KAITAIA AND KAIKOHE WWTP OPTIONS ASSESSMENT

Kaitaia WWTP Options Assessment

Far North District Council

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1.0 INTRODUCTION

Far North District Council (FNDC) currently hold a resource consent to discharge treated effluent from the Kaitaia Wastewater Treatment Plant (WWTP) to the Awanui River. This consent expires in November 2021. In preparation for the renewal of the consent, FNDC are undertaking an investigation into the various options available to upgrade the Kaitaia WWTP and meet the new discharge standards of the Proposed Regional Plan (PRP). Although the PRP is yet to become operative, the effluent quality requirements are likely to be more stringent. This options assessment aims to provide documentation required for the renewal of the resource consent and inform the investment planning under the 2021-2031 Long-Term Plan (LTP) process.

The preferred option to upgrade the Kaitaia WWTP has been derived through an extensive options evaluation process. This process started with the identification of a wide range of potential options, the long list of options. This included historic options considered in previous reports. The options from the long list were then narrowed down to the short list using a qualitative application of the Multi Criteria Analysis (MCA). The shortlisted options were developed to a concept level to allow for a more detailed assessment using a quantitative MCA.

This report presents the basis of design, evaluation methodology and criteria, and evaluation of the long list and short list options. This includes a sensitivity analysis and a risk assessment. Based on this a recommendation of the preferred option has been provided.

2.0 EXISTING PLANT

The Kaitaia WWTP is located adjacent to Awanui River and can be accessed from Bonnetts Road. This plant treats waste generated in Kaitaia, Awanui, and septic waste transferred by trucks from the northern towns of the Far North District. A portion of this wastewater is the industrial waste generated by Juken New Zealand Ltd (JNL Mill). The Kaitaia WWTP has been receiving waste from Awanui since 2013.

The plant consists of a septage receiving system, inlet screening, an oxidation pond, two baffled maturation ponds, a floating wetland, and a sludge disposal drying bed (see Figure 1). The treated effluent is discharged to the Awanui River. There are three sampling points: at the plant outlet, upstream of the discharge to Awanui River, and downstream of the discharge to Awanui River.

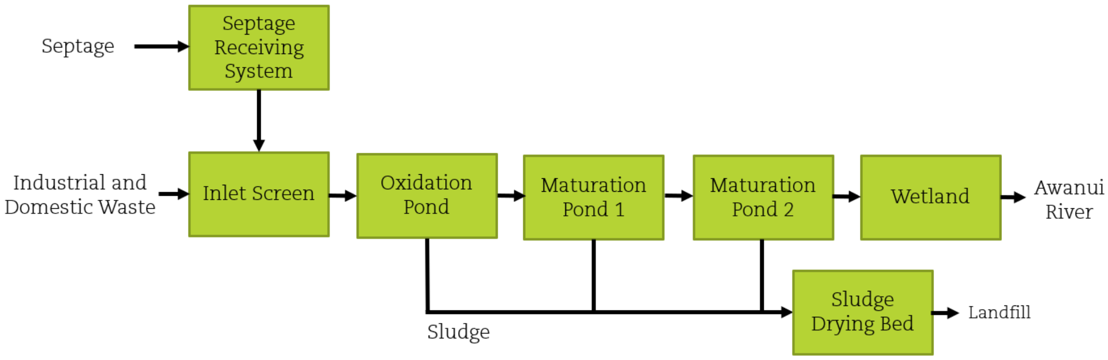


FIGURE 1: BLOCKS DIAGRAM FOR THE EXISTING KAITAIA WWTP.

Figure 2 below provides an aerial view of the plant with various treatment steps and sampling points labelled.

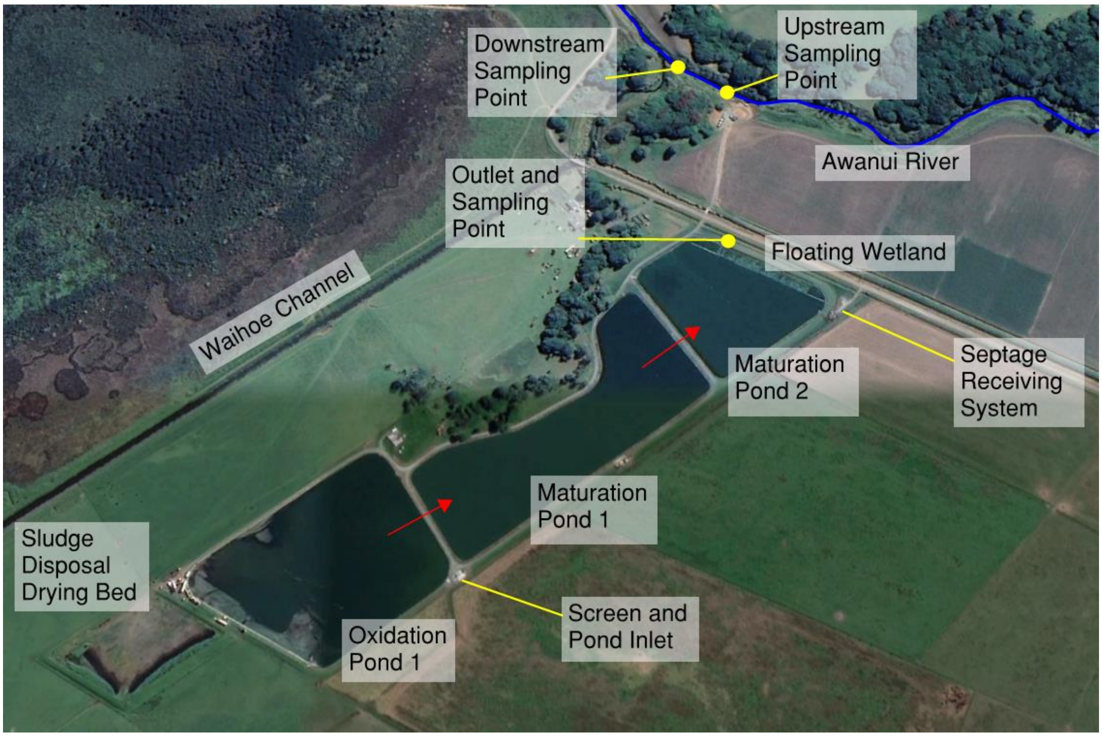


FIGURE 2: TREATMENT STAGES OF KAITAIA WWTP.

3.0 BASIS OF DESIGN

3.1 POPULATION AND GROWTH

The current (2020) and future (2055) population estimates have been based on population projections[1] and the national 2013 Census[2]. The key assumptions are:

- An average annual population change of 0.91% from 2043 to 2055 in Kaitaia. This is the average annual population growth in Kaitaia estimated by .id from 2038 to 2043.
- The population change in Awanui from 2013 to 2043 follows the .id annual percentual growth projections for the 'North Cape/ Houhora/Awanui' region. The Awanui population in 2013 (from the 2013 Census) was used as a starting point.
- An average annual population change of 0.04% from 2043 to 2055 in Awanui. This is the average annual population change estimated for the 'North Cape/ Houhora/Awanui' region from 2038 to 2043.

TABLE 1: KAITAIA AND AWANUI CURRENT AND FUTURE POPULATIONS

TOWN	2020	2043	2055
Kaitaia	5,690	7,281	8122
Awanui	325	320	322
TOTAL	6,015	7,601	8,443

These assumptions and projections will be used to estimate future flows and loads to the plant (see Section 3.2).

3.2 INFLUENT FLOWS AND LOADS

3.2.1 INFLUENT FLOWS

The current (2020) and future (2055) influent flow estimates are summarised in Table 2. Current flows are based on plant log data from January 2017 to March 2019 and include both residential and industrial wastewater. The future (2055) influent flows have been estimated using the current influent flows and forecasted population growth in Table 1. The key assumptions are:

- Industrial waste flows will grow at the same rate as domestic waste flows.
- Industrial waste corresponds to 40% of the total wastewater generated in Kaitaia.[3]

[1] https://forecast.idnz.co.nz/far-north/population-households-dwellings?WebID=140
[2] http://archive.stats.govt.nz/Census/2013-census/profile-and-summary-reports/quickstats-about-a-place.aspx?request_value=13070&parent_id=13069&tabname=&p=y&printall=true#gsc.tab=0
[3] WWA7f Proportion of trade waste 2015-16. WaterNZ 2018-2019 New Zealand Wastewater Treatment Plant Inventory

TABLE 2: ESTIMATE OF CURRENT AND FUTURE INFLUENT FLOW		
PARAMETER	**2020**	**2055**
Average Flow (m^3/day)	2,673	3,752
Median Flow (m^3/day)	2,330	3,271
90th Percentile Flow (m^3/day)	3,964	5,565
Maximum Flow (m^3/day)	10,417	14,621
Average Dry Weather Flow (ADWF)* (m^3/day)	2,277	3,196

** Based on consent condition which states that a "dry weather discharge day" is any day which there is less than 1 millimetere of rainfall, and that day occurs after three consecutive days either without rainfall or with rainfall of less than 1 millimeter on each day. .*

An ADWF wastewater production rate of 227 L/capita/day was calculated. This is aligned with typical values observed in New Zealand, which are generally around 220 L/capita/d.

3.2.2 INFLUENT LOADS

An estimate of the current and future influent loads to the WWTP are shown in Table 3. Loads have been calculated based on the observed concentrations at the plant (data from February 2014 to February 2015), except where assumptions have been made for parameters that are not sampled.

As Kaitaia WWTP started receiving wastewater from Awanui in 2013 (month unknown), data collected before 2014 have been excluded from the calculations to better reflect the current influent quality.

Total Nitrogen (TN) and Total Phosphorus (TP) concentrations of the influent and effluent flows are not continuously monitored in Kaitaia WWTP. Therefore, these have not been included in the plant load calculations.

TABLE 3: CURRENT AND FUTURE AVERAGE INFLUENT LOAD			
PARAMETER	**AVERAGE CONCENTRATION (g/m^3)**	**2020 LOAD (kg/day)****	**2055 LOAD (kg/day)*****
$cBOD_5$	357	813	1,141
TSS	694	1,580	2,217
NH_3-N*	42	96	135

**Loads for NH3-N based on typical New Zealand production values: 16g/capita/day.*

***Calculated using the current influent ADWF of 2,277m^3/day as shown in Table 2.*

****Calculated using the future influent ADWF of 3,196m^3/day as shown in Table 2.*

It is assumed that the current industrial influent water quality remains unchanged until 2055. As there are no known plans for the establishment of new industries in Kaitaia, the assumed industrial growth can be attributed to the existing industrial facilities.

3.3 EFFLUENT QUALITY AND DISCHARGE STANDARD

3.3.1 CURRENT DISCHARGE CONSENT LIMITS

The existing discharge consent limits the 30-day rolling average of dry weather flow (DWF) discharges from the WWTP to 3,100 m^3/day. A 'dry weather discharge day' is defined in the resource consent as a day on which there is less than 1 mm of rainfall, and that occurs after three consecutive days either without rainfall or with rainfall of less than 1mm on each day. The discharge volume is measured from the outlet of the plant.

Figure 3 below compares the 30-day rolling average of DWF discharges and the daily discharges against the consent discharge limit from January 2017 to March 2019. The consent limit was not exceeded during this period.

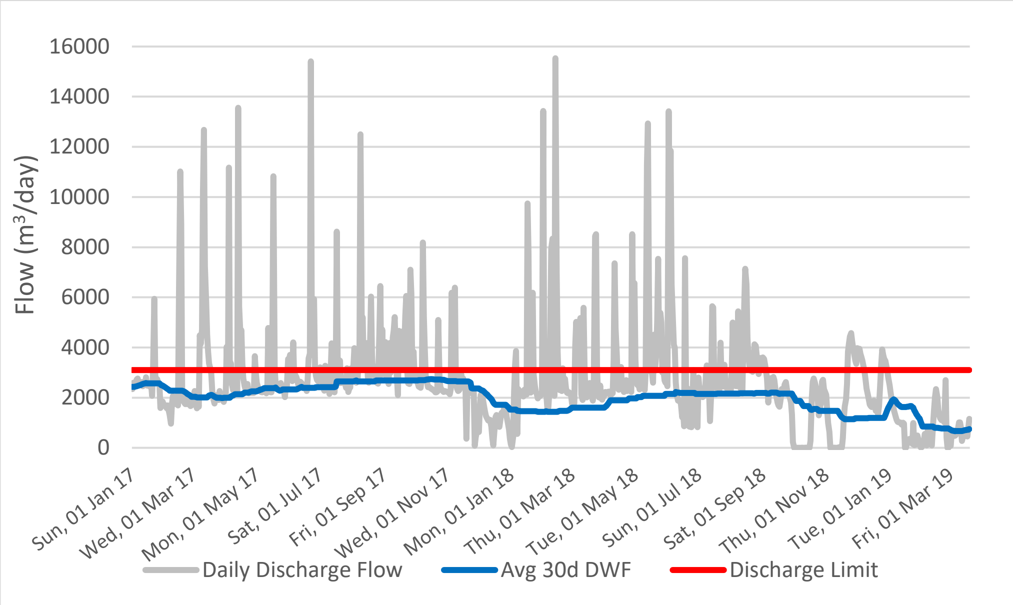


FIGURE 3: COMPARISON OF DAILY DISCHARGE FLOW, AVERAGE 30-DAY DWF, AND CONSENT DISCHARGE LIMIT.

The following limits for F-specific bacteriophage concentrations in the final treated effluent are established by the resource consent in terms of 50th percentile; or 90th percentile:

- 50th percentile of 140 plaque forming units; or
- 90th percentile of 750 plaque forming units.

F-specific bacteriophage concentrations shall be measured monthly. Compliance is determined over a fixed 12-month period by using the last 12 monthly results and any supplementary monitoring results from audit sampling undertaken by the NRC within this period.

F-specific bacteriophage concentrations results from May 2016 to July 2020 are summarised in the table below.

TABLE 4: F-SPECIFIC BACTERIOPHAGE CONCENTRATION RESULTS FOR TREATED EFFLUENT.

PARAMETER	PHAGES [PFU/L]
Average	2,006
Median	20
50th Percentile	20
90th Percentile	1,100
Maximum	80,000
% samples above 140 plaque forming units	27
% samples above 750 plaque forming units	18

The results presented in the table above indicate that the effluent is generally compliant with the 50th percentile limit established by the resource consent. Upgrades to the wastewater treatment plant would be required to comply with the 90th percentile limit.

3.3.2 CURRENT EFFLUENT QUALITY

The current influent and effluent loads are shown in Table 5. Kaitaia WWTP is a pond-based treatment system that targets BOD and solids removal.

TABLE 5: AVERAGE INFLUENT AND EFFLUENT LOADING

PARAMETER	AVERAGE INFLUENT LOAD (KG/DAY)**	AVERAGE EFFLUENT LOAD (KG/DAY)**	PERCENTAGE REMOVED
$cBOD_5$	813	171	79%
TSS	1,580	322	80%
NH_3-N	96*	3	97%

**Loads for NH3-N based on typical New Zealand production values: 16g/capita/day.*

***Calculated based on data from February 2014 to February 2015.*

Table 6 compares the E.coli count from the upstream and downstream sampling points. An increase in E. coli from upstream to downstream of the discharge can be observed.

TABLE 6: EFFLUENT MEDIAN AND 95TH PERCENTILE E. COLI (MPN/100ML)

E. COLI	UPSTREAM OF DISCHARGE	DOWNSTREAM OF DISCHARGE
Median	339	391
95th Percentile	6,309	7,488

3.3.3 PRP WATER QUALITY STANDARDS

A comparison of the Northland Regional Council Proposed Regional Plan (PRP) water quality standards against water quality samples of the Awanui River is shown in Table 7. The water quality values upstream and downstream of the discharge are calculated over a three-year period whereas the PRP standards are assessed on an annual basis.

TABLE 7: COMPARISON OF NORTHLAND PROPOSED REGIONAL PLAN WATER QUALITY STANDARDS AGAINST CURRENT AWANUI RIVER SAMPLING LOCATIONS

PARAMETER	UNITS	COMPLIANCE METRIC	PRP STANDARDS	UPSTREAM OF DISCHARGE *	DOWNSTREAM OF DISCHARGE *
Nitrate	mg/L	Annual Median	≤ 1.0	No data	No data
		Annual 95th percentile	≤ 1.5	No data	No data
Ammonia**	mg/L	Annual median	≤ 0.24	0.01	0.03
		Annual maximum	≤ 0.40	0.27	0.55
Temperature***	˚C	CRI averaged over 5 hottest days	≤ 24˚C	23.1˚C	23.5˚C
DO	mg/L	7-day minimum	≥ 5.0	10.0	9.9

TABLE 7: COMPARISON OF NORTHLAND PROPOSED REGIONAL PLAN WATER QUALITY STANDARDS AGAINST CURRENT AWANUI RIVER SAMPLING LOCATIONS

PARAMETER	UNITS	COMPLIANCE METRIC	PRP STANDARDS	UPSTREAM OF DISCHARGE *	DOWNSTREAM OF DISCHARGE *
		1-day minimum	≥ 4.0	5.6	5.7
pH	-	Annual minimum	6.0 < pH	6.3	6.6
		Annual maximum	pH <9.0	8.6	8.4
E. coli	%	% exceedances over 540	<5%	36%	40%
		% exceedances over 260	<20%	64%	67%
	cfu/ 100mL	Median	≤130	339	391
		95th percentile	≤540	6,309	7,488

**The values shown are calculated over the three-year period from August 2017 to July 2020 as opposed to the PRP annual compliance metric.*

***The PRP standards for ammonia are based on pH 8 and temperature of 20˚C. Upstream and downstream results have not been adjusted.*

****Temperature results are based on discontinuous temperature monitoring.*

Under the current water reform, there is an emphasis on improving discharge quality to freshwater bodies. The current water quality downstream of the discharge is worse than the proposed limits for ammonia (annual maximum) and E. coli. Nitrates are not currently continuously monitored at the sampling points.

FNDC indicated that the downstream compliance point within the Awanui River needs to be shifted approximately 30m closer to the discharge point. This may cause an increase of the nutrients and E. coli concentration at the new downstream sampling point in comparison to the values presented in Table 7, and thus reducing the effective “mixing zone”. Moreover, the WWTP ponds are operating significantly above their BOD treatment capacity [4]. This means that any future increase in influent loads to the current WWTP is likely to result in a lower quality effluent.

Considering the information available, it is likely, upgrades are required at Kaitaia WWTP if FNDC intend to comply with the proposed quality standards. This would involve upgrades to improve nitrogen removal (ammonia and possibly nitrate) and disinfection to meet E. coli limits. FNDC have indicated that cyanobacteria blooms have been happening in Kaitaia WWTP in summer, with a significant impact on the Awanui River. Future plant upgrades should also consider addressing this issue and increasing the plant capacity to treat higher BOD load.

[4] Morphum Environmental Ltd (Morphum). (2020). Kaitaia WWTP Performance Advice (Draft).

3.3.4 EFFLUENT QUALITY REQUIREMENTS

The effluent quality requirements for Kaitaia WWTP were calculated based on publically available Awanui River quality data and flow estimations, future plant effluent flow estimations, and the PRP standards (see Table 8 below). It is important to note that the Awanui River flow assumptions are key assumptions to determine the effluent quality requirements for the Kaitaia WWTP. Therefore, these assumptions should be confirmed by the FNDC.

The complete calculations and assumptions can be found in Appendix 1.

TABLE 8: REQUIRED EFFLUENT QUALITY FOR KAITAIA WWTP.

AMMONIA (NH_3)			
PARAMETER	**UPSTREAM OF DISCHARGE**	**DOWNSTREAM OF DISCHARGE**	**WWTP REQUIREMENT**
Flow (m^3/day)	322,254	326,000	3,752
Concentration (g/m^3)	0.08	0.24	**14**
Load (kg/day)	26	79	53
NITRATES			
PARAMETER	**UPSTREAM OF DISCHARGE**	**DOWNSTREAM OF DISCHARGE**	**WWTP REQUIREMENT**
Flow (m^3/day)	322,254	326,000	3,752
Concentration (g/m^3)	0.052	1	**82**
Load (kg/day)	17	326	309

4.0 OPTIONS EVALUATION

4.1 MULTI CRITERIA ANALYSIS (MCA)

The options analysis for Kaitaia wastewater scheme was based on a MCA using a number of weighted criteria. The MCA considered each of the options in terms of the following categories:

1. Māori cultural values;
2. Environmental values;
3. Practicability;
4. Operability; and
5. Financial.

The criteria and weightings under each of these categories are presented in Table 9 below.

The options evaluation process included rating the long list options against these criteria using a ‘traffic light’ system, where each option was given a rating of low, medium, or high based on a qualitative assessment. Four of the most favourable options from this assessment were taken forward to the short list to be further developed and evaluated.

The short-listed options were assessed using the same criteria but with a quantitative approach. The options were rated from 1-5 against each criterion. An overall score was then developed for each option based on the scores and weighting of the criteria. The highest scoring option was selected as the preferred option for upgrading Kaitaia WWTP.

TABLE 9: OPTIONS EVALUATION CRITERIA

CATEGORY	CRITERIA	WEIGHTING	DESCRIPTION	SUCCESS FACTORS
Māori cultural values	• Impacts on Māori cultural values and practices.	20%	• Gives effect to Te Mana o te Wai • Acceptability of process to local iwi	• The option safeguards Māori cultural values and practices
Environmental values	• Land Use Effects	2%	• Visual, Noise, Traffic impacts	• The option can meet required discharge standards for wastewater (and carbon where applicable) • The option can meet amenity standards, including odour
	• Odour	3%	• The degree to which odour can be expected to be discharged beyond the property boundary	
	• Ecological Effects	10%	• The degree to which the effluent quality exceeds the minimum environmental and consent requirements	
	• Carbon Footprint	3%	• Level of energy consumption, secondary discharges and chemicals required	
	• Public Health	4%	• Impacts on mahinga kai • Recreational use of the receiving environment • Impact of spills and failure	
Practicability	• Constructability	4%	• Complexity of construction process • Distance from networks and services • Time taken to commission option	• The option can be successfully delivered
	• Regulations and Planning	7%	• Complexity to obtain a consent or other authorisations	
	• Staging	3%	• Can the option be staged?	
Operability	• The ease of operation and maintenance	6%	• Complexity of operation • Required expertise • Ease of access • H&S risks of plant process • Sludge management • Reliance on and complexity of plant consumables and replacement componentry	• The option can be successfully used in the future
	• Process reliability and resilience	6%	• Known performance of others with similar technologies • Consistency of quality in the discharge • Ability to maintain compliance with resource consents	
	• Expandability/ future proofing	5%	• The potential for the site to allow for extensions to the treatment process • Proofing against changes in compliance requirements	
	• Hazards	3%	• Proximity to known and potential hazards, e.g., flood plains, climate change hazards	

TABLE 9: OPTIONS EVALUATION CRITERIA

CATEGORY	CRITERIA	WEIGHTING	DESCRIPTION	SUCCESS FACTORS
Financial	• Capital Cost	9%	• Cost of implementation • Site investigations and procurement of land • Ability to reuse existing FNDC assets	• The costs of the option are understood and able to be paid
	• Operating and Maintenance Costs	9%	• Operations and maintenance requirements (e.g., chemical costs, sludge removal) • Power cost	
	• Rating impact	6%	• Impact on targeted rate relative to other options	

4.2 LONG LIST OPTIONS

The long list of options for Kaitaia WWTP considered the following:

- Continued effluent discharge to Awanui River (we understand land disposal options are being considered outside of this project);
- Effluent quality requirements to meet the new discharge standards within the PRP;
- Historical issues experienced at the plant; and
- Review of past assessments of upgrade options for this plant.

The long list of options is shown in Table 10 below.

TABLE 10: LONG LIST OF OPTIONS.

OPTION	DETAILS
Do Nothing (Status Quo)	Keep the WWTP as it is.
Minor Upgrades*	Remove wetland + Upgrade septage receiving system + Ponds in parallel with baffles + Rock filter + UV
	Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV
	Remove wetland + Upgrade septage receiving system + Aerators + Tertiary treatment + Chemical dosing + UV
	Remove wetland + Upgrade septage receiving system + Mechanical mixers + Microscreen/Disc filter + UV
Major Upgrades*	Decommissioning ponds and wetland + Proprietary septage receiving system + Fixed Activated Sludge Treatment (FAST) modules + UV
	Upgrade wetland + Proprietary septage receiving system + Trickling filter and clarifier after pond 3 + Chemical dosing + UV
	Upgrade wetland + Proprietary septage receiving system + Clarifier and aeration basin before ponds + UV
	Proprietary septage receiving system + In pond aeration combined with an attached growth system (e.g. AquaMats)
	Proprietary septage receiving system + Membrane Aerated Biofilm Reactor (MABR)
	Proprietary septage receiving system + Intermittent Decanting Aerated Lagoon (IDAL)
	Proprietary septage receiving system + Biological Nutrient Removal Plant (BNR)
Side Stream Treatment Plant	Portion of the flow treated by a mechanical plant (smaller size with higher effluent quality) and the remaining flow treated through the existing pond system. The final effluents are then blended before discharge.
Industrial Re-use	Portion of the flow treated by a mechanical plant and re-used by industry close by that is willing to take wastewater (none identified at this stage). Remaining wastewater treated through existing pond system.
Alternative Upgrades	Following oxidation pond, electrocoagulation and clarifier.

**De-sludging the ponds should be considered for all the minor and major upgrade options.*

A high-level qualitative MCA matrix for the long list options was presented to FNDC in a teleconference on the 21/09/20. After discussing the options and receiving feedback from the Council, a final MCA matrix was prepared (see Appendix 2).

A preliminary long list of options can be found in Appendix 3. This contains a comprehensive list of all the historic options which were considered in previous assessments.

4.3 SHORT LIST OPTIONS

Based on the MCA evaluation and short-listing discussion with FNDC, the following options have been taken forward to the short list:

- **Option 1:** Remove wetland + Upgrade septage receiving system + in pond upgrades (Aerators + Baffle Curtain) + chemical dosing + tertiary treatment (Clarifier + UV);
- **Option 2:** Proprietary septage receiving system + In pond aeration combined with an attached growth system;
- **Option 3**: Proprietary septage receiving system + IDAL; and
- **Option 4:** Proprietary septage receiving system + Side Stream Treatment Plant (BNR).

These options have been developed to a concept level to allow a more detailed and informed assessment to select the preferred option. This included developing infrastructure upgrade requirements; risks and capital and operating costs for each of the options.

4.3.2 OPTION 1 – REMOVE WETLAND, UPGRADE SEPTAGE RECEIVING SYSTEM, AERATORS, BAFFLE CURTAIN, CLARIFIER, CHEMICAL DOSING, AND UV

This option will utilise two of the three ponds (oxidation pond and maturation pond 1), the septage receiving system, the inlet screen, and the sludge drying bed of the existing Kaitaia WWTP. The treatment process at the plant will be upgraded to include a better septage receiving system, aeration and baffle curtains in the ponds, chemical dosing; and tertiary treatment which will consist of clarification, and UV disinfection.

A block diagram of the upgraded treatment process is shown in Figure 4.

The treatment process upgrades will include:

- De-sludging the oxidation pond and the maturation pond 1 to improve performance and enable the installation of the aerators and baffle curtains. It is understood that only around one-third of the oxidation pond has been recently de-sludged and then the de-sludging process was interrupted.
- De-sludging and decommissioning the maturation pond 2. The installation of a UV disinfection system will eliminate the need for a second maturation pond to reduce the effluent bacterial levels. In addition, decommissioning one of the ponds may reduce problems related to algae blooms in the summer. The maturation pond 2 has to be de-sludged before being decommissioned to avoid algae growth and odour issues. This land could be reclaimed for tertiary treatment.
- Decommissioning the wetland, which is in bad condition and performing poorly.[4]

- Upgrading the septage receiving system with the installation of a new wet well and a mechanical screen. This will reduce blockages and avoid truckers having to discharge septage directly into the ponds.
- Installing pond surface aerators (in the oxidation pond and maturation pond 1) and baffle curtains (in the maturation pond 1) to maximise ammonia removal.
- Installing a new tertiary treatment system. This will involve:
  - constructing one or more buildings for a chemical dosing system (phosphorus removal) and UV units; and
  - cnstalling a clarifier. The clarifier will improve solids removal before the UV disinfection stage.
- Pipeline modifications to connect the new treatment processes.
- Potential modifications to the plant access road to provide the required turning circle for a chemical delivery truck, and a chemical delivery pad alongside the building.

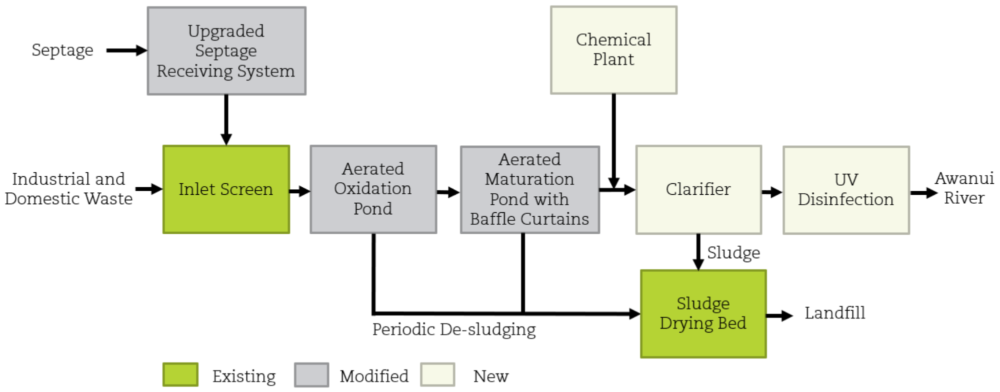


FIGURE 4: BLOCK DIAGRAM FOR OPTION 1

4.3.3 OPTION 2 – PROPRIETARY SEPTAGE RECEIVING SYSTEM, AND IN POND AERATION COMBINED WITH AN ATTACHED GROWTH SYSTEM

This option will utilise two of the three ponds (oxidation pond and maturation pond 1), the inlet screen, and the sludge drying bed of the existing Kaitaia WWTP. The treatment process at the plant will be upgraded to include a proprietary septage receiving system, diffused aeration combined with an attached growth system in pond 1 (oxidation pond), surface aerators in the maturation pond 1, and UV disinfection.

An in pond attached growth system consists of fabric curtains that provide surface area for bacterial growth. Aeration is provided between the curtains via diffused aeration pipes. This system achieves longer sludge residence times hence improving nitrogen removal.

A block diagram of this treatment process is shown in Figure 5.

The treatment process upgrades will include:

- De-sludging the oxidation pond and the maturation pond 1 to improve performance and enable the installation of the aeration and attached growth system. It is understood that only around one-third of the oxidation pond has been recently de-sludged.

- De-sludging and decommissioning the maturation pond 2. The installation of a UV disinfection system will eliminate the need for a second maturation pond to reduce the effluent bacterial levels. In addition, decommissioning one of the ponds will reduce problems related to algae blooms in the summer. The maturation pond 2 has to be de-sludged before being decommissioned to avoid algae growth and odour issues.
- Decommissioning the wetland, which is in bad condition and performing poorly.[4]
- Decommissioning the current septage receiving system and installing a proprietary septage receiving system. This will include a combined screening, grit, and grease removal system. As a result, the system performance will improve and blockages in the pipeline will be prevented.
- Installing the diffused aeration and attached growth system in pond 1.
- Installing surface aerators in maturation pond 1 to avoid algae blooms.
- Constructing a building to house the blowers and UV units.
- Pipeline modifications to connect the new treatment processes.

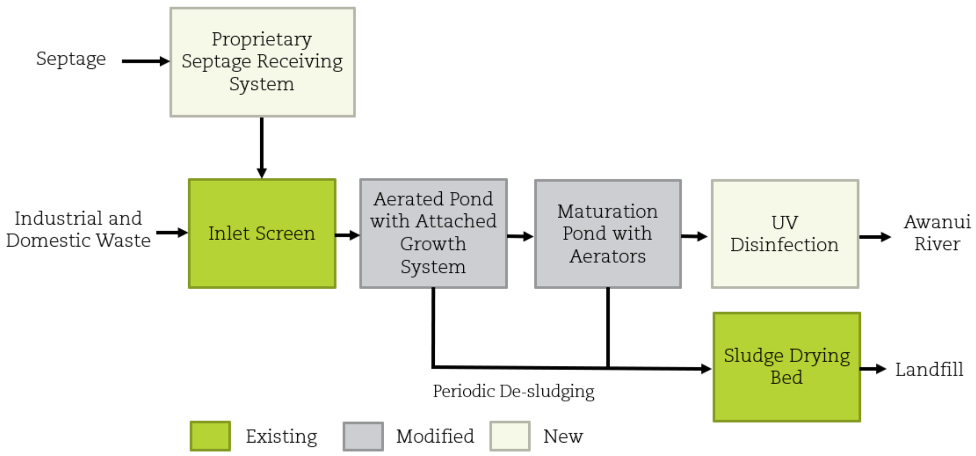


FIGURE 5: BLOCK DIAGRAM FOR OPTION 2

4.3.4 OPTION 3 – PROPRIETARY SEPTAGE RECEIVING SYSTEM AND IDAL

This option will utilise two of the three ponds (maturation ponds 1 and 2) and the inlet screen of the existing Kaitaia WWTP. The treatment process at the plant will be upgraded to include a proprietary septage receiving system, IDAL, filtration, UV disinfection, and a sludge de-watering system.

An IDAL is a pond based activated sludge process where secondary settled wastewater is decanted in batches instead of continuously. Aeration and settling are time-phased in the IDAL and occur in the same pond. The IDAL system will be constructed in the maturation pond 2.

A block diagram of this treatment process is shown in Figure 6.

The treatment process upgrades will include:

- De-sludging the maturation ponds 1 and 2 to improve performance and enable the installation of the IDAL system. It is understood that only around one-third of the oxidation pond has been recently de-sludged and then the de-sludging process was interrupted.

- De-sludging and decommissioning the oxidation pond. The installation of an IDAL system will eliminate the need for three ponds: only a buffering pond and a pond with the IDAL system are required. In addition, decommissioning one of the ponds will reduce problems related to algae blooms in the summer. The oxidation pond has to be de-sludged before being decommissioned to avoid algae growth and odour issues.
- Decommissioning the wetland, which is in bad condition and performing poorly.[4]
- Decommissioning the current septage receiving system and installing a proprietary septage receiving system. This will include a combined screening, grit, and grease removal system. As a result, the system performance will improve and blockages in the pipeline will be prevented.
- Installing the IDAL system in maturation pond 2.
- Constructing one or more buildings for the blowers, UV units, and the sludge de-watering system.
- Pipeline modifications to connect the new treatment processes.
- Potential modifications to the plant access road to provide the required turning circle for a chemical delivery truck, and a chemical delivery pad alongside the building.

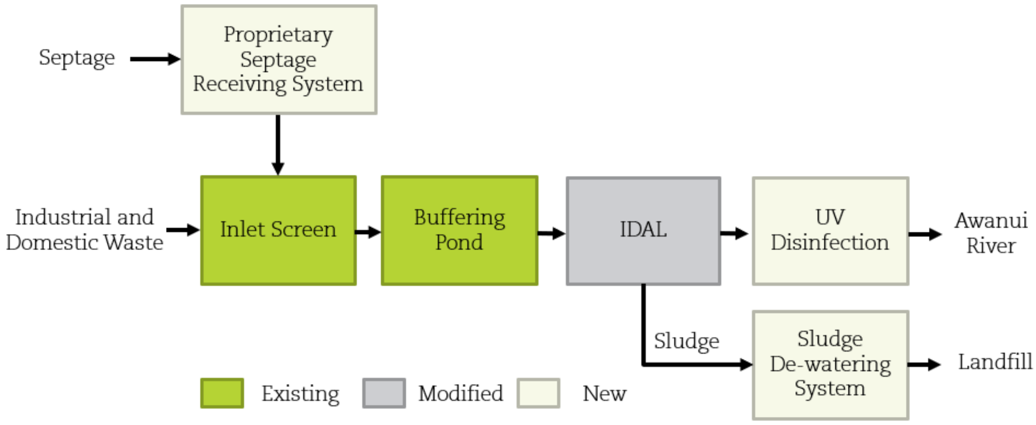


FIGURE 6: BLOCK DIAGRAM FOR OPTION 3

4.3.5 OPTION 4 – PROPRIETARY SEPTAGE RECEIVING SYSTEM AND SIDE STREAM TREATMENT PLANT (BNR)

This option will utilise the inlet screen, three ponds, and wetland of the existing Kaitaia WWTP. The treatment process at the plant will be upgraded to include a proprietary septage receiving system, a side stream treatment plant (BNR), filtration, UV disinfection, and a sludge de-watering system.

BNR is a process used for nitrogen and phosphorus removal. It consists of an anaerobic zone, an anoxic zone, and an aeration zone. The nitrates produced in the aerobic zone are recycled to the anoxic zone for denitrification, resulting in nitrogen removal. In the anaerobic zone, Phosphorus Accumulating Organisms (PAOs) release phosphorus which is subsequently taken up in large quantities in the aerobic zone. Intracellular phosphorus is removed from the wastewater as the sludge is removed.

The BNR plant will be sized to receive 50% of the influent flow. This percentage was calculated based on the effluent quality requirements estimated in Section 3.3.4. Table 11 below summarises these mass balance calculations.

TABLE 11: COMBINED EFFLUENT QUALITY.

PARAMETER		BNR PLANT	EXISTING POND-BASED WWTP	COMBINED FLOW
Effluent Quality	NH3 (g/m³)	2	25	14
	BOD (g/m³)	5	40	23
Flows	Effluent Flow (m³/day)	1,876	1,876	3,752
	% Total Effluent Flow	50%	50%	100%

Notes:

Effluent concentrations for the BNR plant are target values. Effluent concentrations for the current WWTP are based on effluent data.

NH_3 concentration for the combined effluent should be < 14 g/m³. See Section 3.3.4.

Recommended BOD concentration for the comvined effluent: < 25 g/m³.

The effluent of the BNR plant and the pond system will be combined before going through UV disinfection and being discharged to the Awanui River. A block diagram of this treatment process is shown in Figure 7.

The treatment process upgrades will include:

- De-sludging the oxidation pond and the maturation ponds 1 and 2 to improve performance. It is understood that only around one-third of the oxidation pond has been recently de-sludged and then the de-sludging process was interrupted.
- Decommissioning the current septage receiving system and installing a proprietary septage receiving system. This will include a combined screening, grit and grease removal system. As a result, the system performance will improve and blockages in the pipeline will be prevented.
- Installing the side stream plant (BNR).
- Constructing one or more buildings for the blowers, UV units, and the sludge de-watering system.
- Pipeline modifications to connect the new treatment processes.
- Potential modifications to the plant access road to provide the required turning circle for a chemical delivery truck, and a chemical delivery pad alongside the building.

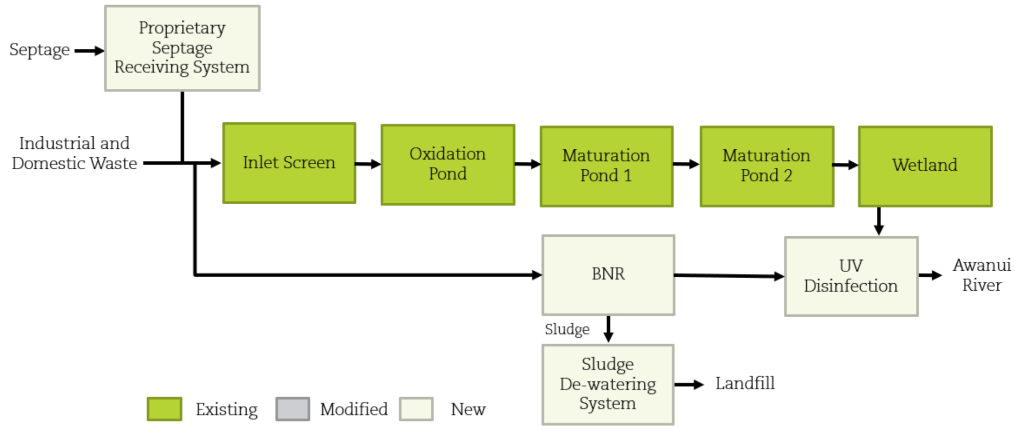


FIGURE 7: BLOCK DIAGRAM FOR OPTION 4

4.3.6 CAPEX AND OPEX ESTIMATIONS

Table 12 shows a comparison among the estimated capital and operation cost ranges for Options 1 to 4. The assumptions and exclusions related to these cost estimations are detailed below.

TABLE 12: CAPEX AND OPEX FOR OPTIONS 1 TO 4.

OPTIONS		CAPEX (-5 TO +30%)	OPEX (-5 TO +30%)
NO	DESCRIPTION		
1	Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV	$4.5M - $6.2M	$500K - $680K
2	Proprietary septage receiving system + In pond aeration combined with an attached growth system	$11.1M - $15.2M	$270K - $370K
3	Proprietary septage receiving system + IDAL	$8.3M - $11.4M	$780K - $1.1M
4	Proprietary septage receiving system + Side Stream Treatment Plant (BNR)	$12.9M - $16.8M	$550K - $760K

<u>Assumptions and Exclusions</u>

- The following items have been excluded from the capital cost estimations to upgrade the Kaitaia WWTP:
  - Decommissioning and disposal of current infrastructure and equipment that are not included in the upgraded system;
  - Major earthworks and pilling;
  - New consents or renewing existing consents;
  - Geotechnical and survey studies;
  - Ground remediation;
  - Alarms, camera systems and fire protection systems;
  - Transformers, generators and power upgrades; and
  - Access roads.

- Any equipment to be used as part of the upgrade is considered to be in good operational condition;
- De-sludging costs are based on a total of 1,500 tons of wet sludge (20% of dry solids) for the three ponds.
- Operational cost estimates do not include interest on capital and depreciation.
- A unit energy charge of $0.10/kWhr has been used to estimate the power costs. The cost estimate does not include any fixed charges paid by the site.
- Cost estimates exclude GST.

4.3.7 SHORT LIST OPTIONS MCA

The MCA scoring of each short-listed option is shown in Table 13 below. These options were evaluated according to the criteria and weightings presented in Table 9 (see Section 4.1).

The complete short list options MCA can be found in Appendix 4.

TABLE 13: SHORT LIST OPTIONS EVALUATION.

OPTIONS		SCORE
NO	**DESCRIPTION**	
1	Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV	57.3
2	Proprietary septage receiving system + In pond aeration combined with an attached growth system	52.7
3	Proprietary septage receiving system + IDAL	56.5
4	Proprietary septage receiving system + Side Stream Treatment Plant (BNR)	51.4

4.4 SENSITIVITY ANALYSIS

The weighting given to each of the criteria influences the overall score given to each of the short-listed options. It is therefore important to test the sensitivity of the MCA to the weightings to ensure that it remains as unbiased as possible. For this analysis, the various criteria were grouped according to the categories shown in Table 14.

TABLE 14: SENSITIVITY ANALYSIS CATEGORIES

CATEGORY	CRITERIA
Non-Technical	Māori cultural values
	Environmental values
Technical	Practicability
	Operability
Management	Financial

The weighting of each of these categories were inflated at the expense of the others in different scenarios to determine the effect of the weighting on the overall rating of the options. A total of nine weighting scenarios were applied to the MCA. These followed the methodology outlined below in the table below.

TABLE 15: SENSITIVITY ANALYSIS OUTCOMES.

CATEGORY	SCENARIOS WEIGHTING								
	1	1A	1B	2	2A	2B	3	3A	3B
Non-Technical	+20%	+20%	+20%	-10%	-20%	-	-10%	-20%	-
Technical	-10%	-20%	-	+20%	+20%	+20%	-10%	-	-20%
Management (Financial)	-10%	-	-20%	-10%	-	-20%	+20%	+20%	+20%

A visual representation of the allocated weightings for all nine scenarios is presented in Figure 8.

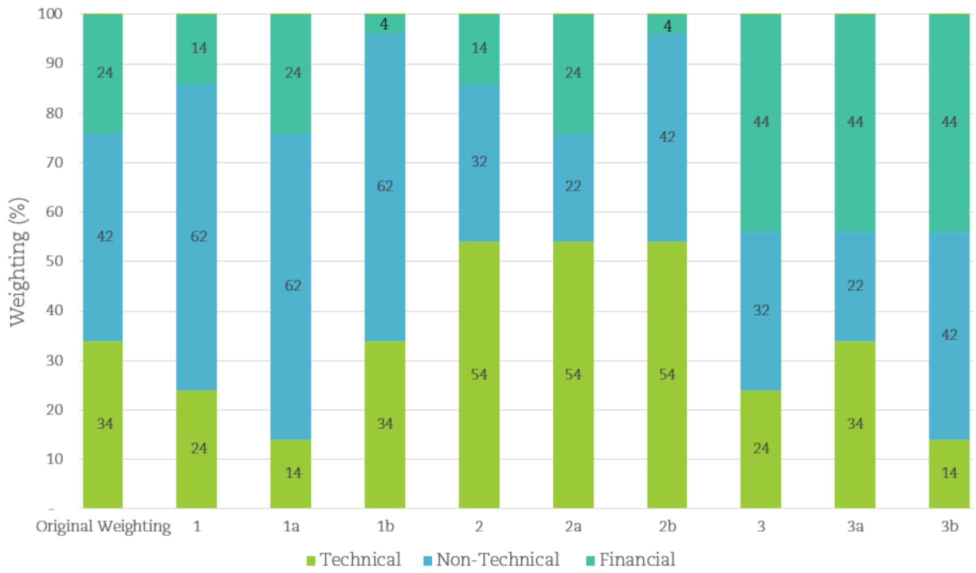


FIGURE 8: WEIGHTINGS OF SENSITIVITY SCENARIOS

The outcome of the sensitivity analysis is summarised in Table 16 below. For each of the scenarios, the highlighted value indicates the highest scoring option. The full sensitivity analysis can be found in Appendix 4.

TABLE 16: SENSITIVITY ANALYSIS OUTCOMES.

OPTIONS		SCENARIOS									
NO	DESCRIPTION	ORIGINAL WEIGHTING	1	1A	1B	2	2A	2B	3	3A	3B
1	Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV	57.3	51.4	55.2	47.8	55.0	59.8	50.2	65.7	67.0	64.8
2	Proprietary septage receiving system + In pond aeration combined with an attached growth system	52.7	47.9	50.9	45.0	50.7	54.5	46.9	59.2	60.0	58.3
3	Proprietary septage receiving system + IDAL	56.5	53.8	53.5	53.2	57.8	58.4	56.0	58.6	58.9	56.8
4	Proprietary septage receiving system + Side Stream Treatment Plant (BNR)	51.4	47.3	47.3	46.6	53.6	55.7	51.2	54.2	55.6	51.8

The sensitivity analysis outcomes indicates that the main factor influencing the choice of Option 1 or Option 3 as the preferred option is costs. Option 1 was the preferred option for all the scenarios where the weighting of the management (or financial) category was kept above 24%. On the other side, Option 3 was the preferred option for all the scenarios where the management category weighting was reduced to 14% or 4%. This is because the capital and operational costs of Option 3 are significantly above the costs of Option 1.

Options 2 and 4 were not the preferred options for any of the tested scenarios. This indicates that Options 1 and 3 are the most favourable options from cultural, environmental, technical, and financial perspectives.

The sensitivity analysis has demonstrated that the weightings used for the short list evaluation did not show a strong bias to any particular criteria. This analysis indicates that Option 1 is the preferred option, followed by Option 3.

4.5 RISK ANALYSIS

The risks associated with each short list option were assessed using a quantitative risk matrix (as per AS/NZ 4360:2004). The risk framework shown in Table 17 was used to derive a risk score for each of the options. The higher the total score, the riskier the option is. The risk scores of the short-listed options must be taken into consideration when selecting the preferred option.

Risk scores are derived by evaluating the likelihood of a risk occurring and the consequence if it does occur. A risk score is given by multiplying the value associated with the likelihood by the value associated with the consequence.

TABLE 17: RISK FRAMEWORK.

LIKELIHOOD		CONSEQUENCES				
Parameter		**Severe**	**Major**	**Moderate**	**Minor**	**Negligible**
	Value	5	4	3	2	1
Almost certain	5	Extreme	Extreme	Extreme	High	High
Likely	4	Extreme	Extreme	High	High	Medium
Possible	3	Extreme	Extreme	High	Medium	Low
Unlikely	2	Extreme	High	Medium	Low	Low
Rare	1	High	High	Medium	Low	Low

The full list of risks is presented in the risk matrix included in Appendix 5. The overall risk scores for the four shortlisted options have been summarised in Table 18 below.

TABLE 18: SHORT LIST OPTIONS RISK ASSESSMENT.

OPTION		SCORE
NO	DESCRIPTION	
1	Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV	156
2	Proprietary septage receiving system + In pond aeration combined with an attached growth system	156
3	Proprietary septage receiving system + IDAL	140
4	Proprietary septage receiving system + Side Stream Treatment Plant (BNR)	148

As presented in Table 18, the risk assessment indicates that the Option 3 currently presents the lowest risk when compared with the other options.

5.0 RECOMMENDATIONS

The options evaluation process indicates that Option 1 (Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV) is the preferred option for upgrading the Kaitaia WWTP. This option has scored highest in the MCA. Although Option 1 currently presents higher risk when compared to the other options, measures can be put into place to reduce the likelihood (and consequently the risk scores) of the risks associated with this option.

The evaluation process has also indicated that Option 3 (Proprietary septage receiving system + IDAL) would be a good alternative option to upgrade the Kaitaia WWTP. This option has the lowest risk when compared to the other options, and it had the second highest score in the MCA. However, Option 3 has higher capital and operation costs when compared to Option 1.

5.1 NEXT STEPS

The following next steps are recommended:

1. FNDC to confirm the Awanui River flow assumptions, as these are key assumptions to determine the required effluent quality of the Kaitaia WWTP. This includes:
    - Mean river flow;
    - MALF and Q5 values; and
    - Typical low flow values (flows below the mean value) and duration of low flow periods.
2. FNDC to confirm their preferred option;
3. If Option 1 is chosen, then there are similar tertiary treatment systems which could be appropriate to remove solids and provide disinfection (i.e ultrafiltration membranes, etc). It is suggested that different combinations of tertiary treatments are investigated as part of the concept design; and
4. Refine costs to provide higher level of certainty for budgeting purposes, and during this process consider staging options to establish the costs to ratepayers over time.

6.0 LIMITATIONS

6.1 GENERAL

This report is for the use by Far North District Council only, and should not be used or relied upon by any other person or entity or for any other project.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and Harrison Grierson Consultants Limited. No responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

6.2 ESTIMATES

Should this report contain estimates for future works or services, physical or consulting, those estimates can only be considered current and will only reflect the extent to which the detail of the project is known to the consultant (feasibility, concept, preliminary, detailed, tender etc) at the time given.

The client is solely responsible for obtaining updated estimates from the consultant as the detail of the project evolves and/or as time elapses.

APPENDICES

APPENDIX 1
EFFLUENT QUALITY REQUIREMENTS CALCULATIONS

KAITAIA WWTP OPTIONS

Required Effluent Quality Calculations

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\420 Calculations\Kaitaia\[Copy of KatS - Logbook-gcb.xlsx]Main

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

Assumptions

Awanui River

Mean	3.7	m3/s	Note: Awanui River flow is based on NRC monitoring data from Awanui at School Cut monitoring site
Minimum	0.19	m3/s	Data from Sept 2018 - Sept 2020
7day MALF	0.19	m3/s	
Q5	0.48	m3/s	
Daily flow	322,254	m3/day	Based on mean flow
Future WWTP effluent	3,752	m3/day	Average flow from influent (data received from FNRC)

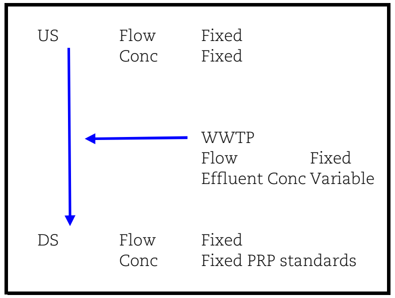
Median Concentrations

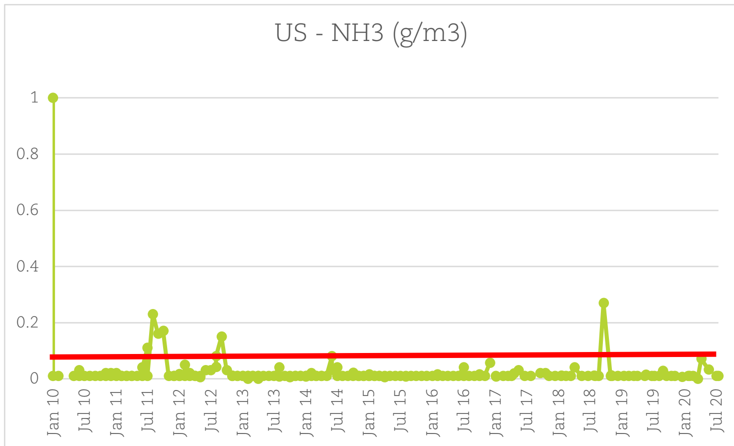
Notes:
Effluent concentrations are based on WWTP logbook data
Median effluent, US and DS values have been used to align with the PRP evaluation standards
Assuming Effluent Nitrates = DIN - NH3
See graphs for assumed US values for NH3
US nitrates concentration based on LAWA river quality data for 5 year median of Total Oxidised Nitrogen. Assuming 'all nitrites = nitrates' due to instability

Parameter	**Effluent**	**US**	**DS**	**PRP Limit (annual median)**	
cBOD5	62				
TSS	126				
TN*					
NH3-N*	11.77	0.08	0.03	0.24	
TP*					
DRP					
DIN	3				Only data available up until 2015
Nitrates	2	0.052		1	

NH3	**US**	**DS**	**WWTP Req**	
Flow (m3/day)	322,253.7	326,006.1	3752	
Concentration (g/m3)	0.08	0.24	**14.0**	g/m3
Load (kg/day)	25.8	78.2	52.5	

Nitrates	**US**	**DS**	**WWTP Req**	
Flow (m3/day)	322,253.7	326,006.1	3752	
Concentration (g/m3)	0.052	1	**82.4**	g/m3
Load (kg/day)	16.8	326.0	309.2	





APPENDIX 2
MCA (LONG LIST OF OPTIONS)

KAITAIA WWTP OPTIONS - Long List Assessment

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Long List\[Kaitaia Long List MCA-v3.0 PDF printing version.xlsx]Print 1

DATE: 16/09/20

HG PROJECT NUMBER: 1014-147856-01

No	Category	Criteria	Description	1		2		3		4		5	
				Status Quo		Minor Upgrades		Minor Upgrades		Minor Upgrades		Minor Upgrades	
				Do Nothing		Remove wetland + Upgrade septage receiving system + Configuring ponds in parallel with baffles + Rock filter + UV		Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		Remove wetland + Upgrade septage receiving system + Aerators + Tertiary treatment + Chemical dosing + UV		Remove wetland + Upgrade septage receiving system + Mechanical mixers + Microscreen/Disc filter + UV	
				Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment
1	Māori cultural values	Impacts on Māori cultural values and practices.	·Gives effect to Te Mana o te Wai. ·Acceptability of process to local iwi	R	Wetland is maintained, but in poor conditions. No improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is removed. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is removed. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is removed. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is removed. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.
2	Environmental values	Land Use Effects	·Visual, Noise, Traffic impacts	G	No additional visual, noise and traffic impact.	G	Minimum visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	G	Minimum visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	G	Minimum visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	G	Minimum visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.
		Odour	·The degree to which odour can be expected to be discharged beyond the property boundary.	O	Currently, receive complaints from farm on the North side of WWTP. Odour logbook also showing frequent issues. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.
		Ecological Effects	·The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	R	High risk of exceeding the nitrate, ammonia and E. Coli limits of the PRP. Plant may not have enough BOD removal capacity to deal with increasing loads in the future. Algal blooms in summer.	R	High risk of exceeding the nitrate, ammonia and E. Coli limits of the PRP. Plant may not have enough BOD removal capacity to deal with increasing loads in the future. Algal blooms in summer.	O	Low risk of exceeding the effluent quality limits of the PRP. No algal bloom issues in summer.	R	Risk of exceeding the nitrate and E.coli limits of the PRP. Algae handling issues in tertiary treatment may impact on the performance of the UV units.	R	Risk of exceeding the nitrate and E.coli limits of the PRP. Algae handling issues in filters may impact on the performance of the UV units.
		Carbon Footprint	·Level of energy consumption, secondary discharges and chemicals required.	G	No change from current system. Power requirements of pond based treatment system are relatively low. No chemical dosing required.	O	Relatively low additional power requirements for UV units and other equipment. No chemical dosing required. Power upgrade likely to be required.	R	Significant additional power requirements for aerators, clarifier, UV units, and other equipment. Chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for aerators, clarifier, UV units, and other equipment. Chemical dosing required. Significant power upgrade likely to be required.	O	Relatively low additional power requirements for mechanical mixers, UV units, and other equipment. No chemical dosing require/ Power upgrade likely to be required.
		Public Health	·Impacts on mahinga kai ·Recreational use of the receiving environment ·Impact of spills and failure	R	Risk to public health due to pathogens and viruses in the treated effluent. High concentrations of nutrients in the effluent and algae blooms can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	R	Risk to public health will be significantly reduced with UV disinfection treatment. UV performance may be impacted by algae blooms. Algae blooms and potential high concentrations of nutrients in the effluent can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	O	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	R	Risk to public health will be significantly reduced with UV disinfection treatment. UV performance may be impacted by algae issues in tertiary treatment. Potential high concentrations of nutrients in the effluent can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	R	Risk to public health will be significantly reduced with UV disinfection treatment. UV performance may be impacted by algae issues in the filtration stage. Potential high concentrations of nutrients in the effluent can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.
3	Practicability	Constructability	·Complexity of construction process ·Distance from networks and services ·Time taken to commission option	G	No construction/commissioning required.	O	Will require medium scale construction works. Easy to commission.	O	Will require medium scale construction works. Moderate difficulty to commission.	O	Will require medium to large scale construction works. Moderate difficulty to commission.	O	Will require medium scale construction works. Easy to commission.
		Regulations and Planning	·Complexity to obtain a consent or other authorisations	R	No additional consents required. Potentially challenging consent process due to inability to meet freshwater target standards.	R	No additional consents required. Potentially challenging consent process due to inability to meet freshwater target standards.	O	Building consent required (chemical plant). Chemicals might require a compliance certificate.	O	Building consent required (chemical plant and tertiary treatment). Chemicals might require a compliance certificate.	R	No additional consents required. Potentially challenging consent process due to inability to meet freshwater target standards.
		Staging	Can the option be staged?	G	No construction required.	R	Only minor upgrades are required. It is cost-effective to build them in one stage.	R	Only minor upgrades are required. It is cost-effective to build them in one stage.	R	Only minor upgrades are required. It is cost-effective to build them in one stage.	R	Only minor upgrades are required. It is cost-effective to build them in one stage.
4	Operability	The ease of operation and maintenance	·Complexity of operation ·Required expertise ·Ease of access ·H&S risks of plant process. ·Sludge management ·Reliance on and complexity of plant consumables and replacement componentry	G	No change from current system. De-sludging ponds is a laborious task. Poor-quality sludge.	G	Simple operation. Additional equipment would have to be maintained. Removing the wetland would eliminate the current difficulties to maintain it. De-sludging ponds is a laborious task. Poor-quality sludge.	O	Additional equipment would have to be maintained. The chemical plant adds complexity and H&S risks to the process and might require operator training . Removing the wetland would eliminate the current difficulties to maintain it. De-sludging ponds is a laborious task. Poor-quality sludge. Excess of sludge would also be removed from clarifier.	R	Additional equipment would have to be maintained. The chemical plant/tertiary treatment adds complexity and H&S risks to the process and might require operator training. Potential O&M issues due to algae blooms. Removing the wetland would eliminate the current difficulties to maintain it. De-sludging ponds is a laborious task. Poor-quality sludge.	R	Additional equipment would have to be maintained. O&M issues due to algae blooms. Removing the wetland would eliminate the current difficulties to maintain it. De-sludging ponds is a laborious task. Poor-quality sludge.
		Process reliability and resilience	·Known performance of others with similar technologies ·Consistency of quality in the discharge ·Ability to maintain compliance with resource consents	R	No change from current system. Compliance issues related to nutrients and E.coli removal.	R	Limited process control with pond-based treatment system. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be	O	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	O	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	R	Limited process control with pond-based treatment system. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be
		Expandability/ future proofing	·The potential for the site to allow for extensions to the treatment process ·Proofing against changes in compliance requirements	R	Pond-based technology is land intensive. Low flexibility to deal with changes in compliance requirements or to expand the plant.	R	Pond-based technology is land intensive. Low flexibility to deal with changes in compliance requirements or to expand the plant.	O	Pond-based technology is land intensive. Low flexibility to expand the plant. Aerators and chemical dosing add limited flexibility to deal with changes in compliance requirements.	O	Pond-based technology is land intensive. Low flexibility to expand the plant. Aerators and chemical dosing add limited flexibility to deal with changes in compliance requirements. Additional modules can be added to the tertiary treatment.	R	Pond-based technology is land intensive. Low flexibility to deal with changes in compliance requirements or to expand the plant. Additional filtration units can be added.
		Hazards	·Proximity to known and potential hazards, e.g., flood plains, climate change hazards	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.
5	Financial	Capital Cost	·Cost of implementation ·Site investigations and procurement of land ·Ability to reuse existing FNDC assets	G	No additional costs associated with this option.	G	Low comparative capital costs.	O	Medium comparative capital costs.	O	Medium comparative capital costs.	O	Medium comparative capital costs.
		Operating and Maintenance Costs	·Operations and maintenance requirements (e.g., chemical costs, sludge removal) ·Power cost	G	No additional costs associated with this option.	G	Low comparative O&M costs.	O	Medium comparative O&M costs.	R	Medium to high comparative O&M costs.	O	Medium comparative O&M costs. Updated
		Rating impact	·Impact on targeted rate relative to other options	G	No additional costs associated with this option.	G	Low comparative rate impact.	O	Medium comparative rate impact.	O	Medium comparative rate impact.	O	Low comparative rate impact.

Total Score	1	2	3	4	5
G	8	5	1	1	1
O	2	4	12	8	7
R	6	7	3	7	8

KAITAIA WWTP OPTIONS - Long List Assessment

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Long List\[Kaitaia Long List MCA-v3.0 PDF printing version.xlsx]Print 1

DATE: 16/09/20

HG PROJECT NUMBER: 1014-147856-01

				6		7		8		9		10	
				Major Upgrades		Major Upgrades		Major Upgrades		Major Upgrades		Major Upgrades	
				Decommission ponds and wetlands + New proprietary septage receiving system + FAST modules + UV		Upgrade wetland + New proprietary septage receiving system + Trickling filter and clarifier after pond 3 + Chemical dosing + UV		Upgrade wetland + New proprietary septage receiving system + Clarifier and aeration basin before ponds + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + MABR	
No	**Category**	**Criteria**	**Description**	**Score**	**Comment**	**Score**	**Comment**	**Score**	**Comment**	**Score**	**Comment**	**Score**	**Comment**
1	Māori cultural values	Impacts on Māori cultural values and practices.	· Gives effect to Te Mana o te Wai. · Acceptability of process to local iwi	R	Ponds (incl. wetland) are decommissioned. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is upgraded or replaced. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is upgraded or replaced. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Wetland is decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural values.	R	Ponds (incl. wetland) are decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural values.
2	Environmental values	Land Use Effects	· Visual, Noise, Traffic impacts	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.
		Odour	· The degree to which odour can be expected to be discharged beyond the property boundary.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.
		Ecological Effects	· The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	O	Low risk of exceeding the effluent quality limits of the PRP. No algal bloom issues in summer.	R	Risk of exceeding the nitrate and ammonia limits of the PRP. Algal bloom issues in summer, but algae is going to be removed in the clarification stage.	R	Risk of exceeding the nitrate and E.coli limits of the PRP. Algal bloom issues in summer.	O	Risk of exceeding the nitrate limit of the PRP. No algal bloom issues in summer.	G	Unlikely to exceed the effluent quality limits of the PRP. No algal bloom issues in summer.
		Carbon Footprint	· Level of energy consumption, secondary discharges and chemicals required.	R	Significant additional power requirements for aeration of FAST modules, UV units, and other equipment. No chemical dosing required. Significant power upgrade likely to be required.	O	Relatively low additional power requirements for trickling filter, UV units, and other equipment. Chemical dosing required. Power upgrade likely to be required.	R	Significant additional power requirements for aeration, UV units, and other equipment. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.
		Public Health	· Impacts on mahinga kai · Recreational use of the receiving environment · Impact of spills and failure	G	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Reduced risk of wastewater spray from FAST modules to beyond property boundary.	O	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	O	Risk to public health will be significantly reduced with UV disinfection treatment. UV performance may be impacted by algae blooms. Potential algae blooms and high concentration of nutrients in the effluent can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	R	Risk to public health will be significantly reduced with UV disinfection treatment. Potential high concentrations of nutrients in the effluent can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	G	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Reduced risk of wastewater spray from ponds to beyond property boundary as contained within smaller mechanical plant.
3	Practicability	Constructability	· Complexity of construction process · Distance from networks and services · Time taken to commission option	R	Will require large scale construction works. Moderate to high difficulty to commission.	R	Will require medium to large scale construction works. Moderate to high difficulty to commission.	O	Will require medium scale construction works. Moderate difficulty to commission.	R	Will require large scale construction works. Moderate to high difficulty to commission.	R	Will require large scale construction works. High difficulty to commission.
		Regulations and Planning	· Complexity to obtain a consent or other authorisations	O	Building consent required (sludge de-watering system).	R	Building consent required (chemical plant). Chemicals might require a compliance certificate. Not significant improvement in nitrification or denitrification, plant ability to met limits in low flow will be difficult. Potentially challenging	R	No additional consents required. Potentially challenging consent process due to inability to meet freshwater target standards.	O	No additional consents required. Potentially challenging consent process if inable to meet freshwater target standards.	O	Building consent required (sludge de-watering system).
		Staging	Can the option be staged?	G	FAST modules can be added to the system as required.	R	Major upgrades are required. It is cost-effective to build them in one stage.	R	Major upgrades are required. It is cost-effective to build them in one stage.	O	Installation of media can be modular.	R	MABR modules likely to be installed in one stage.
4	Operability	The ease of operation and maintenance	· Complexity of operation · Required expertise · Ease of access · H&S risks of plant process. · Sludge management · Reliance on and complexity of plant consumables and replacement componentry	R	The ponds and wetland would be decommissioned. The FAST modules add complexity to the process and are likely require operator training. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.	O	Additional equipment and upgraded wetland would have to be maintained. The chemical plant adds complexity and H&S risks to the process and might require operator training . De-sludging ponds is a laborious task. Poor-quality sludge. Excess of sludge would also be removed from clarifier.	O	Additional equipment and upgraded wetland would have to be maintained. De-sludging ponds is a laborious task. Poor-quality sludge. Excess of sludge would also be removed from clarifier.	R	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. In-pond system is difficult to access. Medium level complexity sludge management.	R	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.
		Process reliability and resilience	· Known performance of others with similar technologies · Consistency of quality in the discharge · Ability to maintain compliance with resource consents	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	R	Limited process control with pond-based treatment system without aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be	O	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	O	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Limited references of this technology.
		Expandability/ future proofing	· The potential for the site to allow for extensions to the treatment process · Proofing against changes in compliance requirements	G	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.	O	Pond-based technology is land intensive. Chemical dosing and trickling filter add some flexibility to deal with changes in compliance requirements. Additional trickling filters can be built for future expansion.	O	Pond-based technology is land intensive. Low flexibility to expand the plant. Aeration adds limited flexibility to deal with changes in compliance requirements.	G	Pond-based technology is land intensive. Further modules could be installed within the ponds for future expansion. Some flexibility to adjust treatment according to new compliance requirements.	G	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.
		Hazards	· Proximity to known and potential hazards, e.g., flood plains, climate change hazards	O	WWTP is in a flood plan. Risk of avian botulism. Reduced cyanobacteria risk as not a pond system.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. Reduced cyanobacteria risk as not a pond system.
5	Financial	Capital Cost	· Cost of implementation · Site investigations and procurement of land · Ability to reuse existing FNDC assets	R	Medium to high comparative capital costs.	O	Medium comparative capital costs.	O	Medium comparative capital costs.	O	Medium comparative capital costs.	R	High comparative capital costs.
		Operating and Maintenance Costs	· Operations and maintenance requirements (e.g., chemical costs, sludge removal) · Power cost	R	Medium to high comparative O&M costs.	O	Medium comparative O&M costs.	O	Medium comparative O&M costs.	O	Medium comparative O&M costs.	R	High comparative O&M costs.
		Rating impact	· Impact on targeted rate relative to other options	R	Medium to high comparative rate impact.	O	Medium comparative rate impact.	O	Medium comparative rate impact.	O	Medium comparative rate impact.	R	High comparative rate impact.
				Total Score		**Total Score**		**Total Score**		**Total Score**		**Total Score**	
				4		0		0		1		4	
				5		10		11		10		4	
				7		6		5		5		8	

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Multi Criteria Analysis

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DATE: 16/09/20

HG PROJECT NUMBER: 1014-147856-01

No	Category	Criteria	Description	11 Major Upgrades		12 Major Upgrades		13 Side Stream Treatment Plant		14 Industrial Re-use		15 Alternative Upgrade	
				New proprietary septage receiving system + IDAL		New proprietary septage receiving system + BNR		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended for discharge.		Portion of effluent treated by mechanical plant and re-used by industry close by that is willing to take wastewater. Remaining wastewater treated through existing pond system.		Following maturation pond 2, Electrocoagulation + Clarifier	
				Score	Comment	Score	Comment	Score	Comment	Score	Comment	Score	Comment
1	Māori cultural values	Impacts on Māori cultural values and practices.	· Gives effect to Te Mana o te Wai. · Acceptability of process to local iwi	R	Wetland is decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural values.	R	Ponds (incl. wetland) are decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural	R	Wetland is maintained, but in poor conditions. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	R	Ponds (incl. wetland) are decommissioned. A portion of effluent would still be discharged to the water body as industry may not take all effluent. Potentially reduced affect on food gathering activities and flora and fauna of the Awanui River. Discharge to waterbody does not reflect cultural	R	Wetland is maintained, but in poor conditions. Minimal evidence of technology used for treatment of municipal wastewater therefore uncertain regarding the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural
2	Environmental values	Land Use Effects	· Visual, Noise, Traffic impacts	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	O	Small visual, noise and traffic impact. Installation and construction of the mechanical plant may result in some disruption of the community. The Kaitaia WWTP is in a remote rural area with few	R	Medium visual, noise and traffic impact, mostly related to building a pipeline from the WWTP to the industry.	O	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.
		Odour	· The degree to which odour can be expected to be discharged beyond the property boundary.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Still an open-to-air treatment system. Option does not resolve odour issue.	O	Part of wastewater still treated through open-to-air treatment system. Options does not resolve odour issue.	O	Part of wastewater still treated through open treatment system. Options does not resolve odour issue.
		Ecological Effects	· The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	G	Unlikely to exceed the effluent quality limits of the PRP. No algal bloom issues in summer.	G	Unlikely to exceed the effluent quality limits of the PRP. No algal bloom issues in summer.	O	Unlikely to exceed the effluent quality limits of the PRP. Reduced algal bloom issues in summer.	O	A portion of discharge will still go to the river. Therefore, may lead to some ecological effects.	R	High risk of exceeding the nitrate, ammonia and E. Coli limits of the PRP. Plant is likely to do not have enough BOD removal capacity to deal with increasing loads in the future. Algal bloom issues in summer.
		Carbon Footprint	· Level of energy consumption, secondary discharges and chemicals required.	R	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for smaller mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	R	Significant additional power requirements for electrocoagulation plant. No chemical dosing required. Significant power upgrade likely to be required.
		Public Health	· Impacts on mahinga kai · Recreational use of the receiving environment · Impact of spills and failure	G	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	G	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Reduced risk of wastewater spray from ponds to beyond property boundary as contained within smaller mechanical plant.	O	Risk to public health will be significantly reduced with UV disinfection treatment. Potential algae blooms can impact on food gathering activities. Reduced risk of wastewater spray from ponds to beyond property boundary as contained within smaller mechanical plant.	O	Risk to public health will be reduced with UV disinfection treatment. A portion of effluent would still be discharged to the water body as industry may not take all effluent. Potentially reduced affect on food gathering activities and flora and fauna of the Awanui River. Therefore, some effect on food gathering activities. Reduced risk of wastewater spray from ponds to beyond property boundary as contained within smaller mechanical plant.	R	Risk to public health due to pathogens and viruses in the treated effluent. High concentrations of nutrients in the effluent and algae blooms can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.
3	Practicability	Constructability	· Complexity of construction process · Distance from networks and services · Time taken to commission option	O	Will require medium scale construction works. Medium difficulty to commission.	R	Will require large scale construction works. High difficulty to commission.	R	Will require medium to large scale construction works. High difficulty to commission.	R	Will require large scale construction works. High difficulty to commission.	R	Will require medium scale construction works. High difficulty to commission due to limited experience or exposure of technology in NZ
		Regulations and Planning	· Complexity to obtain a consent or other authorisations	O	Building consent required (sludge de-watering system).	O	Building consent required (sludge de-watering system).	O	Building consent required (sludge de-watering system and tertiary treatment).	R	Building consent required (sludge de-watering system). Consents will be required for the construction of pipeline. FNDC would need to obtain permission of owners to cross private land (if required).	O	No additional consents required. Potentially challenging consent process due to freshwater target standards.
		Staging	Can the option be staged?	R	IDAL installation cannot be staged.	O	BNR streams can be added to the system as required.	O	Modular mechanical plants can be added to the system as required.	R	Modular mechanical plants can be added to the system as required. Due to pipeline construction likely to be completed in one stage.	R	Electrocoagulation cannot be staged.
4	Operability	The ease of operation and maintenance	· Complexity of operation · Required expertise · Ease of access · H&S risks of plant process. · Sludge management · Reliance on and complexity of plant consumables and replacement componentry	O	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.	R	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.	R	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. O&M of two WWTPs. Medium level complexity sludge management.	R	Operating and maintaining the mechanical plant and long pipeline adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.	R	Operating and maintaining the electrocoagulation system adds complexity to the process. This system is likely to require more intensive operator involvement. May cause resourcing issues. Medium to high level complexity sludge management especially with chemical sludge.
		Process reliability and resilience	· Known performance of others with similar technologies · Consistency of quality in the discharge · Ability to maintain compliance with resource consents	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	G	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	R	Limited knowledge on technology and performance for large scale municipal wastewater treatment in NZ.
		Expandability/ future proofing	· The potential for the site to allow for extensions to the treatment process · Proofing against changes in compliance requirements	O	Pond-based technology is land intensive. Limited flexibility to expand system. Some flexibility to adjust treatment according to new compliance requirements.	G	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.	G	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.	G	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.	R	Smaller footprint of electrocoagulation plant. Uncertain on sizing due to proprietary design.
		Hazards	· Proximity to known and potential hazards, e.g., flood plains, climate change hazards	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. Reduced cyanobacteria risk as not a pond system.	O	WWTP is in a flood plan. Risk of avian botulism. Reduced cyanobacteria risk as not a pond system.	O	Portion of effluent still required to be treated a WWTP. WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk.	O	WWTP is in a flood plan. Risk of avian botulism. As pond based system, has high cyanobacteria risk. Electrical currents and chemical may pose hazardous risks.
5	Financial	Capital Cost	· Cost of implementation · Site investigations and procurement of land · Ability to reuse existing FNDC assets	O	Medium to high comparative capital costs.	R	Medium to high comparative capital costs.	O	Medium comparative capital costs.	R	High comparative capital costs. Would require high effluent quality requirements for re-use	R	High comparative capital costs.
		Operating and Maintenance Costs	· Operations and maintenance requirements (e.g., chemical costs, sludge removal) · Power cost	O	Medium to high comparative O&M costs.	R	High comparative O&M costs.	O	Medium comparative O&M costs.	R	High comparative O&M costs.	R	High comparative O&M costs due to chemical dosing and sludge removal.
		Rating impact	· Impact on targeted rate relative to other options	O	Medium to high comparative rate impact.	R	Medium to high comparative rate impact.	O	Medium comparative rate impact.	R	High comparative rate impact.	R	High comparative rate impact.
				Total Score		Total Score		Total Score		Total Score		Total Score	
				3		4		2		2		0	
				10		5		10		4		4	
				3		7		4		10		12	

APPENDIX 3
PRELIMINARY LONG LIST OF OPTIONS

TABLE 19: PRELIMINARY LONG LIST OF OPTIONS.	
UPGRADE PURPOSE	**OPTIONS**
BOD Removal	• Do nothing (status quo) • Configuring 3 ponds in parallel with baffles as necessary[5] • Aerators in pond 1 + ponds 2 and 3 divided into cells[1] • In pond aeration combined with an attached growth system (e.g. AquaMats)[1] • Replace ponds with BNR[1] • FAST modules in pond 3[1] • Trickling filter and clarifier after pond 3[1] • Add mechanical mixers[6] • Install new primary clarifier and aeration basin before oxidation pond[2] • MABR modules[2] • IDAL
Solids Removal	• Do nothing (status quo) • Rapid Gravity Sand Filter (RGF)[7] • Continuous Up-flow Sand Filter (COUF)[3] • Micro-screen or disc filter[3] • Actiflo (Sand-ballasted Clarifier)[3] • Dissolved Air Flotation (DAF)[3] • Rock filter[1] • Clarifier after pond 3[1] • Work filters after pond 3[1] • Trickling filter and clarifier after pond 3[1] • IDAL
Nitrogen Removal Nitrogen Removal	• Do nothing (status quo) • Configuring 3 ponds in parallel with baffles as necessary[1] • Aerators in pond 1 + ponds 2 and 3 divided into cells[1] • Replace ponds with biological nutrients removal plant[1] • FAST modules in pond 3[1] • Install new primary clarifier and aeration basin before oxidation pond[2] • MABR modules[2] • IDAL
Phosphorus Removal	• Do nothing (status quo) • Clarifier after pond 3[1] • Work filters after pond 3[1] • Actiflo (Sand-ballasted Clarifier)[3] • Replace ponds with biological nutrient removal plant[1] • Chemical dosing • Chemical dosing and rock filter • IDAL
Algae Removal Algae Removal	• Do nothing (status quo) • Surface aerators/mixers + inlet/outlet pipe reconfiguration + curtain and baffles[8] • Add mechanical mixers[2]
Disinfection	• Do nothing (status quo) • UV

[5] MWH. (2004). *Kaitaia Wastewater Treatment - Options for Upgrading.*

[6] Morphum Environmental Ltd. (2020). *Kaitaia WWTP Performance Advice (Draft).*

[7] Harrison Grierson. (2006). *Tertiary Treatment Optioneering Report.*

[8] Harrison Grierson. (2006). *Algal Event Management and Mitigation Report.*

TABLE 19: PRELIMINARY LONG LIST OF OPTIONS.

UPGRADE PURPOSE	OPTIONS
Septage Reception System	• Do nothing (status quo) • Upgrade existing septage receiving system[2] • Install a proprietary septage receiving system[2] • Install a combined septage receiving and screening system[2] • Extend the road to allow direct disposal into the Rotomat screen[2]
Other Plant Modifications	• Remove wetland [2] • Maintain and reconfigure wetland [2] • Replace/upgrade wetland [2] • De-sludging of ponds[2] • Infiltration & Inflow (I&I) Reduction* • Electrocoagulation and Clarifier after ponds
Trade Waste	• Do nothing (status quo) • Discontinue trade waste.

**It was assumed that I&I reduction options are being explored separately from the WWTP upgrade. This option will not be considered further.*

APPENDIX 4
MCA (SHORT LIST OF OPTIONS) AND SENSITIVITY ANALYSIS

KAITAIA WWTP OPTIONS - Short List Assessment

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

					Minor Upgrades			Major Upgrades			Major Upgrades			Side Stream Treatment Plant		
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV			New proprietary septage receiving system + In-pond aeration combined with an attached growth system			New proprietary septage receiving system + IDAL			Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended for discharge.		
No	**Category**	**Weightage**	**Criteria**	**Description**	**Score**	**Weighted Score**	**Comment**	**Score**	**Weighted Score**	**Comment**	**Score**	**Weighted Score**	**Comment**	**Score**	**Weighted Score**	**Comment**
1	Māori cultural values	20%	Impacts on Māori cultural values and practices.	·Gives effect to Te Mana o te Wai. ·Acceptability of process to local iwi	3.00	6.00	Wetland is removed. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.	3.00	6.00	Wetland is decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural values.	3.00	6.00	Wetland is decommissioned. Significant improvement in the quality of the effluent being discharged to the waterbody. High quality effluent would be unlikely to effect potential food gathering activities and flora and fauna. Discharge to waterbody does not reflect cultural values.	3.00	6.00	Wetland is maintained, but in poor conditions. Improvement in the quality of the effluent being discharged to the waterbody. Discharge to waterbody does not reflect cultural values.
						6.00			6.00			6.00			6.00	
2	Environmental values	2%	Land Use Effects	·Visual, Noise, Traffic impacts	8.00	1.60	Minimum visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	6.00	1.20	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	6.00	1.20	Small visual, noise and traffic impact. The Kaitaia WWTP is in a remote rural area with few nearby farms.	6.00	1.20	Small visual, noise and traffic impact. Installation and construction of the mechanical plant may result in some disruption of the community. The Kaitaia WWTP is in a remote rural area with few nearby farms.
		3%	Odour	·The degree to which odour can be expected to be discharged beyond the property boundary.	3.00	0.90	Still an open-to-air treatment system. Option does not resolve odour issue.	3.00	0.90	Still an open-to-air treatment system. Option does not resolve odour issue.	3.00	0.90	Still an open-to-air treatment system. Option does not resolve odour issue.	3.00	0.90	Still an open-to-air treatment system. Option does not resolve odour issue.
		10%	Ecological Effects	·The degree to which the effluent quality exceeds the minimum environmental and consent requirements.	6.00	6.00	Risk of exceeding the effluent quality limits of the PRP. During low river flows, there may be a greater impact on the environment with increased risk of algal blooms. WWTP can hold flows in the pond if required.	6.00	6.00	Risk of exceeding the nitrate limit of the PRP. During low river flows, there may be a greater impact on the environment with increased risk of algal blooms. WWTP can hold flows in the pond if required.	9.00	9.00	Unlikely to exceed the effluent quality limits of the PRP. During low river flows, there may be a greater impact on the environment with increased risk of algal blooms. WWTP can hold flows in the pond if required.	6.00	6.00	Unlikely to exceed the effluent quality limits of the PRP. Reduced algal bloom issues in summer. During low river flows, there may be a greater impact on the environment. WWTP can hold flows in the pond if required or could adjust proportions of flows
		3%	Carbon Footprint	·Level of energy consumption, secondary discharges and chemicals required.	5.00	1.50	Significant additional power requirements for aerators, clarifier, UV units, and other equipment. Chemical dosing required. Significant power upgrade likely to be	5.00	1.50	Significant additional power requirements for mechanical plant. No chemical dosing required. Significant power upgrade likely to be required.	3.00	0.90	Significant additional power requirements for mechanical plant. Polymer dosing required for sludge de-watering system. Significant power upgrade likely to be required.	3.00	0.90	Significant additional power requirements for mechanical plant. Polymer dosing required for sludge de-watering system. Significant power upgrade likely to be required.
		4%	Public Health	·Impacts on mahinga kai ·Recreational use of the receiving environment ·Impact of spills and failure	5.00	2.00	Risk to public health will be significantly reduced with UV disinfection treatment. Potential high concentrations of nutrients in the effluent can impact on food gathering activities. Potential algae blooms can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	5.00	2.00	Risk to public health will be significantly reduced with UV disinfection treatment. Potential high concentrations of nutrients in the effluent can impact on food gathering activities. Potential algae blooms can impact on food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	8.00	3.20	Risk to public health will be significantly reduced with UV disinfection treatment. High quality effluent is unlikely to affect food gathering activities. Risk of wastewater spray from ponds to beyond property boundary.	5.00	2.00	Risk to public health will be significantly reduced with UV disinfection treatment. Potential algae blooms can impact on food gathering activities. Reduced risk of wastewater spray from ponds to beyond property boundary as contained within smaller mechanical plant.
						12.00			11.60			15.20			11.00	
3	Practicability	4%	Constructability	·Complexity of construction process ·Distance from networks and services ·Time taken to commission option	6.00	2.40	Will require medium scale construction works. Moderate difficulty to commission.	6.00	2.40	Will require large scale construction works. Moderate to high difficulty to commission.	4.00	1.60	Will require medium scale construction works. Medium difficulty to commission.	6.00	2.40	Will require medium to large scale construction works. High difficulty to commission.
		7%	Regulations and Planning	·Complexity to obtain a consent or other authorisations	4.00	2.80	Building consent required (chemical plant). Chemicals might require a compliance certificate. Potentially challenging consent process if unable to meet freshwater target standards.	4.00	2.80	No additional consents required. Potentially challenging consent process if unable to meet freshwater target standards.	6.00	4.20	Building consent required (sludge de-watering system). Chemicals might require a compliance certificate.	5.00	3.50	Building consent required (sludge de-watering system). Chemicals might require a compliance certificate. Potentially challenging consent process if unable to meet freshwater target standards. Potential to adjust proportion of flows through mechanical plant to
		3%	Staging	Can the option be staged?	8.00	2.40	Could be staged, however may be cost-effective to build them in one stage.	6.00	1.80	Installation of media can be modular.	3.00	0.90	IDAL installation cannot be staged.	8.00	2.40	Modular mechanical plants can be added to the system as required.
						7.60			7.00			6.70			8.30	
4	Operability	6%	The ease of operation and maintenance	·Complexity of operation ·Required expertise ·Ease of access ·H&S risks of plant process. ·Sludge management ·Reliance on and complexity of plant consumables and replacement componentry	6.00	3.60	Additional equipment would have to be maintained. The chemical plant adds complexity and H&S risks to the process and might require operator training . Removing the wetland would eliminate the current difficulties to maintain it. De-sludging ponds is a laborious task. Poor-quality sludge. Excess of sludge would also be removed from clarifier.	4.00	2.40	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. In-pond system is difficult to access. Medium level complexity sludge management.	6.00	3.60	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. Removing the wetland would eliminate the current difficulties to maintain it. Medium level complexity sludge management.	3.00	1.80	Operating and maintaining the mechanical plant adds complexity to the process. Mechanical plant is likely to require more intensive operator involvement. May cause resourcing issues. O&M of two WWTPs. Medium level complexity sludge management.
		6%	Process reliability and resilience	·Known performance of others with similar technologies ·Consistency of quality in the discharge ·Ability to maintain compliance with resource consents	5.00	3.00	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	6.00	3.60	Improvement in process control through aeration. Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance. Efficacy of treatment technology is dependent of pond sludge. Sludge is therefore a risk and quantity and costs for desludging are yet to be determined.	8.00	4.80	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.	7.00	4.20	Consistency in effluent quality will improve as a result of the treatment upgrade. Known technology with reliable performance.
		5%	Expandability/ future proofing	·The potential for the site to allow for extensions to the treatment process ·Proofing against changes in compliance requirements	4.00	2.00	Pond-based technology is land intensive. Low flexibility to expand the plant. Aerators and chemical dosing add limited flexibility to deal with changes in compliance requirements.	4.00	2.00	Pond-based technology is land intensive. Further modules could be installed within the ponds for future expansion. Some flexibility to adjust treatment according to new compliance requirements.	8.00	4.00	Some flexibility to expand system. Some flexibility to adjust treatment according to new compliance requirements.	9.00	4.50	Modularity and smaller footprint of mechanical plant will increase options for future expansion of the treatment system compared to a pond-based system.
		3%	Hazards	·Proximity to known and potential hazards, e.g., flood plains, climate change hazards	5.00	1.50	WWTP is in a flood plan. Risk of avian botulism. Low cyanobacteria risk: one pond decommissioned and remaining ponds aerated.	5.00	1.50	WWTP is in a flood plan. Risk of avian botulism. Low cyanobacteria risk: one pond decommissioned and remaining ponds aerated.	5.00	1.50	WWTP is in a flood plan. Risk of avian botulism. Low cyanobacteria discharge risk as one pond would be decommissioned and the second pond would be aerated (IDAL system).	3.00	0.90	WWTP is in a flood plan. Risk of avian botulism. Reduced cyanobacteria risk as only half of the waste flow would go to the ponds.
						10.10			9.50			13.90			11.40	
5	Financial	9%	Capital Cost	·Cost of implementation ·Site investigations and procurement of land ·Ability to reuse existing FNDC assets	10.00	9.00	$4.5M - $6.2M	6.00	5.40	$11.1M - $15.2M	8.00	7.20	$8.3M - $11.4M	5.00	4.50	$12.9M - $16.8M
		9%	Operating and Maintenance Costs	·Operations and maintenance requirements (e.g., chemical costs, sludge removal) ·Power cost	8.00	7.20	$500k - $680k	10.00	9.00	$270K - $370K	5.00	4.50	$780K - $1.1M	8.00	7.20	$550K - $760k
		6%	Rating impact	·Impact on targeted rate relative to other options	9.00	5.40	Medium comparative rate impact.	7.00	4.20	Medium comparative rate impact.	5.00	3.00	Medium to high comparative rate impact. - High operating cost over time	5.00	3.00	Medium comparative rate impact.
						21.60			18.60			14.70			14.70	
					57.30		**Total Score**	52.70		**Total Score**	56.50		**Total Score**	51.40		

KAITAIA WWTP

Multi Criteria Analysis - Summary

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

				Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
				Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	Māori cultural values	20%	Impacts on Māori cultural values and practices.	3.00	6.00	3.00	6.00	3.00	6.00	3.00	6.00
					6.00		6.00		6.00		6.00
2	Environmental values	2%	Land Use Effects	8.00	1.60	6.00	1.20	6.00	1.20	6.00	1.20
		3%	Odour	3.00	0.90	3.00	0.90	3.00	0.90	3.00	0.90
		10%	Ecological Effects	6.00	6.00	6.00	6.00	9.00	9.00	6.00	6.00
		3%	Carbon Footprint	5.00	1.50	5.00	1.50	3.00	0.90	3.00	0.90
		4%	Public Health	5.00	2.00	5.00	2.00	8.00	3.20	5.00	2.00
					12.00		11.60		15.20		11.00
3	Practicability	4%	Constructability	6.00	2.40	6.00	2.40	4.00	1.60	6.00	2.40
		7%	Regulations and Planning	4.00	2.80	4.00	2.80	6.00	4.20	5.00	3.50
		3%	Staging	8.00	2.40	6.00	1.80	3.00	0.90	8.00	2.40
					7.60		7.00		6.70		8.30
4	Operability	6%	The ease of operation and maintenance	6.00	3.60	4.00	2.40	6.00	3.60	3.00	1.80
		6%	Process reliability and resilience	5.00	3.00	6.00	3.60	8.00	4.80	7.00	4.20
		5%	Expandability/ future proofing	4.00	2.00	4.00	2.00	8.00	4.00	9.00	4.50
		3%	Hazards	5.00	1.50	5.00	1.50	5.00	1.50	3.00	0.90
					10.10		9.50		13.90		11.40
5	Financial	9%	Capital Cost	10.00	9.00	6.00	5.40	8.00	7.20	5.00	4.50
		9%	Operating and Maintenance Costs	8.00	7.20	10.00	9.00	5.00	4.50	8.00	7.20
		6%	Rating impact	9.00	5.40	7.00	4.20	5.00	3.00	5.00	3.00
					21.60		18.60		14.70		14.70
					57.30		52.70		56.50		51.40

KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 1 Weighting*	*Difference*
Māori cultural values	20%	30%	10%
Environmental values	22%	32%	10%
Practicability	14%	9%	-5%
Operability	20%	15%	-5%
Financial	24%	14%	-10%
	100%	100%	

					Minor Upgrades		**Major Upgrades**		**Major Upgrades**		**Side Stream Treatment Plant**	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		**New proprietary septage receiving system + In-pond aeration combined with an attached growth system**		**New proprietary septage receiving system + IDAL**		**Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.**	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	30%	Impacts on Māori cultural values and practices.	3.00	9.00	3.00	9.00	3.00	9.00	3.00	9.00
						9.00		9.00		9.00		9.00
2	**Non-Technical**	Environmental values	4%	Land Use Effects	8.00	3.20	6.00	2.40	6.00	2.40	6.00	2.40
			5%	Odour	3.00	1.50	3.00	1.50	3.00	1.50	3.00	1.50
			12%	Ecological Effects	6.00	7.20	6.00	7.20	9.00	10.80	6.00	7.20
			5%	Carbon Footprint	5.00	2.50	5.00	2.50	3.00	1.50	3.00	1.50
			6%	Public Health	5.00	3.00	5.00	3.00	8.00	4.80	5.00	3.00
						17.40		16.60		21.00		15.60
3	**Technical**	Practicability	2%	Constructability	6.00	1.20	6.00	1.20	4.00	0.80	6.00	1.20
			5%	Regulations and Planning	4.00	2.00	4.00	2.00	6.00	3.00	5.00	2.50
			2%	Staging	8.00	1.60	6.00	1.20	3.00	0.60	8.00	1.60
						4.80		4.40		4.40		5.30
4	**Technical**	Operability	4%	The ease of operation and maintenance	6.00	2.40	4.00	1.60	6.00	2.40	3.00	1.20
			5%	Process reliability and resilience	5.00	2.50	6.00	3.00	8.00	4.00	7.00	3.50
			4%	Expandability/ future proofing	4.00	1.60	4.00	1.60	8.00	3.20	9.00	3.60
			2%	Hazards	5.00	1.00	5.00	1.00	5.00	1.00	3.00	0.60
						7.50		7.20		10.60		8.90
5	**Management**	Financial	6%	Capital Cost	10.00	6.00	6.00	3.60	8.00	4.80	5.00	3.00
			5%	Operating and Maintenance Costs	8.00	4.00	10.00	5.00	5.00	2.50	8.00	4.00
			3%	Rating impact	9.00	2.70	7.00	2.10	5.00	1.50	5.00	1.50
						12.70		10.70		8.80		8.50
					51.40		47.90		53.80		47.30	

KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 1a Weighting*	*Difference*
Māori cultural values	20%	30%	10%
Environmental values	22%	32%	10%
Practicability	14%	5%	-9%
Operability	20%	9%	-11%
Financial	24%	24%	0%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	30%	Impacts on Māori cultural values and practices.	3.00	9.00	3.00	9.00	3.00	9.00	3.00	9.00
						9.00		9.00		9.00		9.00
2	**Non-Technical**	Environmental values	4%	Land Use Effects	8.00	3.20	6.00	2.40	6.00	2.40	6.00	2.40
			5%	Odour	3.00	1.50	3.00	1.50	3.00	1.50	3.00	1.50
			12%	Ecological Effects	6.00	7.20	6.00	7.20	9.00	10.80	6.00	7.20
			5%	Carbon Footprint	5.00	2.50	5.00	2.50	3.00	1.50	3.00	1.50
			6%	Public Health	5.00	3.00	5.00	3.00	8.00	4.80	5.00	3.00
						17.40		16.60		21.00		15.60
3	**Technical**	Practicability	1%	Constructability	6.00	0.60	6.00	0.60	4.00	0.40	6.00	0.60
			3%	Regulations and Planning	4.00	1.20	4.00	1.20	6.00	1.80	5.00	1.50
			1%	Staging	8.00	0.80	6.00	0.60	3.00	0.30	8.00	0.80
						2.60		2.40		2.50		2.90
4	**Technical**	Operability	3%	The ease of operation and maintenance	6.00	1.80	4.00	1.20	6.00	1.80	3.00	0.90
			3%	Process reliability and resilience	5.00	1.50	6.00	1.80	8.00	2.40	7.00	2.10
			2%	Expandability/ future proofing	4.00	0.80	4.00	0.80	8.00	1.60	9.00	1.80
			1%	Hazards	5.00	0.50	5.00	0.50	5.00	0.50	3.00	0.30
						4.60		4.30		6.30		5.10
5	**Management**	Financial	9%	Capital Cost	10.00	9.00	6.00	5.40	8.00	7.20	5.00	4.50
			9%	Operating and Maintenance Costs	8.00	7.20	10.00	9.00	5.00	4.50	8.00	7.20
			6%	Rating impact	9.00	5.40	7.00	4.20	5.00	3.00	5.00	3.00
						21.60		18.60		14.70		14.70
					55.20		50.90		53.50		47.30	

KAITAIA WWTP

Multi Criteria Analysis

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DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 1b Weighting*	*Difference*
Māori cultural values	20%	30%	10%
Environmental values	22%	32%	10%
Practicability	14%	14%	0%
Operability	20%	20%	0%
Financial	24%	4%	-20%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	30%	Impacts on Māori cultural values and practices.	3.00	9.00	3.00	9.00	3.00	9.00	3.00	9.00
						9.00		9.00		9.00		9.00
2	**Non-Technical**	Environmental values	4%	Land Use Effects	8.00	3.20	6.00	2.40	6.00	2.40	6.00	2.40
			5%	Odour	3.00	1.50	3.00	1.50	3.00	1.50	3.00	1.50
			12%	Ecological Effects	6.00	7.20	6.00	7.20	9.00	10.80	6.00	7.20
			5%	Carbon Footprint	5.00	2.50	5.00	2.50	3.00	1.50	3.00	1.50
			6%	Public Health	5.00	3.00	5.00	3.00	8.00	4.80	5.00	3.00
						17.40		16.60		21.00		15.60
3	**Technical**	Practicability	4%	Constructability	6.00	2.40	6.00	2.40	4.00	1.60	6.00	2.40
			7%	Regulations and Planning	4.00	2.80	4.00	2.80	6.00	4.20	5.00	3.50
			3%	Staging	8.00	2.40	6.00	1.80	3.00	0.90	8.00	2.40
						7.60		7.00		6.70		8.30
4	**Technical**	Operability	6%	The ease of operation and maintenance	6.00	3.60	4.00	2.40	6.00	3.60	3.00	1.80
			6%	Process reliability and resilience	5.00	3.00	6.00	3.60	8.00	4.80	7.00	4.20
			5%	Expandability/ future proofing	4.00	2.00	4.00	2.00	8.00	4.00	9.00	4.50
			3%	Hazards	5.00	1.50	5.00	1.50	5.00	1.50	3.00	0.90
						10.10		9.50		13.90		11.40
5	**Management**	Financial	2%	Capital Cost	10.00	2.00	6.00	1.20	8.00	1.60	5.00	1.00
			1%	Operating and Maintenance Costs	8.00	0.80	10.00	1.00	5.00	0.50	8.00	0.80
			1%	Rating impact	9.00	0.90	7.00	0.70	5.00	0.50	5.00	0.50
						3.70		2.90		2.60		2.30
					47.80		45.00		53.20		46.60	

KAITAIA WWTP

Multi Criteria Analysis

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DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 2 Weighting*	*Difference*
Māori cultural values	20%	15%	-5%
Environmental values	22%	17%	-5%
Practicability	14%	24%	10%
Operability	20%	30%	10%
Financial	24%	14%	-10%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	15%	Impacts on Māori cultural values and practices.	3.00	4.50	3.00	4.50	3.00	4.50	3.00	4.50
						4.50		4.50		4.50		4.50
2	**Non-Technical**	Environmental values	1%	Land Use Effects	8.00	0.80	6.00	0.60	6.00	0.60	6.00	0.60
			2%	Odour	3.00	0.60	3.00	0.60	3.00	0.60	3.00	0.60
			9%	Ecological Effects	6.00	5.40	6.00	5.40	9.00	8.10	6.00	5.40
			2%	Carbon Footprint	5.00	1.00	5.00	1.00	3.00	0.60	3.00	0.60
			3%	Public Health	5.00	1.50	5.00	1.50	8.00	2.40	5.00	1.50
						9.30		9.10		12.30		8.70
3	**Technical**	Practicability	7%	Constructability	6.00	4.20	6.00	4.20	4.00	2.80	6.00	4.20
			11%	Regulations and Planning	4.00	4.40	4.00	4.40	6.00	6.60	5.00	5.50
			6%	Staging	8.00	4.80	6.00	3.60	3.00	1.80	8.00	4.80
						13.40		12.20		11.20		14.50
4	**Technical**	Operability	9%	The ease of operation and maintenance	6.00	5.40	4.00	3.60	6.00	5.40	3.00	2.70
			9%	Process reliability and resilience	5.00	4.50	6.00	5.40	8.00	7.20	7.00	6.30
			8%	Expandability/ future proofing	4.00	3.20	4.00	3.20	8.00	6.40	9.00	7.20
			4%	Hazards	5.00	2.00	5.00	2.00	5.00	2.00	3.00	1.20
						15.10		14.20		21.00		17.40
5	**Management**	Financial	6%	Capital Cost	10.00	6.00	6.00	3.60	8.00	4.80	5.00	3.00
			5%	Operating and Maintenance Costs	8.00	4.00	10.00	5.00	5.00	2.50	8.00	4.00
			3%	Rating impact	9.00	2.70	7.00	2.10	5.00	1.50	5.00	1.50
						12.70		10.70		8.80		8.50
						55.00		50.70		57.80		53.60

KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 2a Weighting*	*Difference*
Māori cultural values	20%	10%	-10%
Environmental values	22%	12%	-10%
Practicability	14%	24%	10%
Operability	20%	30%	10%
Financial	24%	24%	0%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	10%	Impacts on Māori cultural values and practices.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
						3.00		3.00		3.00		3.00
2	**Non-Technical**	Environmental values	1%	Land Use Effects	8.00	0.80	6.00	0.60	6.00	0.60	6.00	0.60
			1%	Odour	3.00	0.30	3.00	0.30	3.00	0.30	3.00	0.30
			6%	Ecological Effects	6.00	3.60	6.00	3.60	9.00	5.40	6.00	3.60
			2%	Carbon Footprint	5.00	1.00	5.00	1.00	3.00	0.60	3.00	0.60
			2%	Public Health	5.00	1.00	5.00	1.00	8.00	1.60	5.00	1.00
						6.70		6.50		8.50		6.10
3	**Technical**	Practicability	7%	Constructability	6.00	4.20	6.00	4.20	4.00	2.80	6.00	4.20
			11%	Regulations and Planning	4.00	4.40	4.00	4.40	6.00	6.60	5.00	5.50
			6%	Staging	8.00	4.80	6.00	3.60	3.00	1.80	8.00	4.80
						13.40		12.20		11.20		14.50
4	**Technical**	Operability	9%	The ease of operation and maintenance	6.00	5.40	4.00	3.60	6.00	5.40	3.00	2.70
			9%	Process reliability and resilience	5.00	4.50	6.00	5.40	8.00	7.20	7.00	6.30
			8%	Expandability/ future proofing	4.00	3.20	4.00	3.20	8.00	6.40	9.00	7.20
			4%	Hazards	5.00	2.00	5.00	2.00	5.00	2.00	3.00	1.20
						15.10		14.20		21.00		17.40
5	**Management**	Financial	9%	Capital Cost	10.00	9.00	6.00	5.40	8.00	7.20	5.00	4.50
			9%	Operating and Maintenance Costs	8.00	7.20	10.00	9.00	5.00	4.50	8.00	7.20
			6%	Rating impact	9.00	5.40	7.00	4.20	5.00	3.00	5.00	3.00
						21.60		18.60		14.70		14.70
					59.80		54.50		58.40		55.70	

KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 2b Weighting*	*Difference*
Māori cultural values	20%	20%	0%
Environmental values	22%	22%	0%
Practicability	14%	24%	10%
Operability	20%	30%	10%
Financial	24%	4%	-20%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	20%	Impacts on Māori cultural values and practices.	3.00	6.00	3.00	6.00	3.00	6.00	3.00	6.00
						6.00		6.00		6.00		6.00
2	**Non-Technical**	Environmental values	2%	Land Use Effects	8.00	1.60	6.00	1.20	6.00	1.20	6.00	1.20
			3%	Odour	3.00	0.90	3.00	0.90	3.00	0.90	3.00	0.90
			10%	Ecological Effects	6.00	6.00	6.00	6.00	9.00	9.00	6.00	6.00
			3%	Carbon Footprint	5.00	1.50	5.00	1.50	3.00	0.90	3.00	0.90
			4%	Public Health	5.00	2.00	5.00	2.00	8.00	3.20	5.00	2.00
						12.00		11.60		15.20		11.00
3	**Technical**	Practicability	7%	Constructability	6.00	4.20	6.00	4.20	4.00	2.80	6.00	4.20
			11%	Regulations and Planning	4.00	4.40	4.00	4.40	6.00	6.60	5.00	5.50
			6%	Staging	8.00	4.80	6.00	3.60	3.00	1.80	8.00	4.80
						13.40		12.20		11.20		14.50
4	**Technical**	Operability	9%	The ease of operation and maintenance	6.00	5.40	4.00	3.60	6.00	5.40	3.00	2.70
			9%	Process reliability and resilience	5.00	4.50	6.00	5.40	8.00	7.20	7.00	6.30
			8%	Expandability/ future proofing	4.00	3.20	4.00	3.20	8.00	6.40	9.00	7.20
			4%	Hazards	5.00	2.00	5.00	2.00	5.00	2.00	3.00	1.20
						15.10		14.20		21.00		17.40
5	**Management**	Financial	2%	Capital Cost	10.00	2.00	6.00	1.20	8.00	1.60	5.00	1.00
			1%	Operating and Maintenance Costs	8.00	0.80	10.00	1.00	5.00	0.50	8.00	0.80
			1%	Rating impact	9.00	0.90	7.00	0.70	5.00	0.50	5.00	0.50
						3.70		2.90		2.60		2.30
					50.20		46.90		56.00		51.20	

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KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 3 Weighting*	*Difference*
Māori cultural values	20%	15%	-5%
Environmental values	22%	17%	-5%
Practicability	14%	9%	-5%
Operability	20%	15%	-5%
Financial	24%	44%	20%
	100%	100%	

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	15%	Impacts on Māori cultural values and practices.	3.00	4.50	3.00	4.50	3.00	4.50	3.00	4.50
						4.50		4.50		4.50		4.50
2	**Non-Technical**	Environmental values	1%	Land Use Effects	8.00	0.80	6.00	0.60	6.00	0.60	6.00	0.60
			2%	Odour	3.00	0.60	3.00	0.60	3.00	0.60	3.00	0.60
			9%	Ecological Effects	6.00	5.40	6.00	5.40	9.00	8.10	6.00	5.40
			2%	Carbon Footprint	5.00	1.00	5.00	1.00	3.00	0.60	3.00	0.60
			3%	Public Health	5.00	1.50	5.00	1.50	8.00	2.40	5.00	1.50
						9.30		9.10		12.30		8.70
3	**Technical**	Practicability	2%	Constructability	6.00	1.20	6.00	1.20	4.00	0.80	6.00	1.20
			5%	Regulations and Planning	4.00	2.00	4.00	2.00	6.00	3.00	5.00	2.50
			2%	Staging	8.00	1.60	6.00	1.20	3.00	0.60	8.00	1.60
						4.80		4.40		4.40		5.30
4	**Technical**	Operability	4%	The ease of operation and maintenance	6.00	2.40	4.00	1.60	6.00	2.40	3.00	1.20
			5%	Process reliability and resilience	5.00	2.50	6.00	3.00	8.00	4.00	7.00	3.50
			4%	Expandability/ future proofing	4.00	1.60	4.00	1.60	8.00	3.20	9.00	3.60
			2%	Hazards	5.00	1.00	5.00	1.00	5.00	1.00	3.00	0.60
						7.50		7.20		10.60		8.90
5	**Management**	Financial	16%	Capital Cost	10.00	16.00	6.00	9.60	8.00	12.80	5.00	8.00
			16%	Operating and Maintenance Costs	8.00	12.80	10.00	16.00	5.00	8.00	8.00	12.80
			12%	Rating impact	9.00	10.80	7.00	8.40	5.00	6.00	5.00	6.00
						39.60		34.00		26.80		26.80
					65.70		59.20		58.60		54.20	

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KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 3a Weighting*	*Difference*
Māori cultural values	20%	10%	-10%
Environmental values	22%	12%	-10%
Practicability	14%	14%	0%
Operability	20%	20%	0%
Financial	24%	44%	20%
	100%	100%	

No	Weighting Group	Category	Weightage	Criteria	Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
					Score	Weighted Score	Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
1	**Non-Technical**	Māori cultural values	10%	Impacts on Māori cultural values and practices.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
						3.00		3.00		3.00		3.00
2	**Non-Technical**	Environmental values	1%	Land Use Effects	8.00	0.80	6.00	0.60	6.00	0.60	6.00	0.60
			1%	Odour	3.00	0.30	3.00	0.30	3.00	0.30	3.00	0.30
			6%	Ecological Effects	6.00	3.60	6.00	3.60	9.00	5.40	6.00	3.60
			2%	Carbon Footprint	5.00	1.00	5.00	1.00	3.00	0.60	3.00	0.60
			2%	Public Health	5.00	1.00	5.00	1.00	8.00	1.60	5.00	1.00
						6.70		6.50		8.50		6.10
3	**Technical**	Practicability	4%	Constructability	6.00	2.40	6.00	2.40	4.00	1.60	6.00	2.40
			7%	Regulations and Planning	4.00	2.80	4.00	2.80	6.00	4.20	5.00	3.50
			3%	Staging	8.00	2.40	6.00	1.80	3.00	0.90	8.00	2.40
						7.60		7.00		6.70		8.30
4	**Technical**	Operability	6%	The ease of operation and maintenance	6.00	3.60	4.00	2.40	6.00	3.60	3.00	1.80
			6%	Process reliability and resilience	5.00	3.00	6.00	3.60	8.00	4.80	7.00	4.20
			5%	Expandability/ future proofing	4.00	2.00	4.00	2.00	8.00	4.00	9.00	4.50
			3%	Hazards	5.00	1.50	5.00	1.50	5.00	1.50	3.00	0.90
						10.10		9.50		13.90		11.40
5	**Management**	Financial	16%	Capital Cost	10.00	16.00	6.00	9.60	8.00	12.80	5.00	8.00
			16%	Operating and Maintenance Costs	8.00	12.80	10.00	16.00	5.00	8.00	8.00	12.80
			12%	Rating impact	9.00	10.80	7.00	8.40	5.00	6.00	5.00	6.00
						39.60		34.00		26.80		26.80
						67.00		60.00		58.90		55.60

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KAITAIA WWTP

Multi Criteria Analysis

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Short List\[Kaitaia Short List MCA-v0.9.xlsx]Summary

DATE: 30/09/20 10/06/2020

HG PROJECT NUMBER: 1014-147856-01

	Original Weighting	*Scenario 3b Weighting*	*Difference*
Māori cultural values	20%	20%	0%
Environmental values	22%	22%	0%
Practicability	14%	5%	-9%
Operability	20%	9%	-11%
Financial	24%	44%	20%
	100%	100%	

`

					Minor Upgrades		Major Upgrades		Major Upgrades		Side Stream Treatment Plant	
					Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV		New proprietary septage receiving system + In-pond aeration combined with an attached growth system		New proprietary septage receiving system + IDAL		Portion of effluent treated through a mechanical plant. Remaining effluent treated through existing pond system. Final effluents are blended.	
No	**Weighting Group**	**Category**	**Weightage**	**Criteria**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**	**Score**	**Weighted Score**
1	**Non-Technical**	Māori cultural values	20%	Impacts on Māori cultural values and practices.	3.00	6.00	3.00	6.00	3.00	6.00	3.00	6.00
						6.00		6.00		6.00		6.00
2	**Non-Technical**	Environmental values	2%	Land Use Effects	8.00	1.60	6.00	1.20	6.00	1.20	6.00	1.20
			3%	Odour	3.00	0.90	3.00	0.90	3.00	0.90	3.00	0.90
			10%	Ecological Effects	6.00	6.00	6.00	6.00	9.00	9.00	6.00	6.00
			3%	Carbon Footprint	5.00	1.50	5.00	1.50	3.00	0.90	3.00	0.90
			4%	Public Health	5.00	2.00	5.00	2.00	8.00	3.20	5.00	2.00
						12.00		11.60		15.20		11.00
3	**Technical**	Practicability	1%	Constructability	6.00	0.60	6.00	0.60	4.00	0.40	6.00	0.60
			3%	Regulations and Planning	4.00	1.20	4.00	1.20	6.00	1.80	5.00	1.50
			1%	Staging	8.00	0.80	6.00	0.60	3.00	0.30	8.00	0.80
						2.60		2.40		2.50		2.90
4	**Technical**	Operability	3%	The ease of operation and maintenance	6.00	1.80	4.00	1.20	6.00	1.80	3.00	0.90
			3%	Process reliability and resilience	5.00	1.50	6.00	1.80	8.00	2.40	7.00	2.10
			2%	Expandability/ future proofing	4.00	0.80	4.00	0.80	8.00	1.60	9.00	1.80
			1%	Hazards	5.00	0.50	5.00	0.50	5.00	0.50	3.00	0.30
						4.60		4.30		6.30		5.10
5	**Management**	Financial	16%	Capital Cost	10.00	16.00	6.00	9.60	8.00	12.80	5.00	8.00
			16%	Operating and Maintenance Costs	8.00	12.80	10.00	16.00	5.00	8.00	8.00	12.80
			12%	Rating impact	9.00	10.80	7.00	8.40	5.00	6.00	5.00	6.00
						39.60		34.00		26.80		26.80
					64.80		58.30		56.80		51.80	

APPENDIX 5
RISK ANALYSIS

KAITAIA WWTP OPTIONS - Short List Assessment

Risk Matrix

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Risk Analysis\[Kaitaia WWTP Short List Risk Matrix-Rev0.3_MSM.xlsx]General (2)

DATE: 06/10/20

HG PROJECT NUMBER: 1014-147856-01

			Option 1: Remove wetland + Upgrade septage receiving system + Aerators + Baffle Curtain + Clarifier + Chemical dosing + UV						**Option 2: Proprietary septage receiving system + In pond aeration combined with an attached growth system**					
	Risks	**Descriptions**	**Likelihood**		**Consequence**		**Risk Grade**	**Risk Score**	**Likelihood**		**Consequence**		**Risk Grade**	**Risk Score**
			Rating	**Score**	**Rating**	**Score**			**Rating**	**Score**	**Rating**	**Score**		
1	Non-performance of the overall treatment scheme	Treatment and disposal systems not operating to design objectives. Assumptions about the Awanui River flow to calculate the required effluent quality are incorrect. Breach of Consent.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
2	Option not acceptable to iwi	Scheme may not have iwi endorsement; difficult to progress the scheme.	Likely	4	Major	4	Extreme	16	Likely	4	Major	4	Extreme	16
3	Option not acceptable to community (negative perception and social unacceptance)	Public opposition to preferred option.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
4	Local expertise not available to operate the plant	Plant operations and performance affected if expertise are not available to operate it correctly.	Unlikely	2	Moderate	3	Medium	6	Unlikely	2	Moderate	3	Medium	6
5	Disruptions to existing WWTPs during construction	Effluent quality affected; breach of consents.	Likely	4	Major	4	Extreme	16	Possible	3	Major	4	Extreme	12
6	Consenting difficulties	Options selection process does not meet the requirements of the existing consent. Difficulties to renew consent if unable to meet standards.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
7	Capacity/future proofing	Option is unable to meet the long term needs of the community. Insufficient capacity for future industry. Unable to deal with changes on the compliance requirements.	Likely	4	Major	4	Extreme	16	Possible	3	Major	4	Extreme	12
8	Failure of equipment at the WWTPs	Failure of equipment at the WWTPs. Power loss.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
9	Option unaffordable		Unlikely	2	Major	4	High	8	Likely	4	Major	4	Extreme	16
10	Availability of suitable land	Risk that suitable land is unavailable to build WWTP upgrades (i.e. land has to be purchased), or the ground conditions of existing land are not appropriate.	Unlikely	2	Moderate	3	Medium	6	Unlikely	2	Moderate	3	Medium	6
11	Odour issues and wastewater sprays	WWTP odour issues affecting nearby residents. Wastewater spray from ponds to beyond property boundary.	Likely	4	Moderate	3	High	12	Likely	4	Moderate	3	High	12
12	Cyanobacteria	Risk of discharging cyanobacteria to the waterbody.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
13	Other risks	Flood in WWTP site. Avian botulism.	Likely	4	Major	4	Extreme	16	Likely	4	Major	4	Extreme	16
							Total	**156**					**Total**	**156**

Likelihood		**Consequence**			
		Severe	Major	Moderate	Minor
		5	4	3	2
Almost certain	5	Extreme	Extreme	Extreme	High
Likely	4	Extreme	Extreme	High	High
Possible	3	Extreme	Extreme	High	Medium
Unlikely	2	Extreme	High	Medium	Low
Rare	1	High	High	Medium	Low

KAITAIA WWTP OPTIONS - Short List Assessment

Risk Matrix

N:\1014\147856_01-Kaikohe and Kaitaia WWTP\400 Tech\421 MCA\Risk Analysis\[Kaitaia WWTP Short List Risk Matrix-Rev0.3_MSM.xlsx]General (3)

DATE: 06/10/20

HG PROJECT NUMBER: 1014-147856-01

			Option 3: Proprietary septage receiving system + IDAL						Option 4: Proprietary septage receiving system + Side Stream Treatment Plant (BNR).					
	Risks	Descriptions	Likelihood		Consequence		Risk Grade	Risk Score	Likelihood		Consequence		Risk Grade	Risk Score
			Rating	Score	Rating	Score			Rating	Score	Rating	Score		
1	Non-performance of the overall treatment scheme	Treatment and disposal systems not operating to design objectives. Assumptions about the Awanui River flow to calculate the required effluent quality are incorrect. Breach of Consent.	Unlikely	2	Major	4	High	8	Possible	3	Major	4	Extreme	12
2	Option not acceptable to iwi	Scheme may not have iwi endorsement; difficult to progress the scheme.	Likely	4	Major	4	Extreme	16	Likely	4	Major	4	Extreme	16
3	Option not acceptable to community (negative perception and social unacceptance)	Public opposition to preferred option.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
4	Local expertise not available to operate the plant	Plant operations and performance affected if expertise are not available to operate it correctly.	Unlikely	2	Moderate	3	Medium	6	Unlikely	2	Moderate	3	Medium	6
5	Disruptions to existing WWTPs during construction	Effluent quality affected; breach of consents.	Likely	4	Major	4	Extreme	16	Unlikely	2	Major	4	High	8
6	Consenting difficulties	Options selection process does not meet the requirements of the existing consent. Difficulties to renew consent if unable to meet standards.	Unlikely	2	Major	4	High	8	Unlikely	2	Major	4	High	8
7	Capacity/future proofing	Option is unable to meet the long term needs of the community. Insufficient capacity for future industry. Unable to deal with changes on the compliance requirements.	Unlikely	2	Major	4	High	8	Unlikely	2	Major	4	High	8
8	Failure of equipment at the WWTPs	Failure of equipment at the WWTPs. Power loss.	Possible	3	Major	4	Extreme	12	Possible	3	Major	4	Extreme	12
9	Option unaffordable		Possible	3	Major	4	Extreme	12	Likely	4	Major	4	Extreme	16
10	Availability of suitable land	Risk that suitable land is unavailable to build WWTP upgrades (i.e. land has to be purchased), or the ground conditions of existing land are not appropriate.	Unlikely	2	Moderate	3	Medium	6	Possible	3	Moderate	3	High	9
11	Odour issues and wastewater sprays	WWTP odour issues affecting nearby residents. Wastewater spray from ponds to beyond property boundary.	Likely	4	Moderate	3	High	12	Possible	3	Moderate	3	High	9
12	Cyanobacteria	Risk of discharging cyanobacteria to the waterbody.	Unlikely	2	Major	4	High	8	Likely	4	Major	4	Extreme	16
13	Other risks	Flood in WWTP site. Avian botulism.	Likely	4	Major	4	Extreme	16	Likely	4	Major	4	Extreme	16
							Total	**140**					**Total**	**148**

Likelihood		**Consequence**			
		Severe	Major	Moderate	Minor
		5	4	3	2
Almost certain	5	Extreme	Extreme	Extreme	High
Likely	4	Extreme	Extreme	High	High
Possible	3	Extreme	Extreme	High	Medium
Unlikely	2	Extreme	High	Medium	Low
Rare	1	High	High	Medium	Low