Takapau Wastewater Treatment and Discharge Best Practicable Option

LEI (2020:T:C.12)

Prepared for

Central Hawke's Bay District Council

Prepared by

November 2020

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1 EXECUTIVE SUMMARY

The Takapau Wastewater Treatment Plant (TWWTP) currently discharges treated wastewater to the Makaretu River under resource consent DP180115W. This consent permits a discharge volume of no more than 2.5 l/s (216 cubic metres per day) to the Makaretu River and is due to expire on the 31st of October 2021.

A comprehensive BPO selection process has been undertaken by CHBDC involving environmental advisors, affected parties (landowners and iwi) and the Takapau community. Community consultation aimed to understand the concerns, aspirations, and potential design constraints from interested parties to assess discharge and treatment options. For each component of the wastewater system, a series of options have been considered, where these were narrowed down through community engagement and technical advice and refined in conformance with BPO principles to arrive at a BPO.

For the discharge of Takapau's wastewater, the BPO is the discharge of wastewater to land under a non-deficit irrigation system, whilst maintaining a discharge to the Makaretu River when soil conditions cannot receive wastewater and storage is at capacity. Additional treatment to the TWWTP has not been included due to the adequate condition of the existing treatment system. CHBDC may incorporate further treatment such as filtration and/or aeration infrastructure to further improve wastewater quality. The Site where land application will occur is 45 Burnside Road, Takapau.

The respective aspects of the BPO include:

- a wastewater discharge to land under non-deficit irrigation, with a contingency discharge to the Makaretu River when soil cannot receive wastewater and storage is at capacity;
- construction of a storage pond between 5,000 – 17,000 m^3 depending on the consented discharge regime and river discharge availability;
- minor additional treatment to the current treatment system such as UV disinfection and filtration improving water quality; and
- the preferred discharge Site is 45 Burnside Road, Takapau.

Each of these aspects are considered to be the BPO for Takapau's wastewater system because:

- all components of the BPO have been selected in order to function effectively as an integrated wastewater management and discharge system;
- the implementation of a combined land and river discharge regime is affordable to the Takapau community in comparison to other initial discharge options;
- a significant portion of wastewater flows are to be applied to land instead of the river, inline with community aspirations of reducing the river discharge component;
- wastewater is able to be beneficially returned to the land to increase pasture productivity rather than wasted under a river discharge, rapid infiltration basin or deep bore injection system;
- environmental impacts are expected to be reduced as wastewater can be filtered through the soil, prior to reaching groundwater, reducing the risks of nitrogen leaching or contamination of waterways. Wastewater aims to supplement existing fertiliser usage, resulting in a reduction of synthetically applied fertiliser;
- a non-deficit system enables higher volumes of wastewater to be applied to land than a deficit system, reducing the necessity for larger storage volumes and management issues for applying wastewater effectively;

- the Takapau WWTP is considered to already have adequate treatment infrastructure for the community's size, meaning further treatment is not strictly essential although may be desired;
- the BPO system has the ability of accommodating for future flows in response to projected population growth for Takapau;
- each aspect of the BPO provides a cost effective and efficient use of CHBDC's finances to manage the community's wastewater while protecting and enhancing environmental aspects; and
- the nominated discharge site is as close as possible to the TWWTP and is considered to be the best possible discharge site for the nominated discharge regime with regards to proximity, landowner interest and site conditions.

The BPO described within this report can form the foundation for refining the details of the design, operation, and implementation timing of each aspect of the treatment, storage, and discharge systems. Many of these details are intended to be further developed and described in the Conceptual Design report. The BPO needed to be developed and confirmed to provide certainty of the key aspects of the future systems before such a conceptual design process could commence.

The future resource consent application documents will rely upon the conceptual design details for assessing its likely effects on the environment and developing appropriate resource consent conditions. The consent application will also rely upon this BPO report to satisfy the RMA requirement that a nominated discharge is the BPO for the system and its locality.

Additionally, it is likely that subsequent reports will superseded this BPO report and that these later reports should be consulted first with relation to this consent application.

2 INTRODUCTION

2.1 Background

Takapau is a small inland community located in the western Central Hawke's Bay region, approximately 35 km north-east of Dannevirke and 20 km west of Waipukurau along State Highway 2. As of 2018, Takapau contained a population of 530 (Beca, 2020:T:C.10a).

The Takapau WWTP is located at 53 Burnside Road approximately 1.5 km north-east of Takapau. CHBDC holds resource consent (DP180115W) permitting discharge of treated wastewater from the Takapau WWTP to the Makaretu River via a wetland system, with this consent is due to expire on the 31st of October 2021. As part of the reconsenting, CHBDC are investigating alternative discharge options for both environmental, alongside social/aesthetic reasons.

A key aspect of seeking any discharge consent is the Resource Management Act (RMA) requires the applicant to demonstrate that the proposed discharge regime adopts the Best Practicable Option (BPO). The BPO option uses the most appropriate current technologies, providing the most benefits for the least impacts on the selected receiving environment, whilst being at an affordable cost to the Takapau community.

2.2 Purpose

This report assesses available treatment and discharge options, describes the selection process, and identifies the BPO for the discharge of Takapau's wastewater. It is intended that the described BPO can form the foundation for the conceptual design, operation, and implementation timing for each aspect of the reticulation, treatment, storage, and discharge systems.

The BPO and conceptual design can be relied upon to develop the future discharge consent application, which will include assessing environmental effects and developing consent conditions to mitigate potentially adverse effects. The application will rely upon this report to satisfy the RMA requirement that the nominated discharge is the BPO. These documents will be relied upon by Hawke's Bay Regional Council (HBRC) to grant or decline the resource consent sought by CHBDC.

2.3 Scope

The scope of this report includes the following:

- Section 3 outlines the BPO definition and underlines the drivers and selection process;
- Section 4 presents existing discharge, treatment and wastewater parameters;
- Section 5 presents the current and alternative receiving environments;
- Section 6 outlines available discharge methods and considerations;
- Section 7 describes treatment, reticulation, and storage options;
- Section 8 evaluates initial and refined wastewater system component options;
- Section 9 outlines site selection for alternative receiving environments to river discharges;
- Section 10 presents the discharge, treatment, and storage BPO for the Takapau WWTP; and
- Section 11 presents a summary and conclusions of the BPO selection.

Additionally, it is likely that subsequent reports will superseded this BPO report and that these later reports should be consulted first with relation to this consent application.

3 BPO DEFINITION AND SELECTION PROCESS

3.1 BPO Definition

The BPO, in relation to the discharge of a contaminant, is defined within the Resource Management Act (1991) as meaning:

> *"the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
> *a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
> *b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
> *c) the current state of technical knowledge and the likelihood that the option can be successfully applied."*

Simplifying this, the BPO must use most appropriate technologies providing the greatest benefits for the least impacts to the receiving environment, all whilst being at an affordable cost to the community. The BPO isn't the option with the lowest environmental disturbance or cheapest outcome, but rather a combination of competing values, where the aim is to achieve a compromise between these. Ideally, the most effective and affordable treatment and discharge options are nominated, and the least sensitive receiving environment selected, however this is not always the case, thus an investigation to develop a BPO is required.

3.2 Drivers and Guidance for Identifying the BPO

Schedule 4 of the RMA (RMA, 1991) identifies the minimum types of information that an Assessment of Environmental Effects (AEE) must include, and clause 6 states in part:

> "*(1) An assessment of the activity's effects on the environment must include the following information:*
> *…*
> *(d) if the activity includes the discharge of any contaminant, a description of—*
> *(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and*
> *(ii) any possible alternative methods of discharge, including discharge into any other receiving environment"*

Clause 7 states in part:

> "*(1) An assessment of the activity's effects on the environment must address the following matters:*
> *…*
> *(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants"*

3.3 BPO Selection Process

The BPO selection process needs to be transparent and consider all options regardless of their initial practicability (within reason) in providing for the Takapau community. To come to an unbiased and representative BPO decision, a representative group consisting of community members, iwi, Council staff and environmental consultants should be formed, ensuring that the BPO is widely accepted across all parties. Engaging with multiple parties allows ideas and perspectives to be shared and understood, further developing the effectiveness and likely approval of the BPO decision.

As options are discounted and the remaining field of contenders narrowed, decisions to discount or retain options need to be rationally explained and justified. An objective ranking system should reliably support each choice. The decisions to discount or retain an option should represent the consensus of the BPO selection group.

Figure 3.13.1 presents a simplified flowchart used for the nomination of a BPO to attain a discharge consent for the Takapau WWTP.

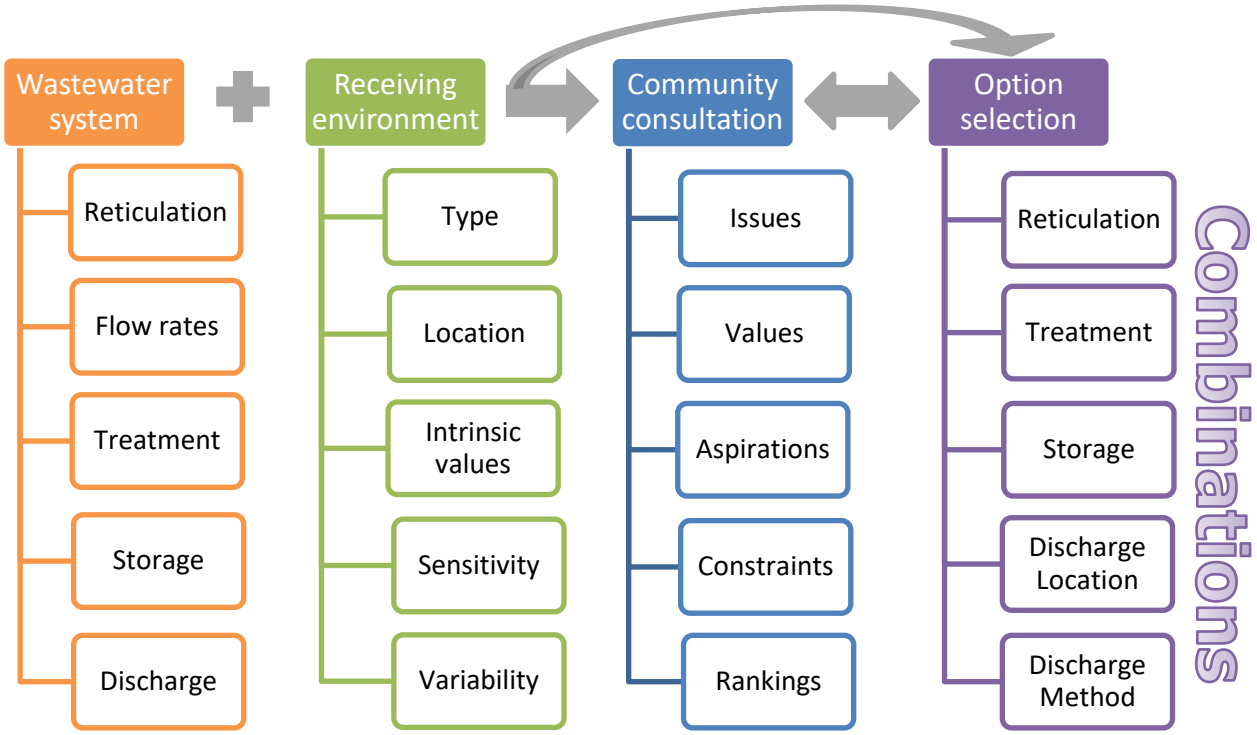

Figure 3.1: BPO Selection Process Overview

3.3.1 Reticulation and Treatment

The volume, quality, and effects of the discharge are all related to and largely controlled by the entire wastewater system upstream of the discharge point. Activities taking place at the WWTP, as well as in the Takapau township itself, will inevitably influence wastewater quality, either in a positive or negative way, regardless of the discharge method.

3.3.2 Discharge Regimes and Storage Implications

Discharge regimes can vary to reflect the receiving environment and community values. Timing of discharges can be designed to reflect seasonal variations. Discharge systems can also be designed to use more than one discharge site and type of receiving environment; for example, river and land discharges can often be complementary.

Discharge regimes strongly determine storage volume requirements to retain flows when the environment is unsuited to receiving wastewater. Varying the discharge criteria can optimise storage volumes while managing the scale of effects to the environment within acceptable ranges.

3.3.3 Broad Environmental Factors

In considering adverse effects of the discharge on the environment, a broad definition of the environment was applied. It factored in ecological, social, cultural, and economic factors, and is consistent with the broad definition of environment within the RMA:

> *"(a) ecosystems and their constituent parts, including people and communities; and*
> *(b) all natural and physical resources; and*
> *(c) amenity values; and*
> *(d) the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters."*

These factors can be used in consultation to define and rank the importance of values which can be used to evaluate how each option matches with RMA principles and community aspirations.

3.3.4 Consultation

Community values need to be reflected in the selection process as the community pays for the selected systems. Consultation is necessary when investing in community infrastructure, particularly when a longer term consent is desired. Consultation allows interested parties to voice opinions and concerns, enabling the nominated BPO to have higher support following extensive engagement, instead of generating unnecessary levels of opposition during the consenting process.

Community consultation takes many forms and uses various communication methods addressing public audiences or specific individuals. It involves a continuum of detail and level of expertise as appropriate to the parties involved and their project roles. Additionally, direct consultation should occur with Māori representatives.

Appendix A presents a detailed Community Consultation Summary (LEI, 2020:T:C.34) for the Takapau WWTP upgrade summarising key engagement and outcomes between CHBDC and relevant parties for the current reconsenting process. Note: This engagement record is correct and up to date at the time of finalising Appendix A (September 2020) and will be updated between now and consent lodgement.

Engagement Record:

- 17th December 2019: Community Meeting (Intro) at Takapau Hall
- 27th July 2020: Community Meeting (BPO) at Takapau Hall
- August 2020: Long term plan pre-engagement with opportunities for community to interact on options through webinars and online interactive feedback tools (COVID-19 constrained)
- 2020-2021: Ongoing discussions with landowners around potential land discharge sites.

4 DESCRIPTION OF EXISTING SYSTEM

4.1 General

To assess future options for the Takapau WWTP discharge, the existing system and its operating parameters and constraints need to be defined.

Takapau's wastewater is reticulated to the Takapau WWTP, operated by CHBDC, who have resource consent (DP180115W) permitting discharge of treated wastewater at a rate of no more than 2.5 l/s (216 m^3/day) via a drain wetland to the Makaretu River, a tributary of the Tukituki River.

4.2 Wastewater Reticulation

The existing wastewater reticulation system consists of a series of gravity mains and a rising main conveying wastewater from the community to the Takapau WWTP where it enters an oxidation pond. This pipeline distance from the town centre to the plant is approximately 2 km.

From the oxidation pond, wastewater is piped approximately 230 m to a drain wetland entering the Makaretu River adjacent to the Burnside Road Bridge. This pipeline runs from the oxidation pond, eastwards beneath Burnside Road, and then northwards to the Makaretu River.

4.3 Wastewater Treatment, Storage and Discharge

The Takapau WWTP, constructed in the 1980's, is spread over 0.9 ha area of which 0.6 ha is a clay/silt lined oxidation pond with a discharge outlet to the drain wetland adjacent to the Burnside Road Bridge (Beca, 2020:T:C.10a).

Regarding treatment, there is no incoming flow monitoring or screening facilities for the plant, with treatment only occurring within the oxidation pond (Beca, 2020:T:C.10a). Within the pond, a proportion of solids settle on the pond bed, where non-aerobic conditions prevail, providing further treatment. A portion of solids remaining in suspension along with nutrients and soluble solids are treated by bacteria and algae in aerobic conditions. Bacteria assist with the oxidation of contaminants under aerobic conditions. Oxygen for this process is provided by algae and a surface aerator. Wastewater is discharged to the drain wetland before eventual discharge to the river (Beca, 2020:T:C.10a).

At the pond outlet, there is an effluent chamber containing a perforated basket to catch eels and debris which didn't settle in the pond, prevents these from entering the river (Beca, 2020:T:C.10a). Upon discharge, the outflow is recorded and monitored as per current consent conditions.

Beca, 2020:T:C.10a provides a summary of the existing Takapau WWTP system and current performance.

4.4 Wastewater Flows and Quality

Beca (2020:T:C.10a) includes daily flow statistics for the Takapau WWTP summarised within Table 4.1. Table 4.2 summarises key wastewater quality parameters for the Takapau WWTP from CHBDC monitoring data. Additionally, Beca (2020:T:C.10a) provides incoming wastewater characteristics to the Takapau WWTP.

Table 4.1: Daily Flow Record of Takapau WWTP (after Beca, 2020:T:C.10a)

Year	2019
Minimum Flow	20
Dry Weather Inflow (ADWF) (m^3/d)	67
Average Daily Flow (m^3/d)	180
95%ile Flow (m^3/d)	446
Maximum Flow (m^3/d)	750

*It is likely that the report providing these flow numbers will be superseded, thus later reports should be consulted first with relation to this consent application around flow numbers.

Table 4.2: Key Wastewater Parameters, Takapau WWTP (Jan 1999 to Aug 2020)

Parameter	Units	n	Mean	Median	95th Percentile	Range
$ScBOD_5$	g O_2/m^3	354	32	28	72	1 to 98
TSS	g/m^3	238	72	70	140	2.5 to 433
TN*	g/m^3	20	15.6	15.4	24.3	5.8 to 26.8
Ammoniacal N*	g/m^3	20	4.6	0.09	19.9	0.005 to 20.9
DIN*	g/m^3	21	7.6	7.4	19.95	0 to 21
TP*	g/m^3	20	3.9	3.9	5.3	1.9 to 5.9
DRP	g/m^3	20	2.7	2.5	3.797	1.3 to 3.93
Faecal Coliforms	cfu/100 mL	356	14,695 (geomean)	15,900	140,000	74 to 410,000
*E. coli**	cfu/100 mL	20	13,178 (geomean)	18,000	72,950	100 to 110,000

* Sampling to these analytes began in February 2019

5 RECEIVING ENVIRONMENT OPTIONS

5.1 General

The receiving environment is one of, if not the most important component of the wastewater system and any impact is influenced by prior reticulation, treatment, and storage components.

5.2 Current Receiving Environment

The Makaretu is the current receiving environment of Takapau's wastewater with this being is a tributary of the larger Tukituki River, originating in the Ruahine Ranges and flowing across pastoral farmland of the Takapau Plains.

CHBDC regularly monitor water quality along the Makaretu River at three locations in conformance with existing resource consent conditions for the Takapau WWTP discharge. These are 50 m upstream and downstream of the existing discharge, as well as 400 m downstream of the discharge location. Beca (2020:T:B.24) outline water quality issues at each of these locations. Upstream of the discharge point, the Makaretu is generally compliant with regional and national limits except for TP and DRP and is considered to be of a good quality status with regards to freshwater macro-invertebrates. Only during high flow events is the Makaretu described as being of a poor water quality status.

A detailed water quality assessment of the Makaretu River and the effects of the current wastewater discharge is provided within Beca (2020:T:B.24).

5.3 Alternative Receiving Environments

Appendix B provides a summary of three alternative receiving environments to the existing river and land discharges at the respective communities. These alternative environments are land and groundwater. It is suggested that the reader consults this appendix as part of this reporting package.

6 DISCHARGE METHODS AND CONSIDERATIONS

6.1 General

When selecting a discharge method, it is important to describe and understand the features of discharging methods for the available receiving environments. Each receiving environment has options for suitable discharge regimes, and every potential site and discharge regime has advantages and disadvantages across varying values and community interests.

There are multiple advantages to considering a system that discharges into two different receiving environments, as one environment has the potential to accept the discharge when another cannot. This protects respective environments from adverse effects during seasons or conditions when it is more sensitive and allows for greater flexibility of discharge and storage management. It's therefore important to consider combined discharges and avoid focussing on a single discharge method as the sole potential solution.

The implications for other components of the integrated wastewater system also need to be identified and understood. For a discharge to be acceptable within a specific environment, there may be target parameters for the treated wastewater to adhere to, which may in turn mean that changes are required within the reticulation and/or treatment components of the system. A key implication is often the need to provide storage of treated wastewater when discharges are unable to occur. There may also be the need for additional treatment. The proximity of a suitable receiving environment is also important, as this is a key factor in the length and cost of a pipeline from the Takapau WWTP to the discharge site.

The complexity of considerations increases with increasing choices, so it is useful to develop a methodology and criteria for excluding options and refining potentially acceptable options early in the BPO selection process. This can streamline and simplify the BPO process so that evaluators are not overloaded, and time isn't unnecessarily wasted.

6.2 River Discharge

6.2.1 Discharge Regime

The current discharge regime and management will remain a considered option for future discharge, however, if this option is the nominated BPO, considerable changes would be implemented from the existing discharge conditions. As this is the current operating option, it should be included within discussion, regardless of its acceptance throughout the Takapau community. Including this enables comparisons to be made between existing and proposed options, with potential for improvements to be discussed to the existing system if this is the nominated BPO.

Currently, treated wastewater is reticulated and discharged from the Takapau WWTP to the nearby Makaretu River via a drain wetland on the southern bank under the Burnside Road Bridge. Under existing consent conditions there is no condition relating to the timing of discharge, implying that the current discharge has the potential to be continuous, so long as the maximum discharge volume does not exceed 216 m^3/day. With future conditions for a 100% river discharge, it is likely that this maximum discharge volume would need increasing, accommodating for frequent flow consent breaches under the current consent and community growth. Furthermore, the drain wetland would ideally require the clearing of weeds.

Current conditions relating to Takapau wastewater quality are for TSS and cBODs only, however depending on the new consent, additional treatment may be applied depending on specific conditions within this future consent or CHBDC aspirations.

An increasingly common practice for wastewater discharge to waterways is adopting a discharge rate that this is dependent on river flow conditions. Future considerations could be that discharge is limited to flows above a given threshold, such as median flow or 20th flow exceedance percentile (20FEP) when the river is high (due to storms/floods) and generally outside of summer and/or recreational periods.

6.2.2 Location and Design

CHBDC could consider discharging at another location along the Makaretu or outside of the river reach entirely. Discharging further downstream towards the Tukipo and Tukituki Rivers would be beneficial for increased dilution of wastewater. Downstream discharge would avoid potential wastewater interaction at the public access point at Burnside Bridge, however downstream are three more public access locations as the Tukipo and Tukituki Rivers come into closer proximity to the Waipukurau township. On top of this, downstream discharge, would require reticulation routes to be established, increasing project costs.

A discharge location upstream would not be appropriate due to further reduced flow of the Makaretu, thus reducing wastewater dilution. Furthermore, discharging upstream would seem counterintuitive as resources are already in place to discharge at Burnside Bridge, meaning costs would be required to discharge wastewater upstream, where wastewater would then flow directly past the current discharge site.

6.2.3 Values and Relevant Factors

Appendix B provides a summary of values and relevant associated with a river discharge regime for Takapau's wastewater discharge. It is suggested that the reader consults this appendix as part of this reporting package.

6.3 Land Discharge

6.3.1 Discharge Regime

There is a continuum of land discharge options:

- high rate rapid infiltration basin (RIB) system;
- deficit/non deficit based irrigation system with no river discharge;
- deficit/non deficit based irrigation system with a river discharge.

The discharge regime needs to match the ability for selected land areas to receive the volume and nutrient application rates without causing unintended land instability, plant cover failure, soil degradation, or groundwater contamination effects.

6.3.2 Location and Design

Location:

Potential application sites need to be in proximity to the community, minimising length and cost of reticulation and pumping from the WWTP to the Site. Whilst not essential, the Site should be at similar or lower elevation to the WWTPs, minimising pipeline pressures and pumping head requirements. Furthermore, the Site should be on landforms and soil types and under appropriate farm management having potential to receive wastewater, whilst not having significant limitations to achieving this.

Prior to nominating a discharge location, relevant policy documents relating to a Site should be identified as these may influence the consenting process through existing rules and regulations governing Site changes or activities. For the case of the Takapau, the main policy documents of concern are the Regional Resource Management Plan (RRMP), specifically Plan Change 6 (PC6) to this plan relating specifically to the Tukituki catchment. Each of these plans will govern rules and regulations for the nominated Site.

Within the Takapau area, several landowners have expressed interest in receiving wastewater, with these properties having their advantages/disadvantages. Engagement with a preferred landowner is underway to understand their property and farming system and to assess land suitability and owner perception to receive wastewater.

Design - Rapid Infiltration Basins (RIBs):
RIBs can be simple low pressure systems, requiring well drained soils, generally growing wetland plants or no plants at all. RIBs enable wastewater to be applied to land at high volumes facilitating soil drainage, by which nutrients move through the soil profile and become dispersed and diluted prior to entering groundwater. RIBs require minimal to no storage due to high discharge volumes and can be considered culturally acceptable due to the avoidance of a direct river discharge. Groundwater interaction may see the requirement for additional treatment.

Design – Deficit/Non-Deficit Irrigation:
In comparison to RIBs, wastewater can be applied at lower rates under deficit or non-deficit irrigation conditions. Deficit irrigation is where water is applied at rates to supply what is needed for plant growth. This minimises soil drainage, typically wetting the profile only to field capacity. Due to low application rates under a deficit irrigation scheme, storage volumes need to be high to capture all wastewater flows, preventing discharges to an alternative receiving environment. Furthermore, due to the need to minimise drainage, deficit systems require larger land areas than what is available to manage incoming flows, which can be expensive.

Non-deficit irrigation is similar to deficit however the difference is that non-deficit provides for small volumes of drainage per event through supplying water at a rate greater than what plants can use and essentially 'over-watering' of the soil profile. Due to this over-watering, non-deficit irrigation enables larger volumes of wastewater to be applied per event, reducing either storage requirements (if all flows are to land) or the volume discharging to an alternative receiving environment.

In contrast to deficit systems, non-deficit irrigation requires smaller land area to manage flows, with total land area required dependent on wastewater flow volume, soil types, storage and alternative discharge environments (i.e. river discharges).

For deficit/non-deficit irrigation, the design of the system can vary considerably and be customised aligning with owner aspirations and land management. Controls can be included to manage climatic conditions, soil moisture, application events and monitoring requirements. The discharge system can include large centre pivot or smaller travelling irrigators, fixed sprinklers to fenceposts or small moveable pods. Sub-surface dripper lines can also be installed. Reticulation to operate these systems can be permanent or temporary (using disconnection fittings) and be trenched underground or laid on the surface.

Combined Discharges:
A challenge with land treatment of wastewater revolves around the management of the system when soils cannot receive wastewater under deficit/non-deficit systems. This develops the requirement for storage to capture and hold wastewater flows until a period for when the soil can receive wastewater. Although storage provides a buffer to the system, there will be periods

where the soil cannot receive wastewater for agronomic benefit, and storage is at capacity. Constructing storage to capture all flows is typically not feasible due to cost which develops the need for a contingency discharge by which wastewater can either be discharged to a surface waterway or land passage under certain conditions, to relieve these flows than cannot be managed.

A common combined discharge regime is primarily land irrigation with a contingency discharge either directly to a surface water body or through a form of land passage. The land passage component enables high volumes of wastewater to be moved through/over the soil before reaching either surface or groundwater.

This regime develops the idea that the discharge may not necessarily be to a single receiving environment, but rather have the ability of discharging to multiple environments depending on climatic conditions, wastewater flows and system design.

6.3.3 Values and Relevant Factors

Appendix B provides a summary of values and relevant associated with a land discharge regime for Takapau's wastewater discharge. It is suggested that the reader consults this appendix as part of this reporting package.

6.4 Groundwater Discharge

6.4.1 Discharge Regime

Treated wastewater can be discharged continuously year round to groundwater through a deep bore injection depending on the assimilative capacity of groundwater, flow rate, and other groundwater users. There would not be any obvious advantages to limiting the timing of discharges because groundwater generally flows slowly and discharge pulses of wastewater would not provide any benefits.

6.4.2 Location and Design

Ideally, it is best practice to establish groundwater bore injection sites downstream of any groundwater users to reduce the risk of groundwater contamination affecting users. Due to Takapau being located reasonably inland/upland, it would be likely there would be users downstream abstracting the same groundwater resource. Bores may need to have sufficient distance from waterways and if a location cannot be downstream of other users or set back far enough from waterways, the discharge should look to be deep and vertically separated

This option can have a minimal environmental footprint and can take place year round. Furthermore, minimal storage maybe required is a continuous system can be used. It is likely that additional treatment before being injected into a groundwater aquifer.

6.4.3 Values and Relevant Factors

Appendix B provides a summary of values and relevant associated with a groundwater discharge regime for Takapau's wastewater discharge. It is suggested that the reader consults this appendix as part of this reporting package.

7 RETICULATION, TREATMENT AND STORAGE OPTIONS

7.1 General

Each component of the existing wastewater system has potential for changes to be considered. The integrated nature of existing and future system means any potential changes to each component must be considered for their reliance and effects upon the design and operation of the rest of the system. Flow rate is probably the most important parameter to ensure it's correctly factored into every component of the system. This is mostly controlled by the reticulation design and condition.

It is also important to have good understanding of the reasons why change is being considered for each component. This ensures that there is a benchmark or goal, against which the potential changes can be assessed to determine how effectively the change can assist with achieving it.

There is no sense in changing something at great expense if there's no need for it, or if it will conflict with another aspect of the integrated system, or if there's no measurable benefit resulting from the change. There may be strong reasons for maintaining the status quo for some aspects or components; these reasons need to be articulated and borne in mind when considering making changes to other parts of the system.

7.2 Wastewater Sources

An aspect of the wastewater system worth considering is what can be done to reduce or avoid the production of wastewater in the first place. For obvious reasons, it's impracticable to entirely avoid producing wastewater within an urban environment, so reduction of volumes and contaminants is the only feasible option. CHBDC has a public health duty to collect and treat wastewater for its urban communities, so a treated wastewater stream cannot be avoided and can only be reduced or controlled to a limited extent. The wastewater treatment system also needs to be capable of accommodating future population growth which can easily exceed reductions in volumes that might be generated by any wastewater minimisation measures. For Takapau, according to projected population and housing statistics, the community is expected to increase from 530 to 545 people by 2048 (Beca, 2020:T:C.10a). This population increase needs to be factored into decision making and the conceptual design for this consent application.

CHBDC currently have an operating wastewater bylaw where Section 2210.12 '*Waste Minimisation'* promotes the installation of dual flush toilet cisterns, low flow shower heads and urinal flushing controls for households and businesses. This bylaw aims to meet the principles of sustainable management to reduce the usage of water and therefore the generation of wastewater within everyday life where possible (CHBDC, 2018).

Furthermore, CHBDC currently have an operating trade waste bylaw by which a trade waste discharges are to be approved by CHBDC (CHBDC, 2018), and is currently working on updating their suite of 3 waters bylaw by June 2021.

7.3 Wastewater Reticulation

There is a gravity sewer reticulation network with the Takapau community. Wastewater reaches a common chamber from where it is pumped to the treatment plant.

As with all older communities, piping materials and construction can deteriorate and over time groundwater can enter (Ingress). Surface water can also enter the sewer network through

cracked piping and as a result of illegal connections at properties as owners seek to get rid of stormwater (Infiltration). Collectively this is known as I & I.

Most councils (including CHBDC) run sewer renewal programs where aged sewer pipes are repaired and replaced to reduce I & I. This is an ongoing process and one that is needed to manage flows to the treatment plant.

7.4 Wastewater Treatment

The receiving environment determines the discharge regime, with this determining the implemented treatment options. Treatment options considered for Takapau are introduced and described in Beca (2020:T:C.10a) and presented in Appendix B.

7.5 Wastewater Storage

The existing Takapau WWTP has a total surface area of 0.6 ha with no current storage capacity. A series of representative options considered for storage were:

1. Status quo;
2. Small (3 days - buffer); and
3. Large to very large (3 weeks - 3 months).

Storage volumes required are typically dependent on daily wastewater flows (and direct rainfall into the WWTP pond) and the criteria used to discharge to a given environment. Essentially, the type of discharge will govern the type and size of storage required.

Smaller storage volumes (less than about 8,000 m^3) can be accommodated within tanks, however larger volumes need to use lined ponds or dams.

Increasing storage volumes incur increasing costs of construction, but the costs per cubic metre become slightly cheaper for larger ponds due to efficiencies of scale. Regardless, the cost of storage is generally a significant factor in a wastewater management system and is often minimised to focus expenditure on treatment and discharge components.

8 OPTION EVALUATION AND SELECTION

8.1 General

There are a multitude of options for each component of the wastewater system with some of these being compatible with one another, whereas others are not. It is important to ensure that the selected option for each component forms an efficient and effective integrated system. All operating parameters and constraints need to work in harmony. The ultimate goal is to develop an integrated system that achieves the best balance of affordable wastewater management and greatest benefits with the least disadvantages.

8.2 Initial Options

For each component of the wastewater system, a series of options were considered in Section 6 to assess their advantages, disadvantages, and how well each option correlates with community priorities and aspirations. Options were also evaluated through their ability to be combined with one another as part of an integrated system. Assessed realistic options for each component of the wastewater cycle include:

- **Discharge System:**
  1. Status quo (River);
  2. Land;
  3. Groundwater; or
  4. Combination.

These options were all included within initial discussions with a Takapau community group (initial community meeting) to cover the full range of available receiving environments and discharge locations. Variations discussed included were:

- **Discharge**
  1. River – Status quo discharge regime;
  2. Land irrigation – non deficit;
  3. Land irrigation – deficit;
  4. Land irrigation – rapid infiltration basin;
  5. Deep bore injection

The continuation of the status quo river discharge could occur due to its reported low impact to the Makaretu River and minimal cost in comparison to other discharge options. Additional treatment options, combinations with land discharges and/or high flow discharges could all be incorporated to a river discharge regime, so long as the community and affected parties support a continuation of all or partial wastewater flows going to the river. It is considered that a river discharge of wastewater would be acceptable, so long as the discharge is shown to have very minimal impact to water quality with high confidence, and that other discharge environments have greater limitations with regards to environmental degradation and/or costs. In addition to this, if a river discharge were to occur, the community would desire additional treatment to address the community's cultural, recreational, and river water quality values. Having a large storage volume might make it practicable to impose river flow restrictions such as above median flow, however it is believed that having some form of land discharge system with a partial river discharge would be favoured by the community.

For combined land and river discharges it may be practicable to impose river flow controls on discharge timing such as above 20FEP. If this were the case, storage volumes, as well as the

area and drainage rate of irrigated land would need to match the implications of such river discharge restrictions. Care may be required to avoid overwhelming the river's assimilative capacity when large volumes need to be rapidly discharged to the river in short timeframes.

Land application of wastewater is preferred by the community as it places emphasis on passing wastewater through the soil profile where nutrients can be adsorbed to soil particles or up taken by plants. Although wastewater has the potential of leaching to groundwater depending on application rates and management, this is preferred by the community as wastewater is not being directly discharged to the river.

Land irrigation of wastewater can be through either a deficit or non-deficit system where irrigation rates are designed for pasture maintenance or growth, resulting in no to minor or minor to moderate drainage to groundwater, respectively. Both systems require a degree of storage, allowing wastewater to be applied to meet soil moisture conditions and plant requirements, however a deficit irrigation system will require more due to less water being applied per event to minimise drainage volumes.

Rapid infiltration was considered due to requiring a smaller storage volume than deficit/non-deficit systems, avoiding a direct discharge to surface water, and ensuring that all treated wastewater passes through the soil profile. This option has also be effectively implemented for other community's wastewater discharges so is considered an option here.

Deep bore injection was also considered due to its limited footprint, its ability to discharge year round and through large volumes per event, whilst preventing a direct river discharge.

- **Treatment**
  1. No changes;
  2. Pond Enhancements
  3. Activated Sludge Treatment or Fixed Film Process
  4. Tertiary Treatment
  5. Chemical Precipitation
  6. Disinfection

A minor treatment option is selected which incorporates both UV disinfection, as well as filtration of wastewater leaving the Takapau WWTP. These options are relatively easy to implement and will improve wastewater quality to the designated receiving environment. Although the effects to the Makaretu River from the existing discharge are considered less than minor, incorporating these treatment options will further improve wastewater quality, minimise risks to public health and align with community requests of additional treatment.

- **Storage**
  1. 2-3 days (current);
  2. 14 days (2 weeks); or
  3. 90 days (3 months)

The number of days storage will need to reflect the designated discharge regime. All storage volumes, regardless of the discharge regime will need to reflect future flows in response to population growth, as well as winter flows where flows are greater (summer flows will generally be lower and could be immediately discharged to land).

Depending on the discharge regime and consent conditions, the need for storage can vary. The existing Takapau aeration pond provides a relatively short retention time of 2-3 days. For a river discharge, this retention time is considered adequate due to the regular outflow from the plant,

limiting the need to store wastewater. Due to the Takapau WWTP experiencing regular consent breaches with regards to the 216 m^3/day discharge limit, an increase to either the discharge limit or storage pond volume may be required for a river discharge regime. Under a river discharge regime, the ability to store wastewater enables discharges to water to occur under particular flow conditions (i.e. > median flow), reducing environmental effects.

A 90-day storage pond would be suitable for discharge regimes utilising land application. Land application requiring a larger storage pond can be either a deficit or non-deficit system, with or without the incorporation of a river discharge. Having a non-deficit system will require smaller storage volumes than deficit systems, with the incorporation of a river discharge reducing the requirement further. Essentially the larger the storage pond, the larger the cost to construct, therefore storage pond size needs to closely reflect the desired discharge option.

8.3 Refined Options

Initial discharge, treatment and storage options identified above were outlined by technical advisors and CHBDC and presented to the Takapau community and affected parties. Here CHBDC invited feedback and engagement which aimed to understand the community's thoughts and aspirations which could be used to assess and reduce these options further. The purpose of these consultations were to eliminate options that were considered unrealistic or undesired by the community and to analyse and refine existing options. This consultation process was largely centred around the discharge regime as essentially this impacts the treatment and storage options. For each option that is disregarded, this has to be rationally justified for both why it was eliminated, as well as why other options remain up for consideration. Beca (2020:T:C.10a) narrowed down the initial discharge options to three varying options; river (DS1), land (DS2) and groundwater DS3). The land option included all varying land discharge regimes. These initial refined discharge options by the technical advisors and the community were as follows:

- River - Status quo river discharge (DS1)
- Land – Deficit irrigation with/without river discharge (DS2)
- Land – Non-deficit irrigation with/without river discharge (DS2)
- Land – Rapid infiltration basin (DS2)
- Groundwater – Deep bore injection (DS3)

Following consultation with the Takapau community, there is a strong desire to cease the sole wastewater discharge from the WWTP to the Makaretu River. Ideally the community wish that there is no discharge to the river whatsoever for the future consent, with a strong interest in applying this to land. Although unwanted, the community may support the continued discharge to the river under a combined scheme with land application. Under a land application regime, the community want an emphasis to apply wastewater to land as much as possible, and to only apply to the river under particular circumstances when there is limited storage capacity, or the river is above a particular flow statistic.

For a land application regime, it is likely that a river discharge component will be necessary to allow for discharge when soil conditions are not suitable for wastewater irrigation or when storage is near capacity. Without a river discharge, storage volumes under either a deficit or non-deficit system would be high to allow for continuous storage over periods where application is not available over extended periods of time. Allowing the discharge to the river allows for essentially a buffer to the system so that wastewater doesn't have to be unnecessarily applied to the land at excessive rates resulting in degradation to the land and vegetation due to storage ponds being at capacity and no other way of discharging the wastewater.

Between a deficit vs a non-deficit irrigation system, for Takapau, it is preferred that a non-deficit irrigation is used. A non-deficit system will allow for more wastewater to be applied over individual events, reducing the demand for a significantly sized storage pond. Although a storage pond will be required for a non-deficit system, this will be smaller than for a deficit system as more wastewater is applied per event, thus less is storage. For Takapau, having a smaller pond whilst also having a river discharge allows for a reduce in total costs, therefore making this affordable for the Takapau community and CHBDC.

9 LAND AVAILBILITY AND SELECTION

9.1 Land Availability

To cease wastewater discharges to the existing receiving environments and discharge this to an alternative land based environment, suitable and sufficient land area needs to be identified. Land closer to the WWTPs, does not necessarily mean that it is preferred, but rather land needs to have desirable characteristics for wastewater discharge. It is also preferred that land is at similar to lower elevation than the WWTPs, reducing pumping pressures.

Dependant on the discharge regime, selected land should have appropriate soil characteristics and land management to receive wastewater, without developing adverse environmental effects. For land discharges, the regime can be designed to suit a range of soil conditions and land management types. Factors such soil texture, soil structure, pans, stoniness, past and present land use, nutrient status, flood risk and erodibility can all heavily influence the discharge regime.

Ownership status is another component influencing land selection. For wastewater discharges, consent is sought for longer durations (35 years), thus CHBDC need to have confidence that the discharge land holding will be available for the consent duration. CHBDC can purchase land themselves for discharge, lease land, or enter into a secured long term access agreement with a landowner.

9.2 Land Selection

Once areas surrounding the WWTP are identified to receive wastewater, an individual site or a series of sites need to be identified where site assessments can occur to better understand soil characteristics and design effective discharge rates. Once land is identified, discussions with landowners can commence to understand their interests in receiving wastewater, as well as any information that may influence discharges to their land.

Desktop investigations to identify appropriate land within 10 km of the Takapau WWTP were undertaken which identified sufficient land area suited for wastewater application within a 10 km radius. Figure 9.1 provides a land suitability map showing the distribution of Zone A (green), through to Zone E (red) land for wastewater irrigation in this 10 km radius. Green represents land with no limitations for irrigation, with red representing severe limitations.

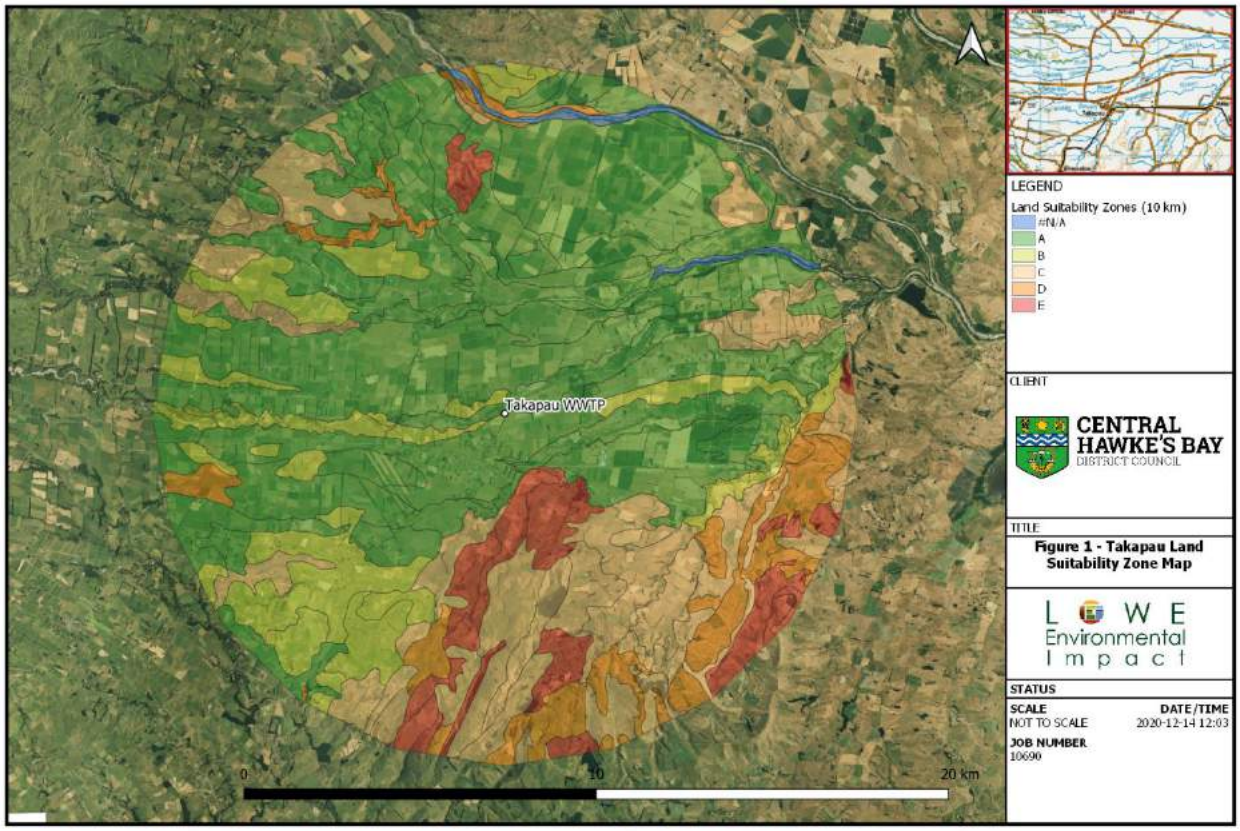

Figure 9.1: Land Suitability for Wastewater Irrigation

9.2.1 45 Burnside Road, Takapau

The property west of the TWWTP located at 45 Burnside Road contains suitable characteristics to receiving wastewater irrigation. Suitable characteristics include proximity to the TWWTP and good soil and land management conditions suiting a variety of discharge regimes. Additionally, correspondence with the landowner revealed a strong interest in receiving wastewater and working with CHBDC. Resulting from this engagement and the property having no clear limitations to receiving wastewater, it was selected as the proposed receiving environment. Other than this property, no investigations into alternative land receiving environments have been done due to this property considered the preferred.

The preferred property is a total of 42.4 ha, encompassing two parcels (one owned/one leased) located west of the TWWTP between SH2 and the Makaretu River. Site investigations were undertaken on the 8th and 9th of October 2020 to investigate site conditions and soil characteristics. Soils across the site are predominantly moderately to well-draining, with a small pocket of poorly draining silty material extending through the western parcel. There does not appear to be any limitations to the Site that cannot be effectively managed through the designed system. The Site spans two alluvial river terraces formed by the Makaretu River, with soils containing rounded river gravels, with these more prevalent on the lower terrace. Figure 9.2 Figure represents the site location of 45 Burnside Road, Takapau.

Figure 9.2: 45 Burnside Road, Takapau

10 BPO ASSESSMENT

10.1 BPO Aims

As noted in the BPO definition (Section 3.1), the BPO must use the most appropriate current technologies that provide the most benefits for the least impacts on the selected receiving environment and at an affordable cost for the Takapau community. Due to competing and often conflicting demands, the BPO is typically the best balance of the range of options and perspectives.

10.2 Treatment BPO

The wastewater treatment system is sufficient for a community the size of Takapau, with the current discharge considered to have less than minor effects to the Makaretu River. Due to this adequate level of wastewater treatment, only minor upgrades, if any upgrades are to be considered for the plant due to no regular clear and obvious issues with wastewater quality. Minor upgrades that could be incorporated to further improve wastewater quality are described within Beca (2020:T:C.10a).

Currently, the only notable issue with wastewater quality for Takapau is the occasional elevated suspended solids concentrations. This is not a frequent cause for concern however, CHBDC may wish to further improve the treatment system of the plant to specifically target these elevated concentrations.

Overall, minor treatment improvements to the existing Takapau WWTP is **considered to be the BPO**. These improvements are the incorporation of UV disinfection, as well as filtration of wastewater leaving the WWTP irrespective of the discharge regime. These options are relatively easy to implement and will improve wastewater quality to the designated receiving environment. Although the effects to the Makaretu River from the existing discharge are considered less than minor, incorporating these treatment options will further improve wastewater quality, minimise risks to public health and align with community requests of additional treatment. Further treatment upgrades are not ruled out and may be incorporated at later dates depending on whether there are changes to inflowing wastewater quality. In addition to this, particular land discharge opportunities may arise that may have specific treatment requirements, and these can be implemented over time as needed.

10.3 Discharge BPO

Despite having its advantages, discharge via deep bore injection was essentially eliminated due to the exceptionally high construction and ongoing costs required to install and maintain a groundwater injection bore. Costs are associated with the construction of the bore itself, as well as the high level of engineering works required to ensure that wastewater discharged, won't have any negative affects to the environment. In addition to this, treatment costs are very high due to wastewater essentially needing to be potable prior to discharge, due to other users tapping into the same aquifer for various uses. For a small community of Takapau, this option appeared to be unjustified and was therefore disregarded.

A rapid infiltration basin was also eliminated due to the desire of wanting the wastewater beneficially reused, rather than flooding it to a small area where it leaches to groundwater. Due to the Central Hawke's Bay region regularly suffering droughts, the community wanted wastewater to be applied to the land to increase pasture growth and land productivity, rather than simply having this resource be lost under an infiltration basin system. Furthermore, the

community did not like the idea of having high quantities of wastewater be directly discharged to groundwater due to social and aesthetic reasons. Therefore, this option is **not** a component of the BPO.

The existing discharge regime of a sole river discharge was not supported by the Takapau community due to conflict with cultural, social, environmental and recreational values. Despite being discharged via small wetland, the community did not feel that this was adequate for a land passage to the river and therefore want discharge to the river to cease. Despite the potential for additional treatment to further improve wastewater quality at the outlet, the community would rather see the wastewater applied to a different receiving environment. Therefore, a status quo continuous discharge of wastewater to the Makaretu River is **not** considered to be the discharge BPO.

The ideal receiving environment from both an environmental as well as a social perspective is to irrigate Takapau's wastewater to land. Irrigation to land will allow the nutrients within wastewater to be beneficially reused to maximise plant uptake and improve soil fertility, reducing the requirement for both freshwater irrigation, as well as fertiliser usage. This land application of wastewater essentially closes the wastewater loop where nutrients once derived from the land area able to beneficially be returned. For the Takapau region, a non-deficit irrigation system is desired due to the ability of being able to apply greater quantities of wastewater per event, reducing the storage requirement in comparison to a deficit system. Although more wastewater is to be applied per event for a non-deficit system, this isn't expected to result in adverse effects to the soil due their predominantly well drained nature across the surrounding land. The main issue regarding a non-deficit irrigation system is around wastewater discharge when soil conditions are not suitable for irrigation and when the storage pond is at capacity. As a result of this, a non-deficit irrigation system **on its own** is **not** the BPO. However, this option remains the idealistic aspiration for the long-term future.

It is accepted that the discharge BPO from the Takapau WWTP must include a contingency discharge to the Makaretu River, at least in some form for the foreseeable future. As mentioned, the purpose of the river discharge is to protect the system when soil conditions are not suitable for application and when the storage pond is at capacity. In future the irrigable area could be expanded and optimisation of storage management may reduce and is likely to result in the ceasing of discharges to the river entirely. Additionally, the direct river discharge is likely to occur only when the river is in flood, where unless this is the case, wastewater will irrigated to the lower terrace facilitating drainage to the river when soils cannot receive wastewater and storage is at capacity. Additionally, should a direct river discharge occur, the existing discharge location could be remediated to improve the existing character of the discharge location and incorporate a land passage type regime. **The discharge BPO for the Takapau WWTP is a non-deficit land irrigation of wastewater, with a contingency discharge to the Makaretu River when soil conditions are not suitable for irrigation and/or storage is at capacity and the river is in flood.**

Under a non-deficit irrigation system, a new storage pond will be required. This is to enable wastewater from the plant to be stored for a short time period before being discharged to land via irrigation. In addition to this, the storage pond needs to have the ability of being able to store wastewater for potentially longer periods of time if soil conditions are not suitable for irrigation to occur. Therefore, the storage pond needs to be of a designated size to accommodate regular wastewater flows under a scenario when wastewater is able to be applied to land regularly, but also it needs to have a buffering volume for when land irrigation cannot occur. It is proposed that a storage pond for Takapau will need to be in the range of between 5,000 – 17,000 m^3, depending on when irrigation to land can occur and when wastewater can be discharged to the Makaretu River.

11 CONCLUSIONS

A comprehensive BPO selection process has been undertaken by CHBDC involving environmental advisors, affected parties (landowners and iwi) and the Takapau community. Community consultation aimed to understand the concerns, aspirations, and potential design constraints from interested parties to assess discharge and treatment options. For each component of the wastewater system, a series of options have been considered, where these were narrowed down through community engagement and technical advice and refined in conformance with BPO principles to arrive at a BPO.

For the discharge of Takapau's wastewater, the BPO is the discharge of wastewater to land under a non-deficit irrigation system, whilst maintaining a discharge to the Makaretu River when soil conditions cannot receive wastewater and storage is at capacity. Additional treatment to the TWWTP has not been included due to the adequate condition of the existing treatment system. CHBDC may incorporate further treatment such as filtration and/or aeration infrastructure to further improve wastewater quality. The Site where land application will occur is 45 Burnside Road, Takapau.

The respective aspects of the BPO include:

- a wastewater discharge to land under non-deficit irrigation, with a contingency discharge to the Makaretu River when soil cannot receive wastewater and storage is at capacity;
- construction of a storage pond between 5,000 – 17,000 m^3 depending on the consented discharge regime and river discharge availability;
- minor additional treatment to the current treatment system such as UV disinfection and filtration improving water quality; and
- the preferred discharge Site is 45 Burnside Road, Takapau.

Each of these aspects are believed to be the BPO for Takapau's wastewater system because:

- all components of the BPO have been selected in order to function effectively as an integrated wastewater management and discharge system;
- the implementation of a combined land and river discharge regime is affordable to the Takapau community in comparison to other initial discharge options;
- a significant portion of wastewater flows are to be applied to land instead of the river, inline with community aspirations of reducing the river discharge component;
- wastewater is able to be beneficially returned to the land to increase pasture productivity rather than wasted under a river discharge, rapid infiltration basin or deep bore injection system;
- environmental impacts are expected to be reduced as wastewater can be filtered through the soil, prior to reaching groundwater, reducing the risks of nitrogen leaching or contamination of waterways. Wastewater aims to supplement existing fertiliser usage, resulting in a reduction of synthetically applied fertiliser;
- a non-deficit system enables higher volumes of wastewater to be applied to land than a deficit system, reducing the necessity for larger storage volumes and management issues for applying wastewater effectively;
- the Takapau WWTP is considered to already have adequate treatment infrastructure for the community's size, meaning further treatment is not strictly essential although may be desired;
- the BPO system has the ability of accommodating for future flows in response to projected population growth for Takapau;
- each aspect of the BPO provides a cost effective and efficient use of CHBDC's finances to manage the community's wastewater while protecting and enhancing environmental aspects; and

- the nominated discharge site is as close as possible to the TWWTP and is considered to be the best possible discharge site for the nominated discharge regime with regards to proximity, landowner interest and site conditions.

The BPO described within this report can form the foundation for refining the details of the design, operation, and implementation timing of each aspect of the treatment, storage, and discharge systems. Many of these details are intended to be developed and described in the Conceptual Design report. The BPO needed to be developed and confirmed to provide certainty of the key aspects of the future systems before such a conceptual design process could commence.

The future resource consent application documents will rely upon the conceptual design details for assessing its likely effects on the environment and developing appropriate resource consent conditions. The consent application will also rely upon this BPO report to satisfy the RMA requirement that a nominated discharge is the BPO for the system and its locality.

12 REFERENCES

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13 APPENDICES

Appendix A – Community Consultation Summary (LEI, 2020:T:C.34)
Appendix B – Receiving Environment & Treatment Considerations

APPENDIX A

Community Consultation Summary
LEI (2020:T:C.34)

MEMORANDUM **Job 10690**

To:	Darren de Klerk (Central Hawke's Bay District Council)
From:	Sam Morris (Lowe Environmental Impact)
Date:	14th September 2020
Subject:	T:C.34 - Takapau Community Consultation Summary

This memo summarises the community engagement undertaken by Central Hawke's Bay District Council ("CHBDC") for a pending consent application that is intended to replace the discharge of Takapau wastewater to the Makaretu River, expiring within 2021.

It is intended that community consultation as it relates to both the existing and future consents informs the Best Practicable Option ("BPO") decision. This memo is to be used as an appendix to supplement the Takapau BPO report and ultimately a consent application.

BACKGROUND

Central Hawke's Bay District Council currently manages and operates the Takapau Wastewater Treatment Plant ("TWWTP") serving the Takapau community. CHBDC hold resource consent for discharge of treated wastewater from the TWWTP to the Makaretu River, a tributary of the Tukituki River.

The original consent for the TWWTP expired on the 30th of May 2018, however Hawke's Bay Regional Council ("HBRC") granted a short-term three year consent extension on the 10th of December 2018, expiring on the 31st of October 2021. Condition 22 of this consent extension states that investigations into alternative treatment options, including an assessment of the feasibility of a land application of wastewater must be conducted, with a report submitted prior to the 30th of April 2021. With the potential for a future land application for Takapau's wastewater, CHBDC need to undertake community consultation, to gauge community interest and/or acceptance for this alternative and collectively agree that this is to be the BPO moving forward.

HISTORIC APPROACH

This section gives a brief overview of the community engagement process undertaken by CHBDC for the three year extension of the existing discharge consent for the Takapau WWTP. Further in depth information relating to this consultation undertaken by CHBDC for the granting of this consent is provided within Tonks (2018)[1].

For this consent extension, consultation was carried out with Tamatea Taiwhenua (Te Taiwhenua o Tamatea), an incorporated society representing the nine local maraes within the CHB region, neighbouring landowners, as well as members of the Takapau and wider rural community downstream of the discharge site.

[1] Tonks, M. (2018). *Takapau Wastewater Treatment Plant: Re-consenting.* Mitchell Daysh Limited

Community consultation was done through a flyer-drop to all houses within the Takapau township and downstream properties within the rural catchment area. This flyer explained the desire of CHBDC to examine alternative wastewater treatment and discharge options for the Takapau WWTP, alongside the need to apply for a three year consent extension to better develop and investigate these potential options and undertake further engagement with the Takapau community. This flyer-drop engagement invited submissions and feedback on the proposal which was received through 29 public submissions, 26 agreed/3 disagreed for the extension of the consent to investigating further discharge options.

Consultation by CHBDC was carried out with Tamatea Taiwhenua to gauge their level of support for CHBDC's plans for the rollover of the existing consent, and longer term desire to apply wastewater to land over a river discharge to the Makaretu.

Direct consultation was also undertaken with neighbouring landowners to the WWTP where CHBDC advised these respective parties of their intentions moving forward with regards to the consent and changing of the discharge regime.

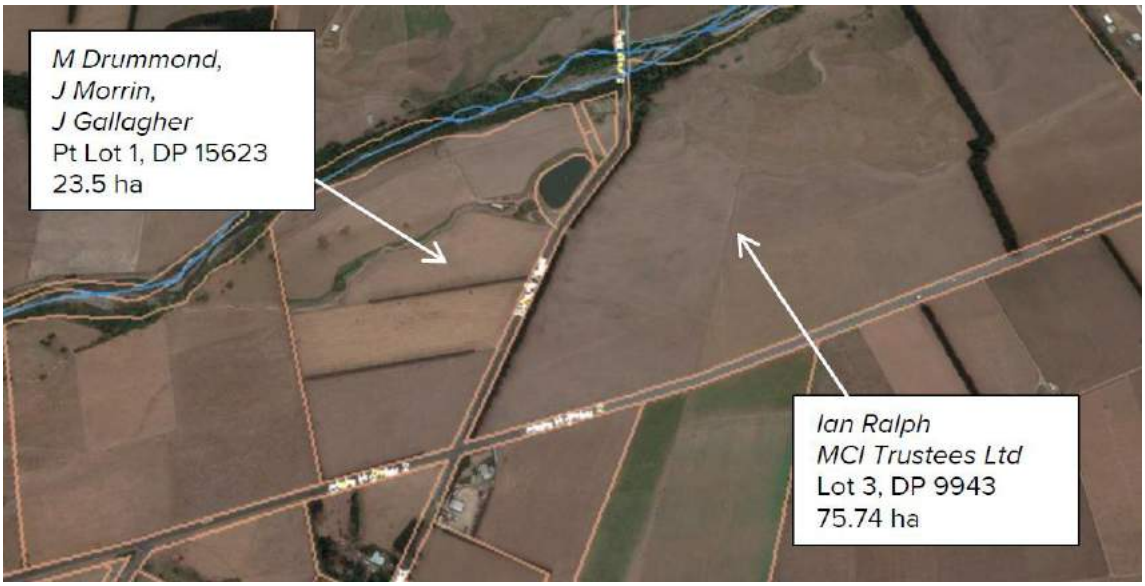
CURRENT APPROACH

This section gives an overview of the community consultation undertaken to date by CHBDC for the proposed land application of Takapau wastewater requiring a new consent, being the existing consent that expires on the 31st of October 2021.

To date, there have been two community meetings with the Takapau community and key stakeholders regarding the reconsenting for the treatment and discharge of Takapau wastewater. Engagement between CHBDC and the Takapau community began in December 2019, with the first consultation being on the 17th of December 2019, at the Takapau Community Hall. This meeting, run by CHBDC, with support from Lowe Environmental Impact ("LEI") and Beca Limited ("Beca"), aimed to provide an overview of CHBDC's intentions for the reconsenting of the TWWTP. A brief education/overview was also provided with the intention to increase knowledge of wastewater management practices. Information was gleaned to be incorporated and considered when determining the BPO decision.

Following this initial meeting, the main feedback received was the desire to cease the discharge of Takapau wastewater to the Makaretu River, and ideally, if possible, apply this to land. The community wanted to see progress by the council and to keep them informed of any developments affecting the project. They also wanted to see discussions with key landowners to commence regarding their potential interest in receiving Takapau's wastewater, as well as an analysis behind the affordability of the project for the Takapau people.

Regular consultation between CHBDC and LEI with neighbouring landowners to the WWTP is underway to understand and discuss their interest in receiving Takapau's wastewater. These landowners are the Drummond's to the west of the plant on the corner of Burnside Road and SH2, and Ian Ellis to the east of the plant and Burnside Road (Figure 1). Engagement with these respective landowners has occurred through both a series of lengthy phone calls, as well as multiple in person discussions.



Retrieved from Tonks (2018)

Figure 1: Landowners surrounding the Takapau WWTP

The second community meeting took place on the 27th of July 2020 at the Takapau Community Hall. Later than planned due to the COVID-19 pandemic resulting in an earlier meeting planned for March 2020 having to be cancelled. As with the first meeting, this was attended by HBRC, LEI and Beca representatives. This consultation essentially followed on from the initial engagement, where a series of three discharging options were proposed to the community to evaluate and receive feedback for. These options were a year round 100% land application of wastewater, a year round land application of wastewater with the ability of discharging to the Makaretu River when soil conditions are not suitable, and a higher rate 100% land discharge.

The overall feedback from this second meeting was again the preference and support of a land application of wastewater, with ideally no discharge to the Makaretu. The Takapau community asked a series of questions regarding the specifics of the TWWTP and overall project, which were all answered. It was noted that due to the population of Takapau, engagement with the community appears to be relatively close-knitted, a positive when consultation and co-operation, with and within the community is important.

Council also undertook a Long Term Plan pre engagement round in August 2020, this involved presenting the options shortlisted to the community to further inform the Long Term Plan engagement in 2021. The method of engagement was predominantly digital with Council utilising an online engagement tool 'social pinpoint' to explain the project and options and gather feedback. This event allowed Council to further inform and refine the project options leading into Long Term Plan 2021 and ultimately consenting.

NEXT STEPS

- Decision on a preferred option
- Get Cultural Impact Assessment underway
- Apply for resource consents
- What info and what level of communication/discussion is needed moving forward?
- Next "touch-point" with the community

Should you have any queries, comments or require further information please do not hesitate to get in contact with Hamish Lowe.

Yours sincerely,

Lowe Environmental Impact

Sam Morris
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APPENDIX B

Receiving Environment & Treatment Considerations

MEMORANDUM **Job 10690**

To:	Darren de Klerk (Central Hawke's Bay District Council)
From:	Sam Morris (Lowe Environmental Impact)
Date:	11th November 2020
Subject:	Appendix B – Receiving Environment & Treatment Considerations

This memo provides a summary of alternative receiving environments for wastewater discharge and outlines values and relevant factors of each that should be considered as part of the BPO selection process. Additionally, it outlines potential treatment options that should be considered for wastewater discharge. It is intended that this memo supplements the Takapau Best Practicable Option (BPO) report (LEI, 2020:T:C.12).

RECEIVING ENVIRONMENT OPTIONS

There are alternative receiving environments to the existing river receiving environment which CHBDC needs to consider as part of any concept development process involving BPO principles. These alternative environments would include the land and groundwater. For completeness however, we also note:

- The discharge of wastewater to ocean environments is an option that is often considered and can be implemented for many coastal communities. This discharging option involves treating wastewater on land at a WWTP, piping treated wastewater to the coast and then discharging to the ocean environment. This option could potentially be viable and analysed under more scrutiny if Takapau was located closer to the coast. The nearest distance to the coastline from Takapau is the community of Te Paerahi at the Porangahau River mouth. Here, Takapau is located approximately 40 km from the coastline as the crow flies and 59 km via roading. The cost of discharging to ocean is already reasonably expensive if the community is located at the coast, therefore adding additional costs to either construct a pipeline from Takapau to the coast or regularly transporting wastewater via trucks, makes this option largely not feasible.

The potentially available and practicable alternative receiving environments for Takapau are land application, and groundwater. Any preferred discharge site needs to be within a reasonable distance of the Takapau WWTP in order to keep pipeline costs from the WWTP to the discharge site within affordable limits. A distance of 10 km is typically considered to be the upper limit for distance from Takapau, and somewhere less than 5 km is ideal.

The feasibility of each for receiving discharges are described below. It is noted that an integrated discharge system could develop and use more than one discharge site and more than one type of receiving environment. This would provide greater flexibility of management and the ability to match discharge events to the most appropriate environmental conditions, times and seasons for each discharge site. Such systems can provide complementary discharge options where one environment can accommodate the discharge during some or all of the time that another environment can't receive it. Storage capacity and discharge criteria would need to be balanced and optimised for such integrated multi-discharge systems.

Land

Discharge to surface water bodies has always been and is still considered to be the easiest option when discharging wastewater, however, land application and the beneficial recycling of nutrients is considered to be an excellent alternative. Wastewater can be applied to the land surface at varying rates depending on the application method (rapid infiltration vs slow rate), alongside soil characteristics and climate. Furthermore, depending on the application method, the total required land area for irrigation, alongside storage can vary considerably. Land application enables nutrients present within wastewater to supplement plant requirements and/or bind to soil particles, essentially closing the loop of the wastewater system. Wastewater can essentially be a substitute for both fertiliser usage, as well as fresh water irrigation.

Due to differing application methods, wastewater can be applied to land of varying area and land uses. Urban parks and reserves have the ability of receiving treated wastewater, however other urban land areas are typically too small and surrounded by sensitive residential or commercial properties. Directly eastward of the community is the Takapau Golf Course, another area of flat land where there could be potential for wastewater to be applied. With Takapau being a small rural community and the WWTP being located on the periphery of this, the volume of land where wastewater could be applied is extensive.

The Takapau township itself is surrounded by both the Takapau and Ruataniwha Plains. These vast expanses of flat, alluvial soils are ideal for farmland, particularly sheep and/or beef as well as dairy, thus the total land area covered by pasture is extensive. Dissecting these plains are a series of river and stream networks (Makaretu, Tukipo, Waipawa), which all converge forming the Tukituki River and its catchment.

Groundwater

Groundwater can receive wastewater either through drainage (from irrigation or soakage), or through direct ground bore injection. Takapau and the surrounding Takapau Plains are located predominantly within the Ruataniwha aquifer system, an extensive aquifer comprised of a relatively shallow, unconfined aquifer and several deeper confined aquifers which are recharged within the Ruahine Ranges. Groundwater recharge generally occurs through rainfall within the Ruahine Ranges, however, some degree of recharge can indirectly come from the Waipawa and Tukituki Rivers. The depth to groundwater within the shallowest unconfined aquifer is typically <15 metres. Typical water uses of these aquifers surrounding Takapau consist predominantly of farmers for irrigation, small communities, as well as a few commercial plants such as a freezing works and limeworks quarry.

DISCHARGE METHODS AND CONSIDERATIONS

- **River Discharge - Values and Relevant Factors**

Key concerns with surface water discharges relate to cultural and public health values. Strong emphasis is placed by local iwi and the Takapau community, to cease discharge of wastewater into the Makaretu. Although undesired, discharge to the Makaretu may be allowed, so long as the wastewater is highly treated that it is considered potable and has percolated through soil and plants first. This degree of treatment would require substantial additional costs.

Public health concerns surrounding river discharges are mainly around the presence of pathogens within wastewater infecting individuals during contact recreation. Despite the Makaretu generally being within the A attribute state (blue) for *E. coli* concentrations, there are occasional increases in concentrations that would be of risk to public health. In theory, the greater the treatment to managing bacteria concentrations, the reduced risk of Takapau wastewater infecting individuals within the Makaretu.

Public health concerns also consider pathogens potentially infecting people through fish consumption. District Health Boards and medical records indicate there is no known evidence of illness (linking to wastewater discharge) from the consumption of kaimoana gathered from the locality of the wastewater discharge. Although there is minimal retrieval of fish from the Makaretu due to its proximity from the coast, this reinforces the low risk of infection through fish consumption within the vicinity of the discharge site.

Restricting river discharges during summertime and/or flow conditions could ensure risks to public health and recreational contact are reduced from current risks. Introducing disinfection treatment would eliminate these risks. To achieve compliance with discharge restrictions, wastewater may need to be stored and probably discharged to another environment.

If land discharges form that "other discharge environment" then it will ideally be suited to receiving discharges during summer and minimise the volume of any storage required. If no alternative discharge is developed, the volume and cost of storage required to prevent low river flow discharges would be enormous. This is primarily due to the Central Hawke's Bay region experiencing regular extended drought periods over summer months meaning storage of wastewater during low flows will likely need to occur for extensive time periods. It would also force subsequent river discharges to occur in larger volumes over shorter durations when river flows are higher, and this consequently may cause greater adverse effects at those times than the existing discharge regime. The capacity of the discharge pipeline may also need increasing to enable such large volumes to be rapidly discharged when the river is flowing fast enough to allow this discharge to occur.

The river discharge needs to consider recreational and scenic values, particularly during summer when there is an increase in public river use.

There are financial implications from each of the treatment, storage, and discharge location and management options which CHBDC and the community will need to factor into their decision making process.

- **Land Discharge - Values and Relevant Factors**

In comparison with a river discharge, applications of wastewater to land are typically perceived as being the preferred option from both an iwi and community perspective. Land is typically the preferred discharge environment for cultural, public health, social/recreational and environmental reasons so long as the discharge does not adversely affect soils, plants, grazing animals, groundwater, or downstream surface water.

Despite typically being perceived as the preferred option for the discharge of wastewater over river discharges, care and appropriate management of the land application system is still essential. Just because land application is preferred and appears more environmentally friendly, doesn't mean that it is immune to failure. Therefore, careful management regarding irrigation application rates, timing and duration, alongside investigations into soil characteristics and wastewater quality is essential to minimise risks of adverse environmental effects.

The financial implications of irrigation can be enormous. The costs mainly reflect the lengths of pipeline infrastructure, changes (increases) in elevation of terrain which determine pumping costs, and the size of storage ponds. If farmers do not wish to allow wastewater irrigation on their land, CHBDC could consider purchasing suitable farms themselves instead of leasing, but again, this would have greater costs and farm management implications for CHBDC.

- **Groundwater Discharge - Values and Relevant Factors**

Groundwater generally has value when it recharges streams and rivers or is abstracted for uses such as drinking water (particularly valuable for human drinking water) or irrigation.

Discharges to groundwater can elevate contaminant concentrations and raise groundwater levels (mounding) near the discharge site. Mounding can redirect natural groundwater flow direction too.

Cultural values may also be compromised if contaminants were found to be entering the groundwater.

There are no recreational values associated with groundwater, but there is a social value of expecting the groundwater resource to be maintained with high purity and available for use wherever people need to access it.

Financially, the cost of implementing a groundwater injection system is expensive, primarily due to the typically high level of treatment and engineering that is required to treat and inject the wastewater respectively.

TREATMENT OPTIONS

The general treatment options for Takapau's wastewater to consider which have been introduced and described within Beca (2020:T:C.10a) are:

Pond Enhancements

Pond enhancements are as the name suggests, enhancements to the pond to improve wastewater quality. For Takapau, this can be done through upgrading the existing aeration and mixing capacity of the pond or considering a tertiary add on such as a UV unit to disinfect the wastewater. These enhancements come in a range of variations with certain enhancements specifically targeting wastewater parameters depending on the situation and desired outcome. Due to the Takapau WWTP having notable issues regarding TSS, there are pond enhancement options aiming to specifically improve this. Pond enhancements come in many shapes and forms and can be specialised depending on the issue and designed outcome. Described enhancements here are a couple of many modifications that can be made to the WWTP with remaining options underlined within Beca (2020:T:C.10a).

Activated Sludge Treatment or Fixed Film Process

Activated sludge is a common form of wastewater treatment, specifically targeting TSS, BOD, TN and P through the use of aeration and a biological floc composed of bacteria and protozoa. Oxygen can be incorporated into wastewater through the use of an aerator, where wastewater flows into a settling tank (final clarifier), allowing biological sludge to settle, thus removing this from wastewater. This process aims to either, oxidise carbonaceous biological matter or nitrogenous matter (mainly ammonium and nitrogen within biological matter) or to simply remove nutrients such as N or P. Activated sludge treatments can further be classified into membrane bioreactors (MBR) or sequenced batch reactors (SBR). These mechanisms have slight variations as to how they remove sludge from wastewater.

Using the same bacteria and protozoa as with activated sludge, a fixed film process utilises a biofilm attached to a media (wood, plastic, rock or another natural or synthetic material) within a tank supporting biomass on its surface and within the material to treat wastewater. Examples of these processes include a submerged aerated filter, trickling filter or a rotating biological contactor.

Tertiary Treatment

As with pond enhancements tertiary treatment of wastewater also comes in a range of forms whether this be as a membrane filter, clarification, tertiary wetlands or filtration. Each of these methods of treatment aim to target specific characteristics of wastewater, improving its quality to varying degrees depending on the option, and therefore its potential usage.

Chemical Precipitation

Chemical precipitation can specifically target P concentrations within wastewater, a nutrient with typically negative adverse environmental effects. This form of treatment can use one of three chemicals; aluminium salts (primarily alum), iron salts (primarily ferric chloride) or hydrated lime (calcium hydroxide). Either of these chemicals can be incorporated into wastewater which can bind phosphorus molecules where through a process of coagulation, can subsequently be removed by a solids separation process.

Worm Farm

This option is essentially a packed bed reactor by which timber shavings are used as a medium. The shavings layer is populated with worms and micro flora. Effluent is applied to the surface where it moves through the system and accumulates within the drainage layer and discharged. With time, a layer of worm humus is formed where worms keep the bed in good condition through the movement of material and aeration of the bed through borrowing tunnels.

Disinfection

Disinfection is the process by which specific pathogens are targeted and deactivated, improving water quality, typically through UV light. Effective UV disinfection relies upon light being able to pass through the water to reach microorganisms which can typically be prevented through either high suspended solid concentrations or light being absorbed by contaminants. For Takapau, this treatment option ranges between moderate to very good effectiveness, meaning if suspended solids can be managed, UV disinfection has the potential to dramatically improve water quality within the WWTP for pathogens.

If you have any questions, please do not hesitate to get in contact.

Yours sincerely,

Lowe Environmental Impact

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