INVIGORATING INTERURBAN INDUSTRY

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ABSTRACT (300 WORDS MAXIMUM)

Kerepehi is a rural township located in the Hauraki Plains, 20km northeast of Paeroa. Once a thriving industrial hub, several large factories were based in the town, including NZ Cooperative Dairy Company (now Fonterra) who operated one of the largest milk powder factories in the southern hemisphere. The dairy plant eventually shutdown, and with other industries leaving and the population fell to new lows by mid-2000's.

Sitting almost perfectly in the centre of the Auckland-Hamilton-Tauranga golden triangle, Hauraki District Council identified the opportunity to re-establish Kerepehi as an industrial hub. After upgrading water supply infrastructure in 2012 several industries began to voice their interest in the township. However, the wastewater treatment plant was still a constraining factor to any development.

The Council owned wastewater treatment plant is a pond-based system, constructed in the 1960's. It underwent minor upgrades in 2011 with the installation of floating wetlands. Although oversized for the now decreased population base, it operates well consistently meeting its consented limits.

A number of wet industries have expressed interest in locating to Kerepehi. However, these typically produce significantly higher waste streams when compared to domestic waste. To enable Council to invigorate interurban industry, they needed to upgrade the treatment plant to ensure sufficient capacity for any increased load.

Any upgrades needed to be cost effective, since there was still no guarantee that any of the industrial growth would occur. This meant that it was essential to determine an upgrade pathway that would stage capital expenditure and ensure the affordability of the project.

This paper will discuss the process undertaken to develop a cost effective and forward planned upgrade strategy that would allow for a positive financial and social impact. It will present details of upgrades (currently in the final stages of commissioning at both the Council plant and the industry site), and how these maximized the use of existing infrastructure and discuss the challenges that this posed.

KEYWORDS

Pathway, optimum, reuse, assets, upgrades, wastewater, oxidation, ponds, industrial, job, growth, rural, economic, social.

PRESENTER PROFILE

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1 INTRODUCTION

Kerepehi is a small rural township located in the Hauraki District, located on State Highway 2 between Ngatea and Paeroa. The Hauraki District is a relatively small territorial area, covering an area of 1,269 square kilometres. The district is centrally located in the North Island with Auckland, Hamilton and Tauranga all within a two hour drive.

Figure 1: Kerepehi Location

Kerepehi was once a thriving industrial hub with several large factories based in the town, including NZ Cooperative Dairy Company (now Fonterra). By the mid 2000's most of the industry had left town (including the dairy company) and the population fell to new lows. At the last census, the population of Kerepehi was only 429.

Hauraki District Council wanted to drive growth in the area. While the township of Kerepehi had low population growth, it had a number of unique characteristics that made development of the industry in the township a viable option.

2 OPPORTUNITY FOR DEVELOPMENT

Hauraki District Council identified Kerepehi as having the ability to redevelop and rejuvenate the industry, due to the location, availability of land and council willingness to develop. Hauraki District Council began work on enabling this potential development to occur through collaboration and liaison with industry and undertaking enabling infrastructure upgrades.

2.1 LOCATION

Kerepehi is located in the upper north island in the centre of the "golden triangle". The golden triangle is an area that is centrally located between the proposed inland port at Hamilton (Ruakura), Ports of Tauranga and Ports of Auckland. This central location between the three ports provides good location for any industry that intends to export its product internationally, domestically or both.

The rural location of Kerepehi is close to a number of horticultural and agricultural (typically dairy cows) activities that naturally leads itself to being an ideal location for a potential food processing industry to start up.

2.2 AVAILABLE LAND

Kerepehi is well placed with available land for industrial development. In addition to a number of existing available lots, a new subdivision adjacent to the historical industrial area was selected as an appropriate site for development. Figure 2 below presents the location of the two industrial development areas relative the existing wastewater treatment plant.

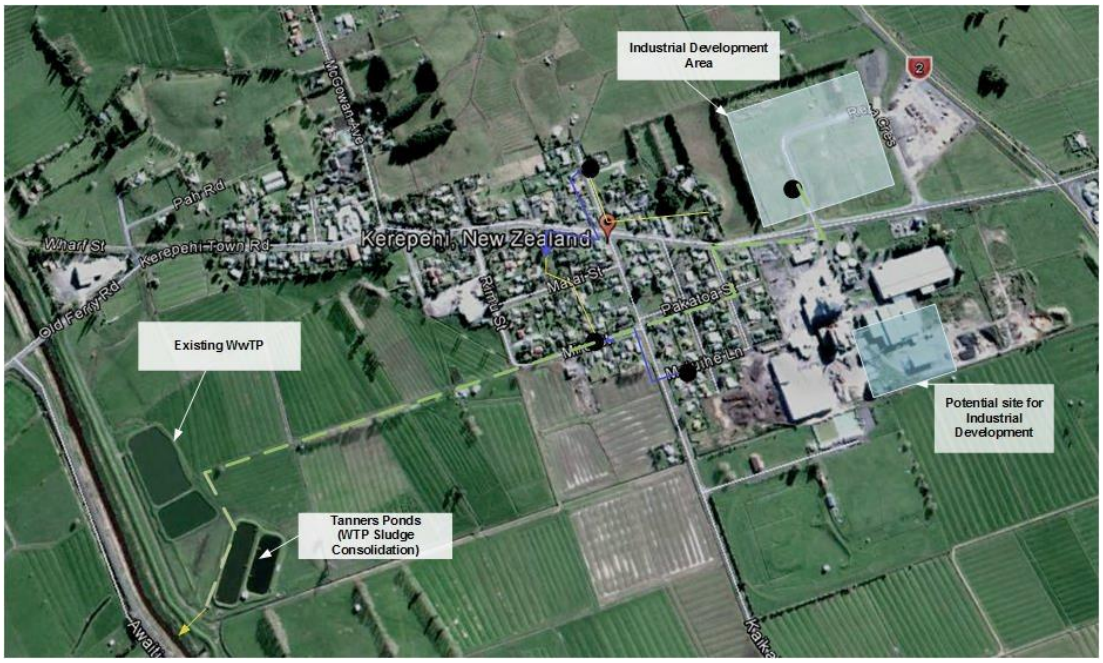

Figure 2: *Potential Industrial Development Locations*

2.3 COUNCIL DEVELOPMENT SUPPORT

Hauraki District Council had recognized the potential for development and growth, and sought to undertake the processes to support that. In 2012, they went out to the local community in the area about potential rejuvenation options, and the decision was made to focus on industrial development in the area.

Hauraki District Council undertook to seek out potential industrial development opportunities and created a promotional marketing campaign that included material on YouTube. While undertaking the promotional work, they recognised that they would need supporting infrastructure to enable the industrial growth.

Provision of infrastructure within the Council's control related to the provision of water supply and wastewater treatment.

3 SUPPORTING INFRASTRUCTURE

3.1 WATER SUPPLY

A local water treatment plant services the Kerepehi community, this sources water from the Waihou River. The plant was originally constructed in the 1960's, consisting of coagulation followed by two blanket clarifiers and two sand filters. In the late 1990's one of the blanket clarifiers was converted into an absorber clarifier. This clarifier worked well when the raw water turbidity was below 20 NTU. However, it struggled with higher turbidities, and resulted in a state of perpetual backwash leading to a heavy restriction on water production and required intensive operator input to keep the plant running. The capacity of the plant was limited to approximately 6 mega litres per day (Mld).

Realising that this would need to be rectified to enable growth, Hauraki District Council undertook work to:

- Increase capacity to 12.5Mld and improve the reliability and robustness;
- Make the plant more resistant to high turbidity events; and
- Achieve compliance with the Drinking Water Standards New Zealand 2005 (revised 2008).

The upgrade converted the blanket clarifiers to tube settler clarifiers and installed membrane filtration and UV plant. The plant upgrades were successful, allowing the plant to be pushed to 15Mld. The plant has become key infrastructure in the region, supporting the local dairy industry, Kerepehi community and industry in the area.

3.2 WASTEWATER TREATMENT

Hauraki Plains Council commissioned the Kerepehi Wastewater Treatment Plant in 1976 by the Hauraki Plains Council for a design population of 750 people. The existing treatment plant consisted of an oxidation pond and a facultative maturation pond. A floating wetland was installed in 2011.

While this infrastructure was adequate for the domestic community, there was little capacity to treat industrial wastewater and hence was a limiting factor for enabling growth in the area. After the WTP upgrade, Hauraki District Council received more interest from companies in developing in this area. As a result, HDC began investigations looking at how to upgrade the WWTP to enable growth.

3.2.1 EVALUATION OF PLANT LOCATIONS

Given the location of the Kerepehi wastewater treatment plant in proximity to the industrial subdivision, it seemed a likely site to upgrade to provide additional wastewater capacity. However, HDC also own and operate a larger capacity wastewater treatment plant in Paeroa approximately 15km away.

The first stage of investigations, undertaken in early 2013 evaluated potential options for treatment at either Kerepehi or Paeroa wastewater treatment plants. A range of options were considered at each township.

From this study we concluded that the Kerepehi WWTP was the preferred location for any plant upgrades, as the increased capacity at the Paeroa wastewater treatment plant wasn't enough to outlay the additional pipeline and pumping costs. Additionally, Paeroa had future development planned subdivisions and the connection of Kerepehi industrial subdivision would have limited this available growth.

In evaluating the risks and costs for both the Council and the potential industrial developers, the outcomes of this study found that some level of onsite treatment (to

predefined characteristics) would be preferable to support some minor upgrades to the Kerepehi WWTP.

3.2.2 ASSESSMENT OF APPROPRIATE TREATMENT UPGRADES OPTIONS

Building on the earlier report, the preferred upgrades were further refined and defined, to provide cost clarity for discussions with industry. This assessment evaluated conceptual designs for wastewater treatment upgrade at the Kerepehi wastewater treatment plant based on three different scenarios:

1. Split Treatment – DAF Pre-Treatment (or similar) at the site of the development, followed by final treatment at the upgraded Kerepehi WWTP;

2. Full Treatment at the industrial site – Full wastewater treatment at the industrial site, with the effluent being combined with the WWTP effluent before discharged to the Kerepehi WWTP Outfall; and

3. No Treatment at the industrial site –Screening only at the industrial site, with Kerepehi WWTP being upgraded to treat the combined industrial and domestic flows

Of the treatment upgrades considered for the Kerepehi wastewater treatment plant these considered either an intermittent decanting aerated lagoon (IDAL) only or an IDAL with anaerobic pond.

<u>Kerepehi Wastewater Plant Capacity</u>

This study highlighted the limited capacity in the existing oxidation ponds in Kerepehi WWTP. Industries with a high flow and contaminant load would likely require upgrades at the Kerepehi wastewater treatment plant.

<u>Re-use of Existing Infrastructure</u>

As presented in Figure 3 below, the existing Kerepehi Wastewater Treatment Plant is located adjacent to two large sludge ponds. The WTP currently uses these for the settling of the sludge from the WTP to appropriate levels before discharge to the Awaiti Canal.

Figure 3: *Kerepehi Wastewater Plant and Tanners Ponds*

These ponds was identified as potential existing infrastructure that Council had as WTP sludge ponds which could be repurposed for wastewater treatment. A high-level review found if Council operated one of the two WTP sludge ponds there was still sufficient retention to consolidate sludge for approximately half the year before desludging would be required.

Conceptual Evaluation

This evaluation found that both pre-treatment at the industrial site and full treatment at the industrial site were viable options. Full treatment at the industrial site would likely be the most economical for council; however, community acceptance swayed the preferred option back to partial treatment at industry.

We recommended that some pre-treatment was required at any industrial site due to significant risk relating to odour in the sewer reticulation as there could be a high concentration of fats and oils in the waste.

Risks

The study also identified high-level risks that that needed to be mitigated prior to taking the design forward. The risks identified at this stage were:

- Resource consenting issues;
- Wastewater characteristics from industrial producers;
- Inflow and infiltration issues with the existing domestic network; and
- Sludge disposal.

The potential risks around resource consent highlighted changing standards that would likely result in the Regional Council stipulating tighter discharge limits than the assumed effluent quality standards. This would in term affect costs and capacity of the plant.

Industrial waste characteristics are highly likely variable which could have a significant impact on the success of any plant upgrade. In order to mitigate this risk it was recommended that HDC "lock in" the industrial discharge characteristics through a trade waste agreement.

The domestic reticulation network currently experiences high inflow and infiltration. The impact of this on any future upgrades is that this may result in the consent limits being breached. HDC were intending to progress work in this area.

Due to higher nutrient loads, the upgraded plant would generate waste sludge that would need to dewatered (onsite or by a contractor) and disposed of. Therefore, the success of this option depends on there being an appropriate place to dispose of the sludge to.

Community members may object to an industry only wastewater treatment plant located closer to the houses, due to odour, noise and visual impacts. Risk of objections being made may be mitigated by early consultation with the community.

Key findings

Based on the findings of this report Hauraki District Council were able to proceed further with negotiations with interested industry as they had an understanding of the preferred treatment system, costs and risk associated with variants of these.

3.2.3 ULTIMATE FUTURE OPTIONS EVALUATION

Discussions began to process with industry in earnest, and an ice-cream factory indicated their strong support for developing in the area. At this stage, there became the need to provide both a short term upgrade that enabled the long term solution to be put in place. This ultimate solution faced a number of challenges, namely the unknown quality of influent, the required timing of the upgrades and economic funding.

Development of Ultimate Design Inputs

At this stage Council had indicated that an ice-cream factory was likely to redevelop an existing dairy site, but that other industrial connections were yet unknown. Although the ice-cream factory had been identified, it was still undergoing design and construction and hence quality and flows of wastewater generated had to be estimated based on typical industry experience and allowance for flexibility in this.

Staging of Upgrade

Any upgrade to the existing wastewater treatment plant would require significant capital expenditure and any short term upgrades needed to fit in with the longer term development of the area. To allow for this, Council worked up a likely list of industries that may be interest. The decision was made to consider four general types of wastewater that could discharge to the ultimate solution. These were as follows:

- Domestic wastewater from Kerepehi Township (existing);
- Industrial wastewater from Ice Cream factory;
- Industrial wastewater from a high volume and concentration industry (likely food processing industry);
- Other futures sources – general capacity allowance for potential new development in future.

The flows and loads vary significantly between these options, with the ice-cream factory and the existing domestic load typically at the lower end of the range. The percentage flow and load breakdown is presented in Table 1 below.

Table 1: Breakdown of Loading for Ultimate Solution

	Flow (%)	BOD Load (%)	Solids Load (%)	Nutrient Load (%)
Domestic	13	4	15	3
Industrial Food (pre-treatment assumed)	50	73	44	84
Ice-Cream Factory (pre-treatment assumed)	7	8	4	2
Other	30	15	37	11

Economic Implications

Based on this ultimate loading a solution was developed which is presented in Figure 4 below. This ultimate solution assumes that all industries will pre-treat their waste prior to discharging into the network. That a centralized treatment facility will be installed to treat all of the flows and that the existing oxidation ponds will be decommissioned.

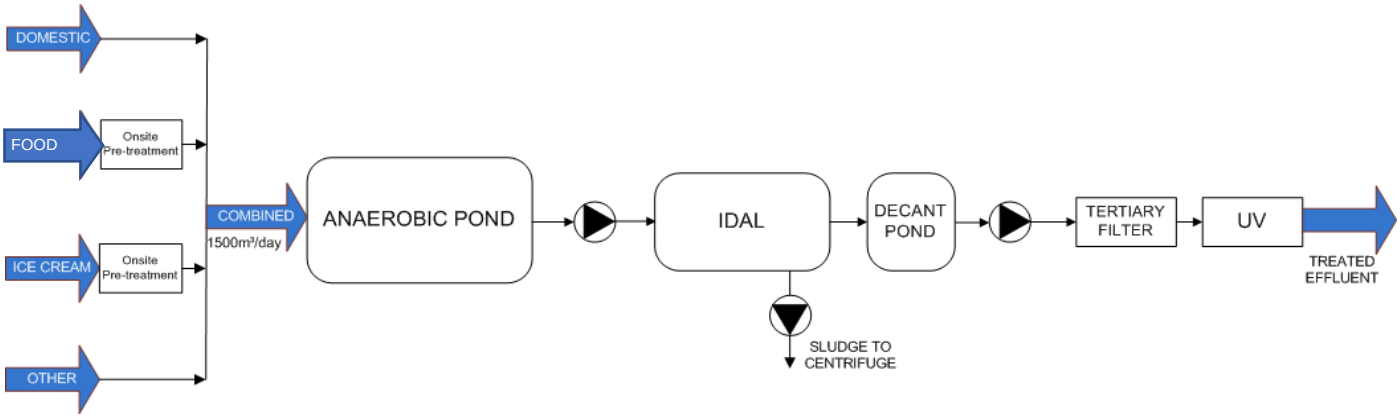

Figure 4: Ultimate Upgrade Solution

While this solution achieved the likely treatment targets, the increased capital expenditure for such a plant was significant, and this option provided little reuse of the existing infrastructure (oxidation ponds).

3.2.4 TRADE WASTE AGREEMENT

Having firm agreement between Council and Industry on the expected wastewater quality would be key to ensuring the upgrades designed were appropriate. While the design and options investigations were being undertaken Hauraki District Council were also in negotiation with the ice-cream factory to secure agreement on quality, monitoring, capital and ongoing operational costs implications of compliance nonconformities..

3.2.5 ULTIMATE SOLUTION

While the ultimate solution developed in previous stages would have provided the treatment requirements, the economic cost of this alone would have been significant with

a small ratepayer base. Therefore, the upgrades need to provide staging to enable ice-cream factory development with allowance for future growth.

In early 2016, Hauraki District Council had agreement for funding of the ice-cream factory portion of upgrades costs fixed and therefore began the process of preliminary and detailed engineering. The timing of this work was key to ensure the plant upgrades were complete prior to the ice-cream factory being ready to discharge.

Options considered in the previous work had included the conversion of one of the WTP sludge ponds (Tanners Ponds) to an anaerobic pond and IDAL. This option had significant cost savings over constructing a new separate concrete tank or new pond. Additionally as the system was separate from the existing wastewater this would mean that there was limited impact on the plants current operation during the construction period.

The installed upgrade utilized the larger of the two existing water treatment plant sludge storage ponds. The converted WTP sludge pond was drained down and de-sludged then divided in two sections. The embankment was raised by approximately 1 m to increase the volumes of the three sections. Figure 5 below presents a schematic diagram of the upgrades.

The first partitioned section was converted into a covered anaerobic pond which will pre-treat the incoming wastewater from the ice cream factory. The remaining section will continue to be used by the WTP for sludge storage as will the smaller of the two WTP settling ponds.

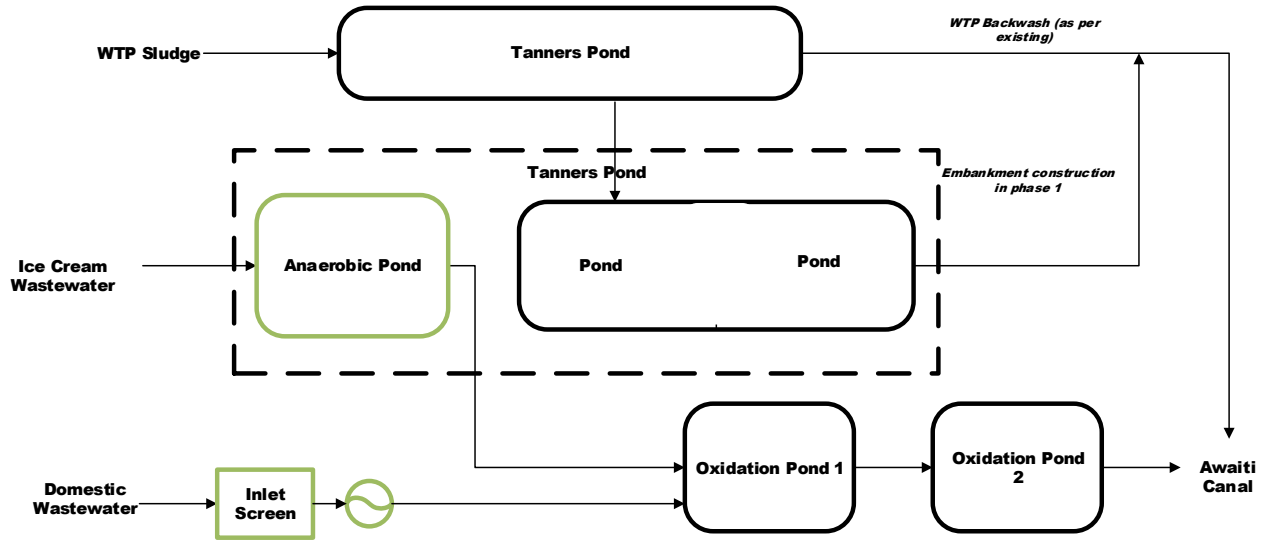

Figure 5: *Interim Upgrade Solution Block Diagram*

The treated effluent from the anaerobic ponds gravitates to the existing oxidation ponds for further treatment. Domestic waste does not typically enter the new anaerobic pond but will bypass it and continue to be treated by the existing oxidation ponds. However, there is the ability to pump the domestic wastewater to the new anaerobic pond to mitigate the risk that the dairy factory isn't producing for a long period.

Future Upgrades

To cater for further industry growth in the future upgrades will be installed in the second portion of the partitioned Tanners pond. The treatment plant upgrades comprise of the

remaining two sections of the old WTP sludge storage pond (larger one) will be fitted out as an Intermittently Decanted Aeration Lagoon (IDAL) reactor and a decant pond. Wastewater from the ice cream factory and other potential industries will be treated in the anaerobic pond, then the IDAL reactor before decanting into the final pond. The domestic waste will continue to bypass the anaerobic pond and will enter directly in to the IDAL reactor. This arrangement is presented in Figure 6 below.

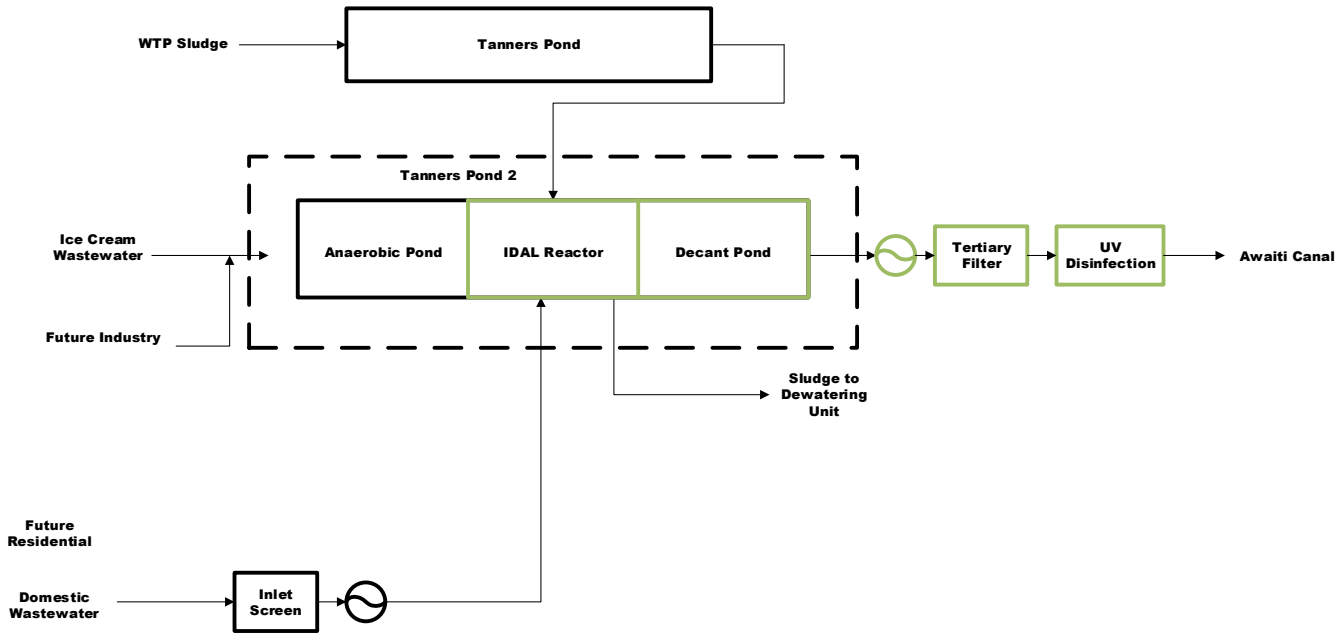

Figure 6: Interim and Ultimate Upgrade Block Diagram

In addition to the commissioning of the IDAL and decant pond a tertiary filter and UV disinfection will be added to the plant. The treated wastewater will then continue to be discharged via the existing outfall to the Awaiti Canal.

At this stage the existing oxidation ponds and floating wetland will be decommissioned as the treatment provided by the IDAL, tertiary filter and UV will be superior to the current pond system.

The backwash water from the Kerepehi water treatment plant will enter the IDAL reactor and be treated along with the other waste streams. This will be directed to the WWTP from the remaining settlement pond which will be used to balance flows.

A dewatering system will be added to dewater the sludge from the IDAL reactor (which will include the WTP sludge). The type of system installed will be evaluated in detail at the time to ensure an efficient and cost effective solution is selected. Dewatered sludge will be carried by truck to a landfill or other authorized location.

These proposed upgrades met the short term needs of the current industry (ice-cream factory), were staged and affordable for the ratepayers and provided a pathway for future upgrades. On this basis Council proceeded with the upgrades of the plant.

4 DEVELOPMENT OF KEREPEHI INDUSTRY

In 2016 Council began the construction of the interim upgrades to the Kerepehi wastewater treatment plant to support the ice-cream development. Funding for these upgrades was provided in large by the ice-cream factory, through early agreement via the memorandum of understanding based on the preliminary design capital fee estimate.

The completion of these upgrades was timed with the completion of construction of the ice-cream factory.

Following the opening of the ice-cream factory in the Kerepehi industrial park four other companies have followed suit, additionally 7 of the newly zoned light industry sites have sold.

The work of the Council to recognize the unique opportunities and potential Kerepehi had for development, supported by the upgrades to the water and wastewater infrastructure enabled the further industrial development, creating an invigorated interurban industry.

ACKNOWLEDGEMENTS

Hauraki District Council