed and sustainable treatment and disposal.*

10. Provision of a targeted and effective environmental monitoring programme through the existence of both resource consent conditions and WDC's own WWTP and environmental monitoring.

Rationale in terms of Project Objectives:

- *To ensure a high level of compliance with recreational, ecological and water quality standards and guidelines and planning instruments.*

- *To ensure the greatest practicable protection of public health.*

Rationale in terms of other WDC Drivers:

- *Assists achieving WDC's vision to be a vibrant, attractive and thriving District.*

- *Assists in achieving a sustainable, environmentally responsible District.*

- *Consistent with meeting the Goals of protecting public health and the environment of the WDC's Waste and Drainage Wastewater Strategy.*

11. Progressing more sustainable wastewater management by further implementation of water conservation, trade waste management, infiltration and inflow management, further wastewater reuse measures, energy management residuals management and other techniques.

Rationale in terms of Project Objectives:

- *Keeps with sustainable management principles and practices.*

- *Promotes efficient use and development of physical resources and the sustainable use of wastewater products.*

- *Promotes sufficient flexibility and technology to enable more sustainable solutions in the future including treated wastewater re-use.*

Rationale in terms of other WDC Drivers:

- *Encourages a forward looking wastewater strategy.*
- *Assists to provide a full range of urban services and facilities.*
- *Consistent with the WDC's Key Principles of Reduce and Reuse-Recycle, Recovery included in their Waste and Drainage Wastewater Strategy.*

12. Ensure the ongoing liaison regarding the Wastewater Scheme with key stakeholders in the Ruakaka Bream Bay area. Such stakeholders are likely to include (but not be limited to), Medical Officer of Health, Department of Conservation, Northland Regional Council, Northland Port Corporation, NIWA Bream Bay Aquaculture Park Might River Power, NZ Refining Company, Ruakaka Surf Club and Commercial Shell fishing Companies.

Rationale in terms of Project Objectives:

- *Working in partnership with stakeholders in order to achieve understanding of the project and enable genuine and effective consultation.*

Rationale in terms of other WDC Drivers:

- *Meet WDC's consultation guidelines.*
- *Assist to achieve the community outcome of a healthy and educated community.*
- *Consistent with the WDC's Waste and Drainage Wastewater Strategy Mission of advancing the welfare of the District and exceeding communities' expectations.*

13. Ensure the involvement of tangata whenua in the ongoing liaison on the existing Wastewater Scheme, 'Proposed Scheme' and associated 'Ruakaka Wastewater Strategy'.

Rationale in terms of Project Objectives:

- *To work in partnership with tangata whenua.*
- *To promote widespread community awareness and concern for the land and water-based resources and taonga including kaimoana, fisheries, native birds and wildlife, the foreshore, seabed and surrounding estuaries, and indigenous flora and fauna of Te Rohe o Patuharakeke Hapu.*

Rationale in terms of other WDC Drivers:

- *Meet WDC's partnership agreements with tangata whenua through the WDC Iwi Liaison Group and other activities.*
- *Meet WDC's consultation guidelines.*
- *Assist to achieve the community outcome of a healthy and educated community.*
- *Consistent with the Goal of providing for cultural sustainability and meeting the Key Principle of knowing our historical and cultural background of the WDC's Waste and Drainage Wastewater Strategy.*

Overall Rationale

The Project's Overall Objective is *(refer Section 2.3):*

To work in partnership with the community and tangata whenua to obtain the necessary long-term resource consents for the 'Proposed Scheme'. The 'Proposed Scheme' shall encompass a high level of public health and environmental protection and be the best practicable option for Ruakaka's future wastewater management that is in keeping with sustainable management principles and practices.

Overall WDC considers that the 'Proposed Scheme' and associated 'Ruakaka Wastewater Strategy' will meet the Project's Overall Objective and associated Environmental, Social, Economic and Tangata Whenua Objectives and in doing so will:

- *Achieve a high level of public health protection.*
- *Achieve a high level of environmental protection.*
- *Ensure a 'Best Practicable Option' approach is implemented that is consistent with the interpretation of 'Best Practicable Option (BPO) in the RMA.*
- *Keeps with sustainable management practices and principles.*
- *Be consistent with WDC's approach to ongoing development and review of the Ruakaka Wastewater Strategy and the linkage to the suggested resource consent review conditions.*
- *Be consistent with the Key Principles of the WDC's Waste and Drainage Wastewater Strategy of the well managed and sustainable treatment and disposal.*

Furthermore in developing the 'Proposed Scheme' and associated 'Ruakaka Wastewater Strategy' WDC considers it has met the objective of working in partnership with the community, stakeholders and tangata whenua.

It is also considered that the 'Proposed Scheme' and associated 'Ruakaka Wastewater Strategy' are not only consistent with WDC's Waste and Drainage Wastewater Strategy, but also sets out a practicable and proactive implementation of this Strategy in the Bream Bay area.