MEMORANDUM

TO:	**Council**
MEETING DATE:	**18 August 2021**
TITLE:	**Wastewater Best Practicable Option: Final Assessment and BPO Selection**
PRESENTED BY:	**Robert van Bentum, Chief Engineer**
APPROVED BY:	**Sarah Sinclair, Chief Infrastructure Officer**

RECOMMENDATION(S) TO COUNCIL

1. **That Council receive the report titled 'Wastewater Best Practicable Option: Final Assessment and BPO Selection,' including the attachments Appendices A to J.**
2. **That Council note the Best Practicable Option (BPO) identified by the technical team for consideration by Council based on Officer recommendations of scoring and weighting of assessment criteria.**
3. **That Council agree the assessment weightings for determining the wastewater management solution are as set out in Figure 3: Technical Recommendation of Assessment Weightings.**

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1. ISSUE

1.1 The process to identify the Best Practicable Option (BPO) for the city's wastewater management solution for the next 35 to 50 years has reached the final phase in the identification of preferred BPO.

1.2 The Project has followed a transparent and measured process to refine a long list of 36 options to a short list of 11 options now being assessed (refer Table 1). The options include treatment solutions that aim to meet relevant environmental and planning standards but with varying levels of confidence in achieving compliance and some potential risk of adverse effects on the receiving environment. The final phase has been developed to provide Council with assurance that potential risks have been considered and that the overall recommendation will provide a solution that meets a range of criteria and standards to the best level that can be achieved.

1.3 This final phase has involved seven separate assessments and the final assessment of options against BPO Criteria as depicted in Figure 1. The methodology used across the assessments is based on a multi-criteria assessment approach. Peer review has occurred across all assessments by technical experts, Council Officers, Project Steering Group Chair and Council's legal counsel.

1.4 This report in combination with the ten attachments (Appendices A to J) is provided to enable Council to understand the methodology used from the individual assessments through to selection of the recommended BPO. The assessment report attachments detail the scores and recommended weighting to be applied across the 7 assessments, prior to assessment under the BPO Criteria.

1.5 Feedback by Council on a recommended weighting scenario to be applied to the seven assessments is sought. This will enable the recommendation of a BPO, based on Council's recommended weighting scenario to be confirmed.

1.6 The Project's technical team has provided a recommended weighting along with a methodology for excluding options at the individual assessment and BPO Test levels, where options are considered to have low levels of alignment and/or high potential risk for not meeting the BPO Criteria. The recommendations are provided for discussion with the expectation that Council will provide clear direction on the final scoring and ultimately confirm a recommended BPO.

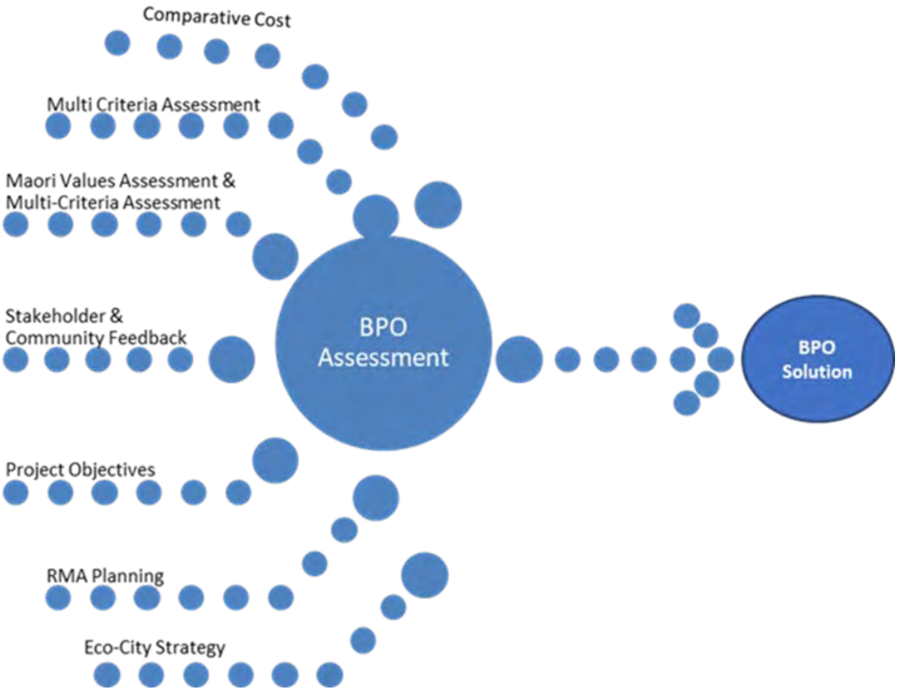
Table 1 Options Description / Reference

Options

No.	Summary Description	Technical Description
1	100% to river	R2 (b) (Level 4 treatment)
2	77% to river / 23% to land & river	R2 (b) (75% DWF land): 760 ha. (Level 4 treatment)
3	Dual river discharges: 57% to river Totara Road / 20% to river Opiki / 23% to land & river	Dual R+L (b) (75% DWF to land): 870 ha. (Level 2 treatment, TN=35)
4	97% to land inland	L+R(a): 3760 ha. (Level 1 treatment)
5	97% to land coastal	L+R(b): 2570 ha. (Level 3 treatment, TN=10)
6	53% to land inland	L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2 treatment, TN=35)
7	43% to land inland	L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2 treatment, TN=35)
8	53% to land coastal	L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2 treatment, TN=35)
9	43% to land coastal	L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2 treatment, TN=35)
10	47% to Ocean / 3% river / 50% to land and coastal	O+L: 1470 ha. (Level 1 treatment)
11	97% to Ocean / 3% to river	Ocean (Level 1 treatment)

*Percentage based on duration not volume

Figure 1 Final Phase BPO Assessment Process



2. BACKGROUND

2.1 Since late 2017 Council has been working through a process to determine a recommended Best Practicable Option (BPO) for managing the city's wastewater for the next 35 to 50 years. The selection of a BPO is required in mid-2021 and the lodgement of an application for new resource consents by June 2022 is a requirement of Council's existing resource consent (Horizons Regional Council Permit 101829).

2.2 Following a refinement process in 2019 an extended long list of options was reduced to a short list of 11 options. Since September 2020, each of the 11 options has been developed to include recommended treatment levels, conveyance requirements, irrigation or discharge areas and arrangements have been developed to enable indicative land areas and high-level comparative costs to be developed. This technical work has been on-going and continued to further add to the robustness of the assessment process.

2.3 Rangitāne o Manawatū, as mana whenua in Palmerston North, are part of the project's steering group, and Council's Project Team have worked closely with representatives at both governance and technical levels of the Project's delivery. Engagement with iwi throughout the wider Manawatū Region, has also occurred and significant effort has been undertaken by iwi to incorporate their values into this options assessment process. This is discussed in detail in the attached documents.

2.4 Community and stakeholder groups in Palmerston North and the wider Manawatū Region have been invited to provide feedback and work with Council at multiple stages of the project. This has included three rounds of community engagement between 2019 and 2021.

2.5 The BPO selection process has been guided by the Project Objectives set by Council at the start of the project and are as follows:

1. Protects public health and minimises public health risk
2. Minimise adverse environmental effects on air, land and water
3. Is sustainable, enduring and resilient
4. Contributes to improving the health and mauri of the Manawatū River
5. Takes an integrated approach to the management of the Manawatū Catchment including understanding the cumulative effects
6. Enhances peoples use and enjoyment of the Manawatū River
7. Is affordable and cost effectives
8. Minimises whole of life carbon emissions and optimises resource recovery
9. Is innovative while being evidence based
10. Facilitates long term growth and economic development
11. Is developed with the active engagement of the community and key stakeholders

3. THE FINAL BPO SELECTION PROCESS

3.1 The project has now arrived at the final stage of the BPO selection process. This process has been developed to achieve two key outcomes:

- Bring together a range of technical, social, economic and cultural considerations in a robust and transparent manner allowing for weighting of different considerations to arrive at a single preferred option

- Ensure the selected BPO meets the requirements of the BPO test which is a condition of Council's current wastewater consent.

3.2 The BPO Project is highly complex and the process developed reflects this complexity while drawing on similar processes used in other complex optioneering projects. It includes the following steps described and illustrated in Figure 2 below.

- Step 1. For each assessment a range of criteria and sub-criteria have been scored by technical experts, iwi participants or determined from quantitative data (e.g. costs) to arrive at a single score for each option for each assessment.

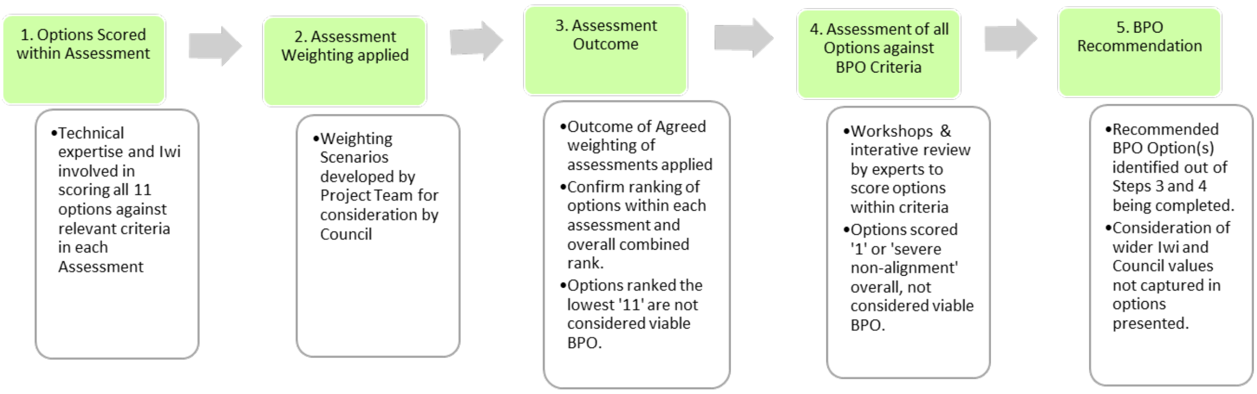
- Step 2. A relative weighting scenario has been developed by the experts based on the assessment importance and the robustness of the data assessed.

- Step 3. The relative weighting has been applied to each of the assessments to arrive at a single combined score for each option and a rank order. Options ranked below 9 are not recommended to proceed to the BPO but have not been excluded at this stage.

- Step 4. Each option is then rated on how well it aligns with the 6 BPO criteria. The options are filtered to remove any with severe non-alignment (score of 1) leaving a short-list in rank order.

- Step 5. Recommended BPO identified through step 3 and 4 is then checked against wider iwi and Council values consideration not otherwise captured in the options presented.

Figure 2 Staged Assessment Approach to Determine BPO



3.3 The seven assessments considered in Step 1 comprise:

1. Comparative Cost Assessment
2. Multi-Criteria Assessment
3. Maori Values / MCA Assessment
4. Stakeholder and Community Feedback Assessment
5. Project Objectives Assessment
6. RMA Planning Assessment
7. Eco-City Strategy Assessment

3.4 Following scoring of each option against the various assessment criteria (refer Appendix B, C, D, E, F, G, H), the scores have been compiled and based on the score a rank allocated to each option for each assessment. The option scores across the 7 assessments are then added to determine an overall score and this is then ranked from highest to lowest, as outlined in Table 2 below.

Table 2 Options Rank Across 7 Assessments and Overall

Option	Ranking of Option within each Assessment							Overall Ranking
	MCA	Maori	Stakeholder	Objectives	Planning	EcoCity	Comparative Cost	
Weight scenario	Combined							
1: R2 (b) (Level 4)	5	7	3	3	2	5	1	1
2: R2 (b) (75% DWF land): 760 ha. (Level 4)	8	8	3	2	3	6	5	4
3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	4	9	11	6	6	11	2	10
4: L+R(a): 3760 ha. (Level 1)	3	1	9	7	6	7	5	7
5: L+R(b): 2570 ha. (Level 3, TN=10)	7	4	10	5	1	1	9	5
6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	6	2	5	10	3	9	2	5
7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	2	2	5	10	3	10	2	3
8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	5	5	8	9	2	9	9
9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	5	5	8	9	3	9	11
10: O+L: 1470 ha. (Level 1)	9	10	1	4	11	4	8	8
11: O no land (Level 1)	1	11	1	1	2	8	5	2

3.5 As part of Step 3, those options which ranked at 11 in any assessment are not recommended to become the BPO but all options have been referred through to the Step 4 BPO Criteria assessment.

3.6 The BPO Criteria which have been assessed in Step 4 are specifically detailed in Council's current wastewater consent and are considered to comprise the following 6 elements:

1. Receiving Environment Sensitivity
2. Comparison of Effects on the Environment
3. Comparative Financial Implications
4. Technical Knowledge
5. Exceedance of Targets, Limits or Standards
6. RMA Part 2 and Section 104, 105 and 107 Considerations

4. TECHNICAL TEAM WEIGHTING RECOMMENDATION

4.1 Following the five-step process outlined in section 3, and Appendix I, the technical team determined a recommended weighting of the seven assessments in order to determine a combined score for each option. The weighting is depicted in Figure 3.

Figure 3 Technical Recommendation of Assessment Weightings

Octopus Arm	Proportion
Multi Criteria Assessment	15%
Maori Values & MCA	20%
Stakeholder & Community Feedback	5%
Project Objectives	25%
RMA Planning	20%
Eco-City Strategy	5%
Comparative Cost	10%

4.2 The basis for the weighting recommended by the project technical advisers is described in summary below and in more detail in Appendix J.

4.2.1 The highest weighting of 25% is given to Project Objectives, given these were defined at the start of the project with the purpose of defining the priority for options development and assessments. The Objectives have been the reference for each assessment phase at which options have been filtered. An options alignment with the objectives will be a key determinate of likely success of a resource consent application.

4.2.2 The RMA Planning Assessment is allocated the next highest weighting of 20% based on the critical importance of alignment between Council and Rangitāne o Manawatū in respect of agreement on an option in the spirit of true partnership and the importance of demonstrating iwi values have been meaningfully addressed through the consenting process.

4.2.3 A weighting of 20% is also given to RMA planning on the basis that a BPO selection needs to ensure the risks to consenting are minimized. The RMA Planning assessment considers the broader range of planning issues which may impact on consent risk for any option.

4.2.4 The MCA assessment is given a weighting of 15% reflecting acceptance that the tool is a proven approach in a selection of options in complex project environments which require consideration of a wide range of factors. The MCA assessment weighting is given lower emphasis to allow for greater emphasis to be given to the Maori Values and Project Objectives. assessments.

4.2.5 The Eco-City Strategy assessment has been given a low weighting largely because the BPO will have a limited impact on the city's carbon footprint and because Council has committed to prioritizing sustainability and wastewater re-use for all options.

4.2.6 The Stakeholder and Community Feedback has also been assigned a low weighting largely because of the low level of confidence in the robustness of the feedback, and concern that the output from these engagements is not representative of all community and stakeholder views.

4.3 Based on these weightings a combined score and rank for the options was determined. and this is depicted in Table 1 of this report. Alternative weightings were also proposed to provide an understanding of the sensitivity of option rank to weightings. These alternatives will be worked through with Council and are reported on in Appendix I.

4.4 The technical team then assessed alignment for each option with the 6 BPO Test Criteria, with the same 1 to 5 scoring system as used in all the other assessments. The scores (with colour coding) are tabulated in Figure 4 below. These scores are linked to the option and are independent of the weighting scenarios.

4.5 To determine the recommended BPO, options with scores of 1 on any of the BPO criteria are recommended for removal on the basis that there is a low likelihood of the option progressing through the consent process with any certainty. This results in the following additional options being discarded:

- Option 1: 100% to river – score 1 for receiving environment sensitivity
- Option 4: 97% to land inland; 3760 ha – scores 1 for technical knowledge
- Option 5: 97% to land coastal; 2570 ha – scores 1 for comparative financial implications and technical knowledge
- Option 8: 53% to land coastal; 3640 ha – scores 1 for comparative financial implications and technical knowledge
- Option 9: 43% to land coastal, 3010 ha – scores 1 for comparative financial implications
- Option 10: 47% to Ocean / 3% river / 50% to land coastal & river – scores 1 for comparative financial implications

4.6 Figure 4 indicates (outlined in green) those options recommended to progress through to the recommended BPO consideration following removal of options with a BPO criteria score of 1. Of the options not excluded, Option 3 which had ranked at 9 in the Technical Recommendation is not recommended to proceed to final BPO consideration. The options confirmed comprise:

- Option 2 (77% to river / 23% to land & river),
- Option 6 (53% to land inland) and
- Option 7 (43% to land inland)

- Option 11: 97% to ocean / 3% to river

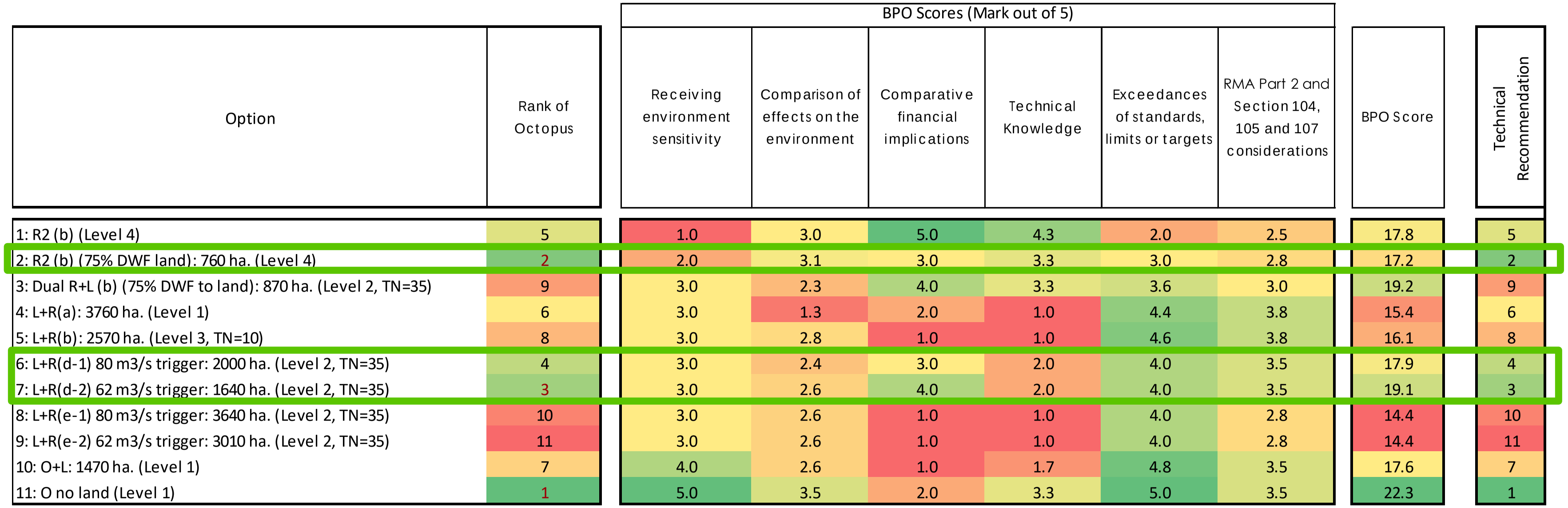
4.7 Following confirmation that the highest ranked of these 4 options comprised Option 11, the technical team considered the wider issues to confirm whether the option should be selected as the preferred BPO. On the basis that Option 11, was not supported by iwi and was ranked at 11 in the Maori Values/ MCA assessment, the team recommended that the next highest ranking option be considered i.e. Option 2.

4.8 The recommended BPO option which has been identified through the process detailed above is Option 2 comprising the highest treatment level (4) in combination with a significant area of land. It is recommended that the BPO include exploring other options to increase the diversion of wastewater away from the river including:

- beneficial re-use e.g. parks and golf course irrigation - city
- beneficial re-use – agricultural irrigation
- recharge for new or degraded wetlands

4.9 Increasing the proportion of diversion over time will look to approach the proportional split between river and land (beneficial use) achieved with Option 7. This could be achieved over time under an adaptive management approach.

Figure 4 BPO Scoring and Recommended BPO Ranking



Option	Rank of Octopus	BPO Scores (Mark out of 5)						BPO Score	Technical Recommendation
		Receiving environment sensitivity	Comparison of effects on the environment	Comparative financial implications	Technical Knowledge	Exceedances of standards, limits or targets	RMA Part 2 and Section 104, 105 and 107 considerations		
1: R2 (b) (Level 4)	5	1.0	3.0	5.0	4.3	2.0	2.5	17.8	5
2: R2 (b) (75% DWF land): 760 ha. (Level 4)	2	2.0	3.1	3.0	3.3	3.0	2.8	17.2	2
3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	9	3.0	2.3	4.0	3.3	3.6	3.0	19.2	9
4: L+R(a): 3760 ha. (Level 1)	6	3.0	1.3	2.0	1.0	4.4	3.8	15.4	6
5: L+R(b): 2570 ha. (Level 3, TN=10)	8	3.0	2.8	1.0	1.0	4.6	3.8	16.1	8
6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	4	3.0	2.4	3.0	2.0	4.0	3.5	17.9	4
7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	3	3.0	2.6	4.0	2.0	4.0	3.5	19.1	3
8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	3.0	2.6	1.0	1.0	4.0	2.8	14.4	10
9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	3.0	2.6	1.0	1.0	4.0	2.8	14.4	11
10: O+L: 1470 ha. (Level 1)	7	4.0	2.6	1.0	1.7	4.8	3.5	17.6	7
11: O no land (Level 1)	1	5.0	3.5	2.0	3.3	5.0	3.5	22.3	1

6. NEXT STEPS

6.1 Following confirmation by Council of their preferred weighting for the assessments and the process around consideration of the BPO Criteria Test, Officers will reconfirm the process followed and the preferred BPO, by updating the Draft BPO Assessment and Recommendation Report attached as Appendix I.

6.2 An officer report will be prepared which recommends the adoption of the recommended BPO arising from this final phase, which will be presented to Council's 1st September 2021 meeting for final adoption.

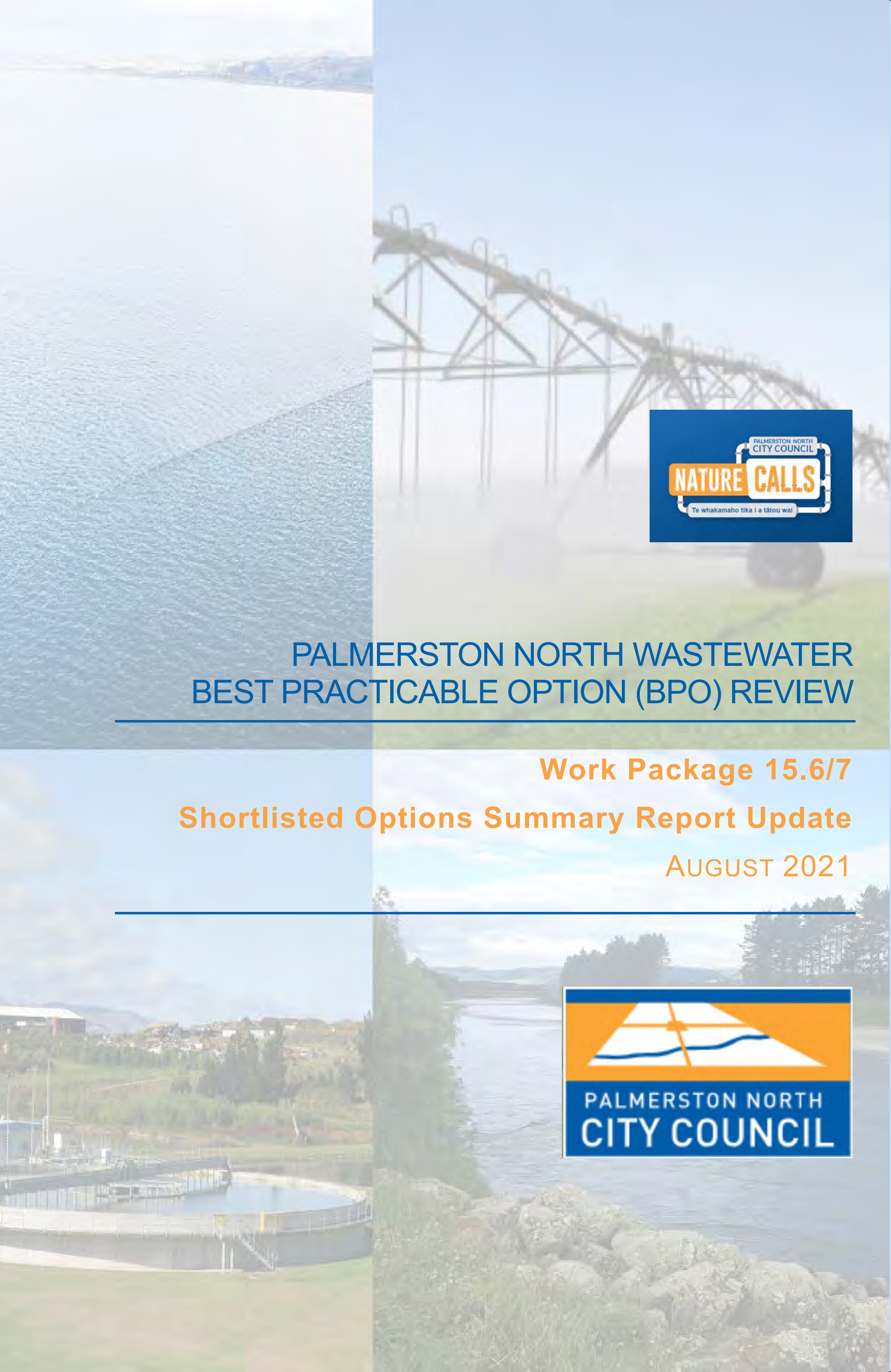
7. COMPLIANCE AND ADMINISTRATION

Does the Council have delegated authority to decide?	**Yes**
Are the decisions significant?	**Yes**
If they are significant do they affect land or a body of water?	**Yes**
Can this decision only be made through a 10 Year Plan?	**No**
Does this decision require consultation through the Special Consultative procedure?	**No**
Is there funding in the current Annual Plan for these actions?	**Yes**
Are the recommendations inconsistent with any of Council's policies or plans?	**No**
Council has consulted on the likely impacts of the selection of the BPO through both the just completed 10 Year plan process and a separate BPO engagement process. Legal advice confirms that these processes meet the Local Government Act significance requirements.	
The recommendations contribute to Goal 4: An Eco City	
The recommendations contribute to the achievement of action/actions in the Three Waters Plan The actions include: • The Wastewater Treatment Plant is fully compliant with its existing resource consent requirements • Council has agreed to bring forward the renewal of the resource consent for the wastewater treatment plant by five years to June 2022	
Contribution to strategic direction and to social, economic, environmental and cultural well-	The decision on the BPO for wastewater management for the city is critical to achieving all four well beings, given it will enable application for resource consents to effectively manage wastewater for at least the next 35 years. Modern and sustainable management of wastewater is a prerequisite for Palmerston North continuing to develop in a way which effectively mitigates the negative impacts of urban

being	development on the landscapes and local environments.

ATTACHMENTS

1. Appendix A BPO Short List Options Report (attached separately)
2. Appendix B Comparative Cost Assessment (attached separately)
3. Appendix C MCA Assessment Report (enclosed separately)
4. Appendix D Māori Values / MCA Assessment (attached separately)
5. Appendix E Stakeholder & Community Engagement Assessment (attached separately)
6. Appendix F Objectives Assessment (attached separately)
7. Appendix G Eco-City Strategy Assessment (attached separately)
8. Appendix H RMA Planning Assessment (attached separately)
9. Appendix I BPO Scoring Workshop Report
10. Appendix J Draft BPO Assessment and Recommendation Report
11. Appendix K Legal Memo BPO and Three Waters Review



PALMERSTON NORTH CITY COUNCIL
NATURE CALLS
Te whakamaho tika i a tātou wai

PALMERSTON NORTH WASTEWATER BEST PRACTICABLE OPTION (BPO) REVIEW

Work Package 15.6/7

Shortlisted Options Summary Report Update

AUGUST 2021

PALMERSTON NORTH
CITY COUNCIL

Prepared for Palmerston North City Council by:

Stantec

pdp
PATTLE DELAMORE PARTNERS LTD

Aquanet Consulting Limited

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Jim Bradley

Report Details

Prepared by:	Anna Bridgman/Michelle Chew	14/10/2020
Checked by:	Jim Bradley/Anna Bridgman	14/10/2020
Reviewed by:	Jim Bradley/Richard Peterson	14/10/2020
Approved & Issued by:	Roger Hulme	15/10/2020

Revision History

Version:	Description	Prepared	Checked	Reviewed	Date
1	Original Release	Anna Bridgman	Richard Peterson	Jim Bradley	October 2020
2	February 2021 – Treatment & shortlist upgrades	Rita Whitfield	Anna Bridgman	Jim Bradley	February 2021
3	May 2021 - edits	Anna Bridgman	-	Jim Bradley	June 2021

4	July 2021 – edits	Ashleigh Dick/ Rita Whitfield	Anna Bridgman	Jim Bradley	July 2021
5	Aug 2021 – edits	Anna Bridgman	-	Jim Bradley	August 2021

Executive Summary

What does this report cover?

PNCC identified the shortlist for the Best Practicable Option (BPO) in July 2019. Since then, work has been undertaken to further develop the different elements of each option. This option development work has resulted in the identification of option variants. This report describes the refined options and summarises their "key matters". This summary reports takes in to account that previous work, and work identified in the comparative assessment workshop.

BPO short list of options

For the BPO review six options were shortlisted in July 2019. However it is recommended that the groundwater option not proceed through the shortlist assessment phase. The five remaining options are:

R2(b) All treated wastewater is discharged, via a wetland and land passage system to the Manawatū River at/near the existing Tōtara Road site with improved removal of phosphorus and nitrogen

L + R (a) & (b) Treated wastewater applied to land, with discharge to the Manawatū River in exceptional circumstances.

L + R (d) & (e) Treated wastewater applied to land, with some discharges to the Manawatū River

Dual R+L Manawatū River discharge at Tōtara Road and below Oroua confluence with some land application in drier months

O+L Most of the treated wastewater discharged to the ocean and some applied to land in drier months

It is proposed to carry forward 11 variants of these five options to the further shortlist assessment phase.

For the BPO assessment short listed options names have been used that are more description of the options. The previous and new names are listed in the table below together with the previous and new option numbers. The new names and Option numbers 1 to 11 are used for the briefing materials and the BPO assessment. The previous (shorter) names may also be used throughout the text of this report.

Option No.	New Name	Previous Option No.	Previous Name
1	R2(b) River discharge with enhanced treatment	1	R2 (b)
2	R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow	1	R2 (b) (75% ADWF to land at low River flows)
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	Dual R+L (b) (75% ADWF to land at low River flows)
4	L+R (a) 97% of the time to Land (inland)	3	L+R(a)
5	L+R (b) 97% of the time to Land (coastal)	3	L+R(b)
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)	4	L+R(d-1) 80m^3/s River flow trigger
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)	4	L+R(d-2) 62m^3/s River flow trigger

Option No.	New Name	Previous Option No.	Previous Name
8	L+R (e-1) to Land <$80m^3$/s / 53% of the time to Land (coastal) TN = 35 mg/L	4	L+R(e-1) $80m^3$/s River flow trigger
9	L+R (e-2) to land <$62m^3$/s / 43% of the time to Land (coastal) TN = 35 mg/L	4	L+R(e-2) $62m^3$/s River flow trigger
10	O+L / Ocean with Land (coastal)	6	O+L
11	Ocean discharge	-	O no land

What work was undertaken?

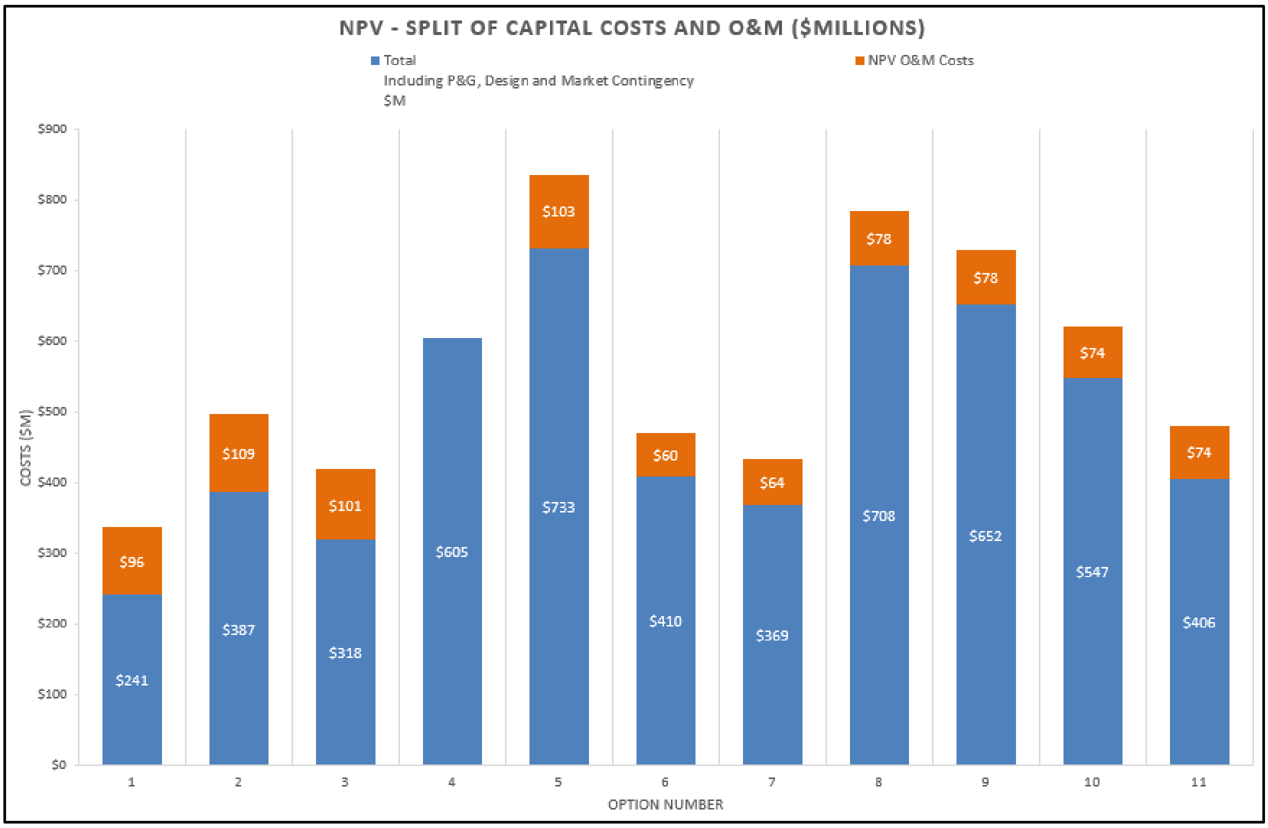
For this report we outline the key considerations of the wastewater schemes. We discuss the development of the options from previous stages of the shortlist to as they are now. This is followed by summaries of each option with more detail on each component part of the total option scheme.

We also updated the indicative comparative cost estimates for each option. The capital cost for a full scheme (without staging) and lifecycle net present value (NPV) of each of these options is covered below. The NPV is based on a 35 year (maximum resource consent duration) operating period. The cost estimates included in this version of the report use updated land values (compensation assessments) prepared by The Property Group in March 2021, higher percentage contingencies advised by Alta Consulting, updated population forecasts, review of land application infrastructure, and review of capital costs items.

The updated population forecast has a 17% increase for projected population at 2073 from what was previously forecast. The higher population at 2051 (covering a 35 year resource consent duration) results in higher domestic wastewater flows and loads as compared to the previous 2018 projections.

The increased flows resulted in an increase in the land areas required for land application and associated infrastructure costs, some of the treatment elements not based on peak flows, and overall operations and maintenance costs.

Option		Capital Cost $M	NPV $M
1	R2(b) River discharge with enhanced treatment	$241	$337
2	R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow	$387	$496
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	$318	$419
4	L+R (a) 97% of the time to Land (inland)	$605	$604
5	L+R (b) 97% of the time to Land (coastal)	$733	$836
6	L+R (d-1) to Land <$80m^3$/s / 53% of the time to Land (inland)	$410	$470
7	L+R (d-2) to Land <$62m^3$/s / 43% of the time to Land (inland)	$369	$433
8	L+R (e-1) to Land <$80m^3$/s / 53% of the time to Land (coastal) TN = 35 mg/L	$708	$786
9	L+R (e-2) to Land <$62m^3$/s / 43% of the time to Land (coastal) TN = 35 mg/L	$652	$730
10	O+L / Ocean with Land (coastal)	$547	$621
11	Ocean discharge	$406	$480



The chart above shows the net present value (NPV) of each option, and the split between the capital cost and the NPV of the operations & maintenance costs over the proposed 35-year consent duration.

The option of 50% (rather than the 75% above) of average dry weather flow (ADWF) being applied to land when the Manawatū River is less than half median flow was also looked at, resulting in a lower indicative cost estimate, but would have a greater effect on the River quality.

The option of 100% of ADWF being applied to land for the Dual R+L option was also looked at, but did not provide a material improvement on 75% application to land at low River flows, and was more expensive. It has been removed from the options list.

For the coastal land application options (L+R(e) and O+L), the initial assessment identified that a Total Nitrogen (TN) of 10mg/L was required to control the nitrogen leaching rate. An assessment was completed to determine the land areas required if the current level of treatment (i.e. TN of 35mg/L) was allowed for, with a larger land application area, due to the land values used initially. Whilst this option (larger land area, lower level of treatment) has a higher level comparative indicative cost estimate with the reviewed costs, for continuity it has been included in the summary tables. The costs of the alternative (higher level of treatment, smaller land area) are included in Table 3-1 of this report for completeness, but not the option summaries.

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APPENDICES

1 Introduction

In 2018 and early 2019 Palmerston North City Council (PNCC) identified and assessed a long list of options as part of its wastewater treatment and discharge Best Practicable Option (BPO) Review. This process is outlined in the Longlist Assessment Report (22 July 2019). This phase of the project culminated within the identification of a shortlist of options.

Since PNCC identified the shortlist, work has been undertaken to further develop the different elements of each option. This option development work has resulted in the identification of option variants. As a result, it was decided to carry forward six options and eleven option variants to the shortlist assessment phase. These are listed in Table 1-1.

In developing the shortlisted options a conservative approach has been taken to the inclusion of measures which might otherwise mitigate the cost or adverse effect of an option. That is, mitigation measures have only been included where these are well understood and where there is relative certainty that they can be delivered. It is recognised that there are other potential mitigation measures which might increase an option's likelihood of being identified as the BPO. However, given uncertainty regarding these measures they have not been included for the purpose of the short list assessment. Examples of such potential mitigation measures are:

- The inclusion of an adaptive management regime in Option 1: R2(b) and R2(b-2) (now Option 1 and 2 respectively). Such a regime might improve the environmental performance of the option and increase the option's level of 'compliance' with One Plan requirements. However, the form such a regime would take is uncertain at this point and, therefore, is very difficult to incorporate into the cost estimates for the option
- Negotiation of land lease or partnership arrangements associated with the land application elements of options. Such arrangements may reduce the cost of an option over time. However, the form of such arrangements and whether they can be negotiated remains uncertain. Therefore it has been decided to assume that land application areas need to be acquired, as this can be achieved through powers under the Resource Management Act and the Public Works Act.

The option development work has also identified that one option, former Option 5 (GW2) should be removed from the shortlist. The reasons for this are covered in more detail in Section 3.1. The option of Ocean (O) with no land has been added to the shortlist. This is covered further in Section 2.7.5.

Table 1-1 Short List Options & Option Variants

Option No.	Previous Option No.	Title	Description
1	1	R2 (b)	All treated wastewater is discharged, via a wetland and / or land passage system to the Manawatū River with improved removal of phosphorus and nitrogen
2	1	R2 (b) (75% ADWF land at low river flows)	All treated wastewater is discharged, via a wetland and / or land passage system to the Manawatū River with improved removal of phosphorus and nitrogen, with removal of 75% ADWF to land when the River is below half median flow (37.5m^3/s).

Option No.	Previous Option No.	Title	Description
3	2	Dual R+L (b)	Manawatū River discharge near Tōtara Road and below Opiki Bridge with, with removal of 75% ADWF to land when the River is below 37.5m^3/s)
4	3	L + R (a)	Treated wastewater applied to inland land, with discharge to the Manawatū River in exceptional circumstances (approximately 3% of the time)
5	3	L + R (b)	Treated wastewater applied to coastal land, with discharge to the Manawatū River in exceptional circumstances (approximately 3% of the time)
6	4	L + R (d-1)	Treated wastewater applied to inland land, with discharges to the Manawatū River (when River flow is above 80m^3/s)
7	4	L + R (d-2)	Treated wastewater applied to inland land, with greater discharges to the Manawatū River (when River flow is above 62m^3/s)
8	4	L + R (e-1) (TN = 35mg/L)	Treated wastewater applied to coastal land, with discharges to the Manawatū River (when River flow is above 80m^3/s)
9	4	L + R (e-2) (TN = 35mg/L)	Treated wastewater applied to coastal land, with greater discharges to the Manawatū River (when River flow is above 62m^3/s)
8b*	-	L + R (e-1) (TN = 10mg/L)	Treated wastewater applied to coastal land, with discharges to the Manawatū River (when River flow is above 80m^3/s)
9b*	-	L + R (e-2) (TN = 10mg/L)	Treated wastewater applied to coastal land, with greater discharges to the Manawatū River (when River flow is above 62m^3/s)
10	6	O + L	Most of the treated wastewater discharged to the ocean and 50% ADWF applied to land in drier months, with discharge to the Manawatū River in exceptional circumstances (approximately 3% of the time)
11	-	O	Treated wastewater discharged to the ocean, with discharge to the Manawatū River in exceptional circumstances – **Added to Shortlist**

Code:

R	River
L	Land
GW	Groundwater
O	Ocean

* Options 8b and 9b have not been carried forward into the arms of the BPO assessment. While they require a higher degree of treatment for nitrogen removal and result in smaller land areas required, with a lower NPV (but in the BPO assessment fall in the same (highest) cost band), for the purposes

of continuity in the BPO evaluation Option 8 and 9 have remained with the larger land areas and lower level of treatment. Options 8b and 9b are included in the above for completeness. If Option 8 or 9 did become the Preferred/BPO solution they would probably be further considered as a potential variance as the option was developed.

For the BPO assessment short listed options names have been used that are more descriptive of the options. The previous and new names are listed in the table below together with the previous and new option numbers. The previous and new names are listed in the table below, and in the summary tables in Section 4. The previous names are also used in the text throughout this report.

Table 1-2 Option Updated Names

Option No.	Previous Option No.	New Name	Previous Name
1	1	R2(b) River discharge with enhanced treatment	R2 (b)
2	1	R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow	R2 (b-2) (75% ADWF to land) 37.5m^3/s River flow trigger
3	2	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	Dual R+L (b) (75% ADWF to land, 37.5m^3/s River trigger)
4	3	L+R (a) 97% of the time to Land (inland)	L+R(a)
5	3	L+R (b) 97% of the time to Land (coastal)	L+R(b)
6	4	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)	L+R(d-1) 80m^3/s River flow trigger
7	4	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)	L+R(d-2) 62m^3/s River flow trigger
8	4	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L	L+R(e-1) 80m^3/s River flow trigger (TN = 35mg/L)
9	4	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L	L+R(e-2) 62m^3/s River flow trigger (TN = 35mg/L)
8b	-	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 10 mg/L	L+R(e-1) 80m^3/s River flow trigger (TN = 10mg/L)
9b	-	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 10 mg/L	L+R(e-2) 62m^3/s River flow trigger (TN = 10mg/L)
10	6	O+L / Ocean with Land (coastal)	O+L
11	6	Ocean discharge	O no land

1.1 Purpose of this work package and structure of this report

Since the shortlist was confirmed by PNCC in mid-2019, elements of each option have been further developed through the work packages listed in Table 1-3. Consequently, the objective of this work package is to prepare a report which describes the refined options and summarises their “key matters”. This summary will be used as the basis for the shortlist assessment, and in particular, the comparative assessments and any further MCA.

The first iteration of this report was prepared in March 2020. A discussion on the development of the options since that time is included in this report.

Table 1-3 List of work packages

Work Package	Name	Date
7.3	Flow and Loads Summary Report Update	May 2021
15.1	Preliminary Assessment of Land Application Site Alternatives	December 2019 & June 2020
15.2	Short List Treatment Assessment Short List Treatment Assessment Rev1	September 2020 February 2021
15.4	Coastal Outfall Constraints	December 2019
	Cawthorn - Assessment of Coastal Ecological Effects of Ocean Outfall	January 2021
15.5	Wetland and Land Passage Elements	April 2020
	River Impact Modelling Report (Aquanet)	September 2020
15.7	Development of Options	September 2020
15.9	Short List Treatment Addendum	March 2021

2 Key Considerations

A number of key considerations relating to the key components of a total scheme need to be considered to arrive at a complete option. This section summarises these considerations.

2.1 River Flows Triggers

The Manawatū River flow trigger levels for the treatment upgrades and discharge elements are outlined in the individual option summaries. These have been refined by Stantec and Aquanet during the shortlist option development stage, as a greater understanding of the effects of discharge to the River has been gained through modelling scenarios.

2.2 Treatment Upgrades

WP15.2 (Shortlist Treatment Assessment) identified the "most appropriate" treatment alternative to deliver the treated wastewater quality required for each of the shortlisted options. The assessment was made against the following factors:

1. Process Reliability
2. Process Flexibility
3. Process Constructability (including space requirements)
4. Process Affordability (capital, operating and net present value)
5. Other Process Impacts (odour and noise; chemical consumption and energy demand; health and safety

WP15.2 also involved:

- A comparative high-level assessment of the WWTP operating effects.
- A review of planning aspects of the existing Totora Rd WWTP site.
- An assessment of the current WWTP site, infrastructure and treatment processes and suitability for future developments.

An update of the WP15.2 report was completed in March 2021, and the indicative comparative capital, operating cost estimates and net present value (NPV) are included in that report and carried forward to the shortlist options. This July 2021 report further updates those costs bringing in a range of factors as set out in Section 3.

An addendum to the WP15.2 report was completed in February 2021 to align the treatment to the shortlist options taken to the MCA in November 2020. This is WP15.9. The treatment levels discussed in this report relate to WP15.9.

For each shortlisted option it has been identified a level of additional storage at the WWTP would benefit those options with a discharge to the River. An optimum volume has not yet been identified, and so is identified in each schematic as "storage optimisation". A provisional sum ($3M) is included in the capital cost estimate for storage at the WWTP.

2.3 Wetlands and Land Passage Options

A work package (WP15.5) was completed in April 2020 to identify an appropriate wetland and / or land passage for all river discharge elements of each short list option. These wetlands / land passages, agreed in a workshop in May 2020, are included in the option summaries in Section 4.

2.4 Land Application Sites and Land Use

WP15.1 identified a number of potential site locations for each option. For the development of options to take to the MCA workshop, a single site location was identified to be used. For the coastal sites it was agreed to use Coastal Site 2, the middle land parcel on the coast, closest to Himatangi Beach. This is not to be read as the site that may be the preferred land discharge location if an option is selected. A robust site selection process will be undertaken should an option that includes a land application element be selected as the BPO. The potential land application areas used for the development of the options are shown in Figure 2-1.

Land use categorisation is referenced from WP15.1 “Assessment of land use alternatives, December 2019”, including Appendix 7 – Land Use Options Assessment, PDP, December 2019.

The WP15.1 evaluation has developed a preferred/recommended type of land use for each of the Short List Options at each possible land application site location. This recommendation is based on the technical suitability and favourability, based only on aspects covered in the assessment. For the inland sites it was agreed to use Site Location 1, the land parcels closest to Palmerston North.

Generally, the recommendations for each land application site location correlates with the soil types which dominate each site. In summary:

- The Inland LA sites (L+Ra, L+Rd, GW-2, and Dual R+L) are typically dominated by High Productivity Soils being fluvial and loam soils. The recommended land use is Cut and Carry (Lucerne or Barley).
- The Coastal LA sites (L+Rb, L+Re, and O+L) are typically dominated by raw sandy soils. Exotic Forestry is the recommended land use for these regions.

The land application infrastructure is based on the summary provided as part of WP15.1, and updated as part of WP15.7 and following the revision of the population forecasts (refer A03109212_PDP_UpdatedPopulation_OptionsSummary_STRev.xlsx, PDP, June 2021). The areas and volume of storage and rapid infiltration basins are based on the indicative preferred site, and the assumed split between irrigation/storage and rapid infiltration.

Some rapid infiltration has been included with each of the land options to provide buffering from above average wastewater treatment plant flow, and to bridge wet periods where land application is not suitable or practicable. The benefit of installing rapid infiltration infrastructure, versus greater discharge to the river for these days, will need to reviewed if one of these options is selected as the BPO.

2.5 Conveyance Updates

Conveyance upgrade requirements were initially updated as part of WP15.1, based on the land locations identified, and River and ocean outfall locations, and following the same rationale as in the Long List Traffic Light Briefing Report. The range of pipeline lengths and number of pump stations required is based on the potential land application sites identified. These have been updated for this report based on the site selected that was taken into the MCA process.

For sites identified with multiple land parcels, the location for discharge has been taken at the centroid of the land parcel (or multiple land parcels), as per WP15.1.

2.6 Regional Scheme

The May 2021 Options Summary Report included this additional assessment not included in the earlier report. This July 2021 report similarly includes this assessment of the additional works that would be required for this option with regards to a regional scheme, or sub-regional scheme. There are many options available if a regional scheme was to be considered. This section outlines at a high level how the scheme would have to be adapted (post construction or pre-construction) to allow for the additional flows should such a scheme not be implemented from the outset.

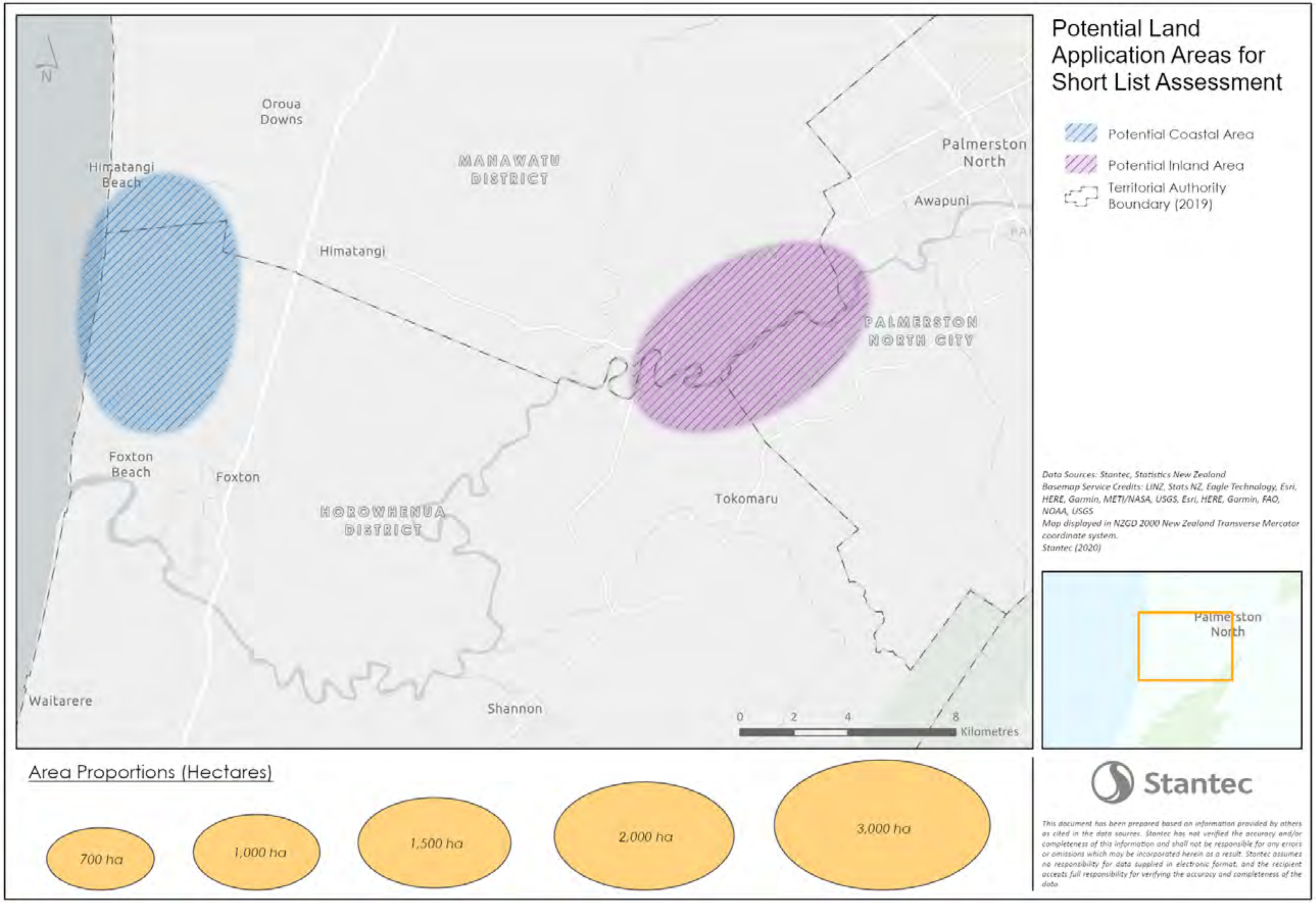
A regional scheme includes picking up the wastewater from communities such as Fielding, Marton, Bulls, Halcombe etc.

This does assume the additional flows are treated at the wastewater treatment plant. An alternative would be to treat locally and look at regional discharge (most likely suitable for the ocean outfall options).

As outlined in the Shortlist Treatment Addendum Report it is expected there is sufficient room at the treatment plant for additional treatment processes to be added if required for growth.

2.7 Staging Possibilities

Following on from the May 2021 Options Summary Report, this July 2021 report also outlines at a high level whether there are possibilities of staging the options. This is only to give an indication at this stage, and does not complete a full assessment of staging alternatives for each option.



Data Sources: Stantec, Statistics New Zealand
Basemap Service Credits: LINZ, Stats NZ, Eagle Technology, Esri, HERE, Garmin, METI/NASA, USGS, Esri, HERE, Garmin, FAO, NOAA, USGS
Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Stantec (2020)

Figure 2-1 Potential Land Application Areas for Short List Assessment

3 Indicative Comparative Cost Estimates

Initial indicative comparative cost estimates were prepared for the long list workshop and comparative traffic light assessment. These indicative, comparative cost estimates have been updated through work packages listed in Table 1-3, and again recently following a review of the capital costs. The updated indicative comparative cost estimates are included here. These estimates were compiled to the same level of accuracy as used for the traffic light assessment of the long list options. They cover capital, annual operation and maintenance and Net Present Value (NPV).

Key assumptions made in the development of these cost estimates, and the breakdown of the cost estimates into their key components is covered in each of the work packages listed in Table 1-3.

For this version of the shortlist summary report (August 2021) the costs include the following:

1. Review of capital costs including higher percentage contingencies by Alta Consulting
2. Review of land purchase costs by the Property Group following feedback at the comparative assessment workshops that the land values used did not reflect the current market situation.
3. Revised population forecasts used by Palmerston North City Council (PNCC) in its 10-year plan process which required– re-calculation of capital and operational costs due to the dependency of option scope and particularly land area on projected populations
4. Review of land application infrastructure construction cost rates
5. Review of capital cost estimate completeness leading to identification of some work items not previously included
6. Review of electricity supply requirements for specific options leading some additional allowance for electrical network upgrades

The Flows and Loads Summary report (WP 7.3) was updated in May 2021 to include the updated population forecast based on Infometric's high growth rate projections from 2021 through to 2051. The higher population at 2051 (covering a 35 year resource consent duration) results in higher domestic wastewater flows and loads as compared to the previous 2018 projections. This increase results in the revised 2073 (50 year projections) rising from 120,000 population equivalent to 140,000 population equivalents, a 17% increase.

The increased flows resulted in an increase in the land areas required for land application and associated infrastructure costs, some of the treatment elements not based on peak flows, and overall operations and maintenance costs.

The Assessment of Land Use Alternatives, December 2019 report includes a high-level estimate of incomes from an assumed commercial crop on the land application options. The land use values that were included in this report were challenged at the MCA workshop. As noted above updated land values have been sought and the comparative cost estimates have been updated with these new values.

The Preliminary & General, Professional Services Fees PNCC costs, and contingencies have been included as a total for each option.

The NPV shown is based on the P50 estimate. The P50 estimate represents a cost that likely to be exceeded in half of the outcomes. It is estimated that the project cost has equal chances of being under or over this value. The P95 estimate represents a cost that is likely to be exceeded in only 5% of the outcomes. The P95 is therefore a conservative estimate at this stage of the project. A cost estimate summary table is included in Appendix 2 (not rounded to the nearest million).

Operating & Maintenance (O&M) Costs presented are based on the O&M costs in Year 1 and do not include net income from land use activities. O&M varies through growth, and includes renewal works for infrastructure in the year estimated to be required. Net Annual Income is assumed to happen annually from Year 1 (Y1) for inland cut and carry sites, and for the coastal forestry sites it has been assumed they will be harvested and replanted through Y26-30. Income from carbon credits has not been included in the annual income.

The updated indicative comparative cost estimates, with the projected population increase allowed for, are summarised in Table 3-1, rounded to the nearest million.

Table 3-1: Summary of updated indicative comparative cost estimates (in millions) – June 2021

Option		Capital Cost[1]	Land Cost[2]	Y1 Operating & Maintenance Costs (O&M)[3]	Net Present Value (NPV)
1	R2(b) River discharge with enhanced treatment [4]	$241	$3	$6	$337
2	R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow	$387	$55	$7	$496
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	$318	$61	$6	$419
4	L+R (a) 97% of the time to Land (inland)	$605	$249	$4	$604
5	L+R (b) 97% of the time to Land (coastal)	$733	$81	$7	$836
6	L+R (d-1) to land <80m^3/s / 53% of the time to Land (inland)	$410	$136	$5	$470
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)	$369	$112	$5	$433
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L	$708	$115	$5	$786
9	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L	$652	$95	$5	$730
8b	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 10 mg/L	$614	$42	$6	$712

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[1] Total Capital Cost with P50 contingencies.
[2] Land purchase with P50 contingencies, inclusive of wetland and land parcel.
[3] This does not include estimate income from land application schemes and is the estimate for Y1 of operation. The individual Option Summaries include estimates of incomes.
[4] This option is for SIN = 2mg/L, Treatment Option 1.4 outlined in WP15.2 Report, September 2020 and the WP15.9 Addendum Report, February 2021.

Option		Capital Cost[1]	Land Cost[2]	Y1 Operating & Maintenance Costs (O&M)[3]	Net Present Value (NPV)
9b	L+R (e-2) to land <62m^3/s / 43% of the time to land (coastal) TN = 10 mg/L [4]	$599	$38	$6	$697
10	O+L / ocean with land (coastal)	$547	$49	$5	$621
11	Ocean discharge	$406	$1	$5	$480

As discussed in Section 1 two variations were considered for the L+R(e) options – Options 8 & 9 with lower (Level 2) levels of treatment and larger land areas, and Options 8b and 9b with higher (Level 3) levels of treatment and smaller land areas. The costs for both are included in Table 3-1 above for completeness, but for consistency only Option 8 and 9 are included in the Option Summaries in Section 4.

Chart 3-1 below shows the split of the NPV between capital costs (P50) and the NPV of the Operations and Maintenance costs over the proposed 35 year duration of the consent.

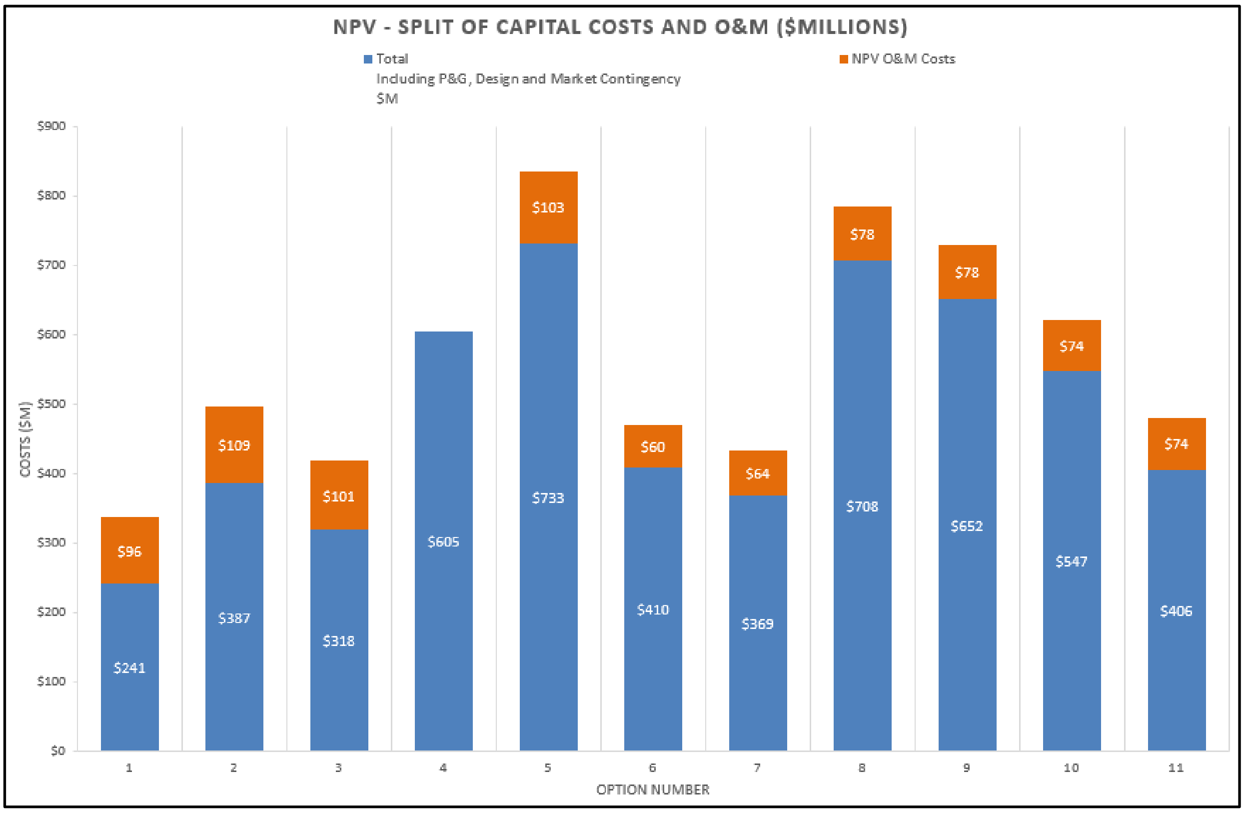

Chart 3-1 NPV - Split between Capital Costs (P50) and NPV of Operations & Maintenance Costs (35 year duration)

3.1 Options Development

As discussed in the sections above the shortlist options have been further developed and refined as further information was available, and assessment and modelling work completed. This has led to the following changes to the shortlist options from the longlist assessment report, and previous reports.

3.1.1 R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow

The Aquanet modelling of the effects on the Manawatū River of full discharge at Tōtara Rd showed that the level of treatment required to meet the One Plan targets (Soluble Inorganic Nitrogen (SIN) = 0.3mg/L in dry flow conditions) would be equivalent to treating the wastewater with technology that is more regularly used for drinking water, i.e., using a Reverse Osmosis (RO) plant. A RO plant has a very high capital cost, as well as high annual operating and maintenance costs, and the treatment process results in a brine byproduct which could be difficult to dispose of. Workpackage 15.2 discusses the practicalities and issues associated with a RO plant and highlights how globally it would amongst few (if any) examples.

It was agreed by the Project Technical Group to include a wastewater treatment plant upgrade option that could provide a significant improvement in the level of treatment for the discharge (although not to the level required to meet all One Plan standards) and which is more feasible from an operational and cost perspective than an RO plant. Option R2(b) outlines this option for a 5-Stage Bardenpho Biological Nutrient Removal with membrane treatment (MBR) and UV disinfection. The RO treatment upgrade option is not included in the Options for assessment because its anticipated cost would render the option ‘fatally flawed’ based on criteria used in the long list phase of the project.

A variant of R2(b), included in the Options for short list assessment, is removing 50-75% of the average dry weather flow (ADWF) for discharge to land. This results in a gross land area of 430 ha to 670 ha being required, as well as the treatment upgrades. R2(b) 75% to land is included in the Option Summaries and costing.

3.1.2 Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow

Initial assessment of this option undertaken as part of Aquanet’s river modelling work, showed that as described for the long list assessment phase, this option was unlikely to get consent granted if it was selected as the BPO due to the adverse effects on the River.

This option has therefore been refined to have discharge to the Manawatū River at the Tōtara Rd outlet when river flow is greater than 62m^3/s, discharge to the Manawatū River downstream of the Opiki Bridge and Oroua confluence when the river flow is between 62m^3/s and 37.5m^3/s, and partial to full discharge to land when the river flow is less than 37.5m^3/s (two variants included in the options summary – 75% and 100% discharge to land). Only Dual R+L 75% to Land has been included in the options to go forward to the MCA at this stage as there was not a material benefit for the 100% to land option for the additional cost.

A further refinement that could be undertaken, if this option is selected as the BPO, increasing the trigger level for discharge at Tōtara Rd (i.e. discharge at Opiki/Oroua confluence more often) and keeping the Tōtara Rd discharge for very high flows only. A discussion could be had on the suitable level of wetland/land passage at Tōtara Rd weighed up against the quantity of flow pumped to

Opiki/Oroua for discharge. The primary requirement of this option is removal of the discharge from the Tōtara Rd location when the River flow is less than 62m^3/s.

3.1.3 L+R (d) and (e)

The initial intent of the L+R (d) and (e) options was removal of at least 50% of the flow to land. The flow triggers for these options have changed, and two trigger levels (discharge to river at flows >62m^3/s and >80m^3/s, which equate to removing the flow from the river 43% and 53% of the time respectively) have been included in the assessment.

The Pattle Delamore Partner (PDP) assessment of the land discharge requirements for coastal land (L+R (e) and O+L) initially identified that a Total Nitrogen (TN) of 10mg/L was required for discharge on coastal land environments, due to assumption of leaching rates of <20kg N/ha/yr maximum[5]. An assessment was also completed to determine the land areas required if a lower level of treatment (i.e. a higher TN level in the treated wastewater) was allowed for. WP15.9 Shortlist Treatment Addendum identifies the higher level of treatment as being required for the L+R (e) options as this is what the receiving environment can handle.

There is a trade-off in the coastal land application areas between a higher level of treatment and less land, and a lower level of treatment and greater land areas for application. Though the value of the land areas is still under consideration, for the basis of this report this has resulted in a selection of an option of a TN treatment level of 35mg/L, with a gross land area of 3,110 ha for assessment.

Due to the dual trigger levels (discharge to river at flows >62m^3/s and >80m^3/s, which equate to removing the flow from the river 43% and 53% of the time respectively) , and inland and coastal land locations, there are four variants for assessment under this option.

3.1.4 GW2

This option was identified as needing the same level of treatment as for R2(b) as it discharges to shallow aquifers, from which it is assumed will enter the River. This resulted in high capital and operating costs due to the high level of treatment required, combined with land purchase, conveyance and discharge infrastructure. It was proposed by the Project Technical Group that this option did not offer anything of value over the other options and coupled with its very high cost should be removed from the list of options for assessment.

This was endorsed in Principal by the Project Steering Group. No description of this option has been included in the summaries below and it will not be carried through the short list assessment phase.

3.1.5 O+L / Ocean with Land (coastal)

As discussed in Section 3.1.3 above, the PDP assessment identified a land treatment level for TN of 10 mg/L. As a large portion of flow under this option is to be discharged to the ocean, approximately 2km off shore, into approximately 20m of water, it was questioned whether upgrading the WWTP to treat to this level was required. The options of treating to a lower level of TN, and discharging to a

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[5] Note: these proposed leaching rates are higher than those required in Table 14.2 of the Horizons One Plan. As part of WP 15.1 it has been assumed that achieving the One Plan table 14.2 requirements would require either unfeasibly large areas of land or unfeasibly high levels of treatment. Further conversations with Horizons are recommended in relation to this point, and in line with PNCC's submission on One Plan PC 2.

greater area of land, were compared, and it was proposed to go with a TN treatment level of 35mg/L, with a gross land area of 1,470 ha for assessment.

It was also agreed to include an alternative option, brought back from the long list, of an ocean discharge with no land application (Option O). This was re-included given the increases in the cost of O+L. Based on these cost increases it was considered appropriate to re-assess the appropriateness of an ocean discharge (only) option as part of the short list assessment.

3.2 River Discharge Mixing

One significant improvement that could be made to any option that includes River discharge would be to design and install a discharge system that allows for a higher level of mixing than is currently achieved. This will have significant positive effect in low flow situations in River. The current diffuse bankside discharge only achieves partial mixing as defined under the One Plan.

In order to maximise the fusion of the treated wastewater flow in low River flow situations (in high flow there should be enough flow/turbulence), the discharge location and discharge arrangements is important. Narrowing of rivers and river bends are good places to place discharges as any turbulence created by the river bends lasts a while before returning to a more laminar flow. Figure 3-1 below highlights some areas within relative close proximity to the WWTP current site where modifications could potentially be made for improved mixing.

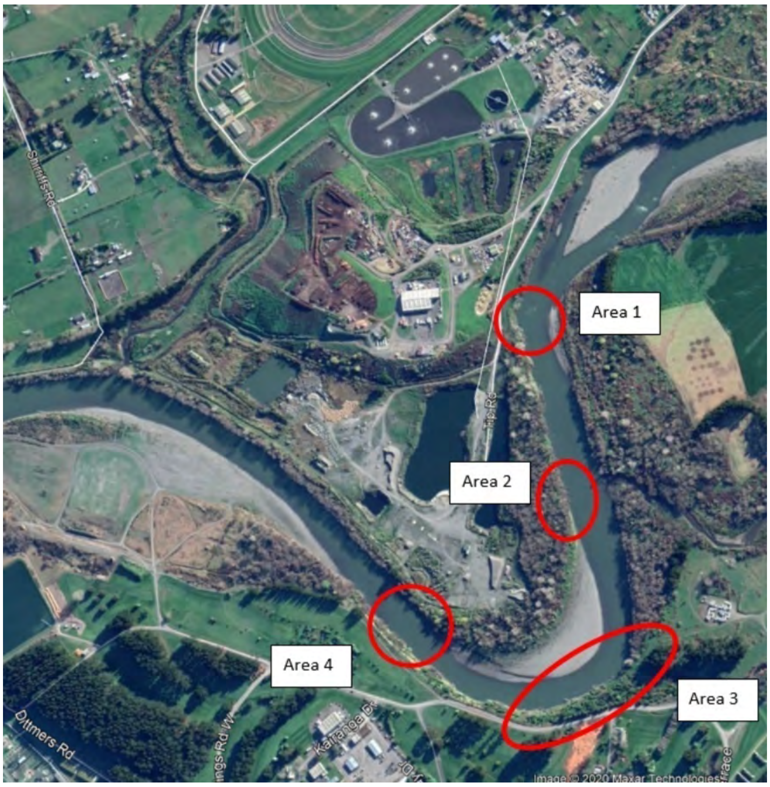


Figure 3-1 Totora Rd River Discharge Options for Mixing

- Area 1 is a place of conference which could allow for more complete mixing.
- Area 2 is the inside of a of a beginning bend, which will be slower moving initially but flow discharged there is likely to be pulled across the River in natural diffusion process. Area 4 is where the discharge at Area 2 will be mixed as the turbulence from the bend is reduced.

  - It’s also important to identify the material on the outer edge of the bend. For example ideally at Area 3 it will be rocks or willows as these strengthen the riverbank and create rough surfaces which are areas of higher turbulence. If the Area 2 discharge position was chosen, further investigation on the bank composition would be required and likely recommend armament (if not already in place), to protect surrounding infrastructure and add turbulence.

Another approach that could be investigated is the discharge mechanism. Some potential options that could be investigated are discussed below.

- The treated wastewater could be diffused across the width of the river by using a multi-point diffuser pipe (similar to Hamilton City Council discharge into Waikato River). This would not fulfil the cultural preferences that have been expressed by Rangitāne representatives so far in the project.
- The treated wastewater could be discharged from a single discharge through a length of bankside rock wall and diffuse below river level.
- Could spread the flow in long perforated pipe and allow for ground soakage/diffusion through rock wall into the river. This spreads the entry point into the river to aid with mixing.
- The flow could be divided into smaller channels/pipes close to the point of discharge to achieve similar dispersion by discharging at multiple points.
- A proportion of the river flow could be diverted into a bank side mixing pond to which treated wastewater is discharged.
- In River turbulent mixers could be strategically placed to aid mixing.

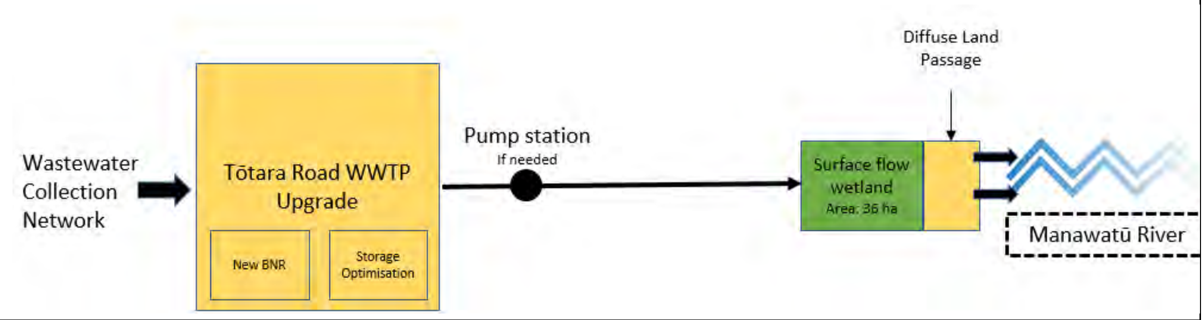
These options have been outlined here for information only. If either variant of option 1 is identified as the BPO then opportunities to achieve more complete mixing will be thoroughly investigated. Such investigation would need to consider all implications and values relevant to the discharge.

3.3 Glossary

A glossary of terms being used for the entire project is included in Appendix A.

4 Options Summaries

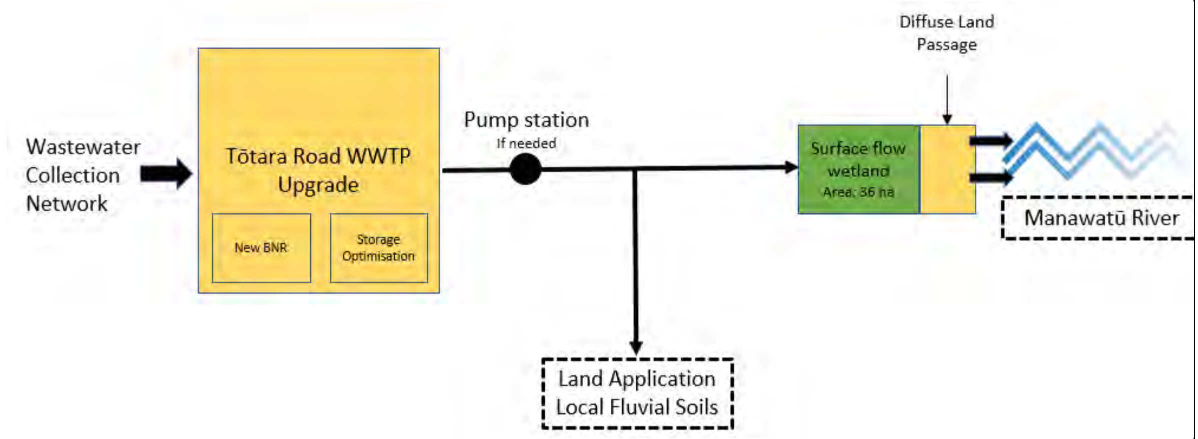
4.1 Option 1: R2(b) River Discharge with Enhanced Treatment

	
a. Flow triggers for treatment levels	100% of treated wastewater discharged to the Manawatū River at the Tōtara Road site. Additional Phosphorus (DRP) removal applied as River flow falls below 75 m^3/s (DRP = 0.2mg/L below median flow) with greater removal as River flow drops further below half median flow (DRP = 0.1mg/L below half median flow). Additional treatment will be required when river flows are low to meet SIN = 2mg/L for low flow.
b. Treatment upgrades	Treatment Level 4 High level of nitrogen and phosphorous removal, and includes membrane filtration. Membranes provide additional disinfection, treated wastewater has zero suspended solids and very low BOD content. The following new infrastructure is required: • New fine screens • New grit removal facilities (replacing existing) • Additional primary sedimentation tanks (for population growth) • New activated sludge bioreactors • New membrane bioreactors (MBRs) and associated equipment • New carbon dosing facilities • New waste activated sludge thickeners • Upgrade of the existing UV disinfection facility
c. Wetland / land passage	Surface flow wetland approximately 36Ha (Wetland 1) with diffuse land passage discharge to water (Land Passage 1).
d. Conveyance upgrades	Due to the size of the wetlands some additional conveyance costs for the wetland or land passage have been allowed for in the wetland indicative cost estimates.
e. Regional Scheme	Treatment would have to be upgraded to a higher level to mitigate effects of additional flow on the river, or would require discharge to land to be added to the scheme. WWTP upgrades would be required for additional flow.

<table>
<tr><th></th><th></th></tr>
<tr><td>f. Staging Possibilities</td><td>The activated sludge and membrane bioreactors can be easily staged, with 2-3 bioreactor trains and 3-4 MBR trains constructed initially and additional bioreactor and MBR trains deferred until required by population growth.</td></tr>
<tr><td>g. Comparative cost estimate</td><td>Comparative Cost Estimate in millions.
<table>
<tr><th>NPV</th><th>$337</th></tr>
<tr><td>Treatment</td><td>$183</td></tr>
<tr><td>Conveyance</td><td>$1</td></tr>
<tr><td>Wetlands & Land Passage</td><td>$45</td></tr>
<tr><td>Land Application Infrastructure</td><td>-</td></tr>
<tr><td>Land Application Land Purchase</td><td>-</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$241</td></tr>
<tr><td>Y1 O&M</td><td>$6</td></tr>
<tr><td>Net Income per annum</td><td>$0</td></tr>
</table>
</td></tr>
<tr><td>h. Key Matters</td><td>• River discharge point likely to be within Palmerston North City boundary, depending on location of wetland and / or land passage
• High level of treatment which increases as river flow falls
• Treatment targeted at nutrient (nitrogen and phosphorous) removal
• Potential for staging of treatment plant upgrades to match growth
• Lowest NPV cost but high O&M cost
• Will be expected to require wetland and land passage to be acceptable to iwi</td></tr>
</table>

4.2 Option 2: R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow

Formerly a variation of Option 1.

<table>
<tr><th></th><th></th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>a. Flow triggers for treatment levels</td><td>Majority of treated wastewater discharged to the Manawatū River at the Tōtara Road site, with 75% ADWF applied to land when River flow is less than half median (37.5m^3/s).
Additional Phosphorus (DRP) removal applied as River flow falls below 75 m^3/s (DRP = 0.2mg/L below median flow) with greater removal as River flow drops further below half median flow (DRP = 0.1mg/L below half median flow).
Additional treatment will be required when river flows are low to meet SIN = 2mg/L for low flow.</td></tr>
<tr><td>b. Treatment upgrades</td><td>Treatment Level 4
High level of nitrogen and phosphorous removal, and includes membrane filtration. Membranes provide additional disinfection, treated wastewater has zero suspended solids and very low BOD content.
The following new infrastructure is required:
• New fine screens
• New grit removal facilities (replacing existing)
• Additional primary sedimentation tanks (for population growth)
• New activated sludge bioreactors
• New membrane bioreactors (MBRs) and associated equipment
• New carbon dosing facilities
• New waste activated sludge thickeners
• Upgrade of the existing UV disinfection facility</td></tr>
<tr><td>c. Wetland / land passage</td><td>Surface flow wetland approximately 36Ha (Wetland 1) with diffuse land passage discharge to water (Land Passage 1).</td></tr>
<tr><td>d. Land application location</td><td>Inland, fluvial soils</td></tr>
<tr><td>e. Land use alternatives</td><td>Potential sites are typically all High Productivity Soils. The recommended land use is Cut and Carry (Lucerne or Barley).</td></tr>
</table>

<table>
<tr><th></th><th colspan="2"></th></tr>
<tr><td rowspan="3">f. Land application area requirements[6]</td><td>Irrigation Area Required (ha)</td><td>585</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>175</td></tr>
<tr><td>Total Area Required (ha)</td><td>760</td></tr>
<tr><td>g. Land application infrastructure</td><td colspan="2">• A significant proportion of the scheme is located in a flood area so the irrigation will all be via k-line irrigators (50%) and centre pivot (50%).
• 40,000 m³ active volume onsite storage facility (lined), lagoon area 1 ha, 4m operational depth + 1m freeboard.</td></tr>
<tr><td>h. Conveyance upgrades</td><td colspan="2">Due to the size of the wetlands, some additional conveyance costs for the wetland or land passage have been allowed for in the indicative cost estimate for the wetlands.
Discharge of ADWF has been assumed to be as per Inland site 1.
630mm dia pipeline in the road reserve (11km long, depending on sites location)
Pump stations including power supply (1 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td colspan="2">Treatment would have to be upgraded to a higher level to mitigate effects of additional flow on the river, or a greater percentage would need to be discharged on to land.
WWTP upgrades would be required for additional flow.
Additional land would need to be purchased to meet the requirement of 75% ADWF to land.</td></tr>
<tr><td>j. Staging Possibilities</td><td colspan="2">The activated sludge and membrane bioreactors can be easily staged, with 2-3 bioreactor trains and 3-4 MBR trains constructed initially and additional bioreactor and MBR trains deferred until required by population growth.
It may not be necessary to install all land application infrastructure initially, though the land would be expected to be secured for the future land areas required.</td></tr>
<tr><td>k. Comparative cost estimate</td><td colspan="2">Comparative Cost Estimate in millions.
<table>
<tr><th>NPV</th><th>$496</th></tr>
<tr><td>Treatment</td><td>$183</td></tr>
<tr><td>Conveyance</td><td>$58</td></tr>
<tr><td>Wetlands & Land Passage</td><td>$44</td></tr>
<tr><td>Land Application Infrastructure</td><td>$36</td></tr>
<tr><td>Land Application Land Purchase</td><td>$52</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$387</td></tr>
<tr><td>Y1 O&M</td><td>$7</td></tr>
<tr><td>Net Income per annum</td><td>$0.3</td></tr>
</table>
</td></tr>
</table>

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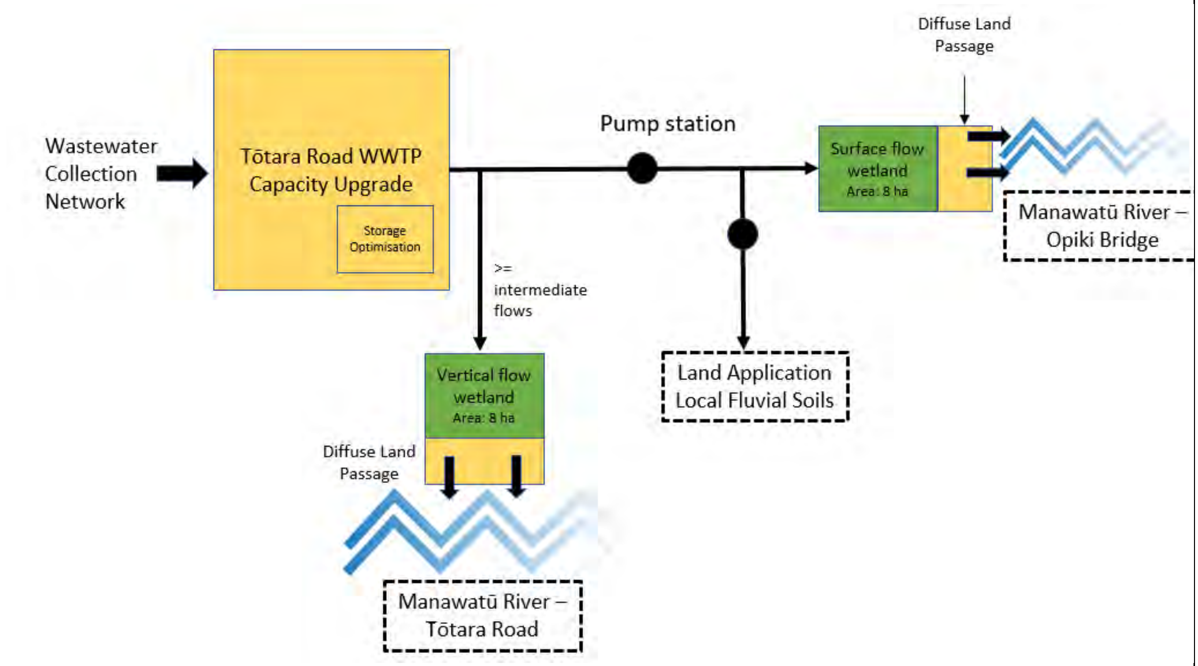
[6] These areas are based on the possible land application sites assessed in WP15.1.

I. Key Matters	• River discharge point likely to be within Palmerston North city boundary, depending on location of wetland and / or land passage • High level of treatment which increases as river flow drops • Treatment targeted at nutrient (nitrogen and phosphorous) removal • Potential for staging of treatment plant upgrades to match growth • Relatively small land area and number of land parcels affected • Will be expected to require wetland and land passage to be acceptable to iwi

4.3 Option 3: Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow

Formerly Option 2

	
a. Flow triggers for different discharge elements*	When the River flow is greater than 62m³/s the treated wastewater would be discharged, via wetland/land passage, to Manawatū River at or near Tōtara Rd. When the River flow is between 62m³/s and 37.5m³/s the treated wastewater would be discharged, via wetland/land passage, to Manawatū River below Opiki Bridge and Oroua confluence. When the River flow is less than half median flow (37.5m³/s) 75% of ADWF would be discharged to land (condition to apply year-round), whilst still maintaining enough flow to keep the wetlands alive. This option has discharge to the River at all times when the River flow is above 37.5m³/s (half median flow).
b. Treatment upgrades	Treatment Level 2 Provides a similar level of treatment to the existing WWTP with chemical phosphorous removal, at River flow less than median flow (75m³/s). The following new infrastructure is required: • New grit removal facilities (replacing existing facilities) • Additional primary sedimentation tanks for growth • New aerators and baffles in the existing aerated lagoons • Additional chemical clarifier • Upgrade of the existing UV disinfection facility

<table>
<tr><td>c. Wetland / land passage</td><td colspan="2">For the discharge at or near Tōtara Road, a vertical flow wetland (Wetland 2) with a diffuse land passage discharge (Land Passage 1) to the Manawatū River.
For the discharge below Oroua, a surface flow wetland (Wetland 1) with a diffuse land passage discharge (Land Passage 1) to the Manawatū River.
There will likely be a need to configure the flow arrangements to keep the wetlands alive during the time the treated wastewater is applied to land.</td></tr>
<tr><td>d. Potential downstream discharge location(s)</td><td colspan="2">Proposed Opiki discharge location is below Oroua confluence.</td></tr>
<tr><td>e. Land application location</td><td colspan="2">Inland, fluvial soils</td></tr>
<tr><td>f. Land use alternatives</td><td colspan="2">Potential sites are typically all High Productivity Soils. The recommended land use is Cut and Carry (Lucerne or Barley).</td></tr>
<tr><td rowspan="3">a. Land application area requirements[7]</td><td>Irrigation Area Required (ha)</td><td>670</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>200</td></tr>
<tr><td>Total Area Required (ha)</td><td>870</td></tr>
<tr><td>g. Land application infrastructure</td><td colspan="2">• Centre pivot irrigators (80% of area) with solid set irrigators in between (20% of area).
• 30,000 m^3 onsite storage facility (lined), lagoon area 1 ha.
• Rapid infiltration with capacity of 5,000 m^3/day, typically used 1 day per year.</td></tr>
<tr><td>h. Conveyance upgrades</td><td colspan="2">Discharge to river below Opiki bridge:
1300mm dia pipeline in the road reserve (14km long to Opiki discharge point)
Pump stations including power supply (1 No.)
Discharge to land:
1300mm dia pipeline in the road reserve (7 km long, depending on site location)
Pump stations including power supply (included in above)</td></tr>
<tr><td>i. Regional Scheme</td><td colspan="2">Treatment would have to be upgraded to a higher level (potentially BNR plant) to mitigate effects of additional flow on the river, or a greater percentage would need to be discharged on to land.
WWTP upgrades would be required for additional flow.
Additional land would need to be purchased to meet the requirement of 75% ADWF to land.</td></tr>
<tr><td>j. Staging Possibilities</td><td colspan="2">Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.</td></tr>
</table>

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[7] These areas, are based on the possible land application sites assessed in WP15.1.

<table>
<tr><td></td><td>Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>k. Comparative cost estimate</td><td>Comparative Cost Estimate in millions.
<table>
<tr><th>NPV</th><th>$419</th></tr>
<tr><td>Treatment</td><td>$56</td></tr>
<tr><td>Conveyance</td><td>$117</td></tr>
<tr><td>Wetlands & Land Passage</td><td>$21</td></tr>
<tr><td>Land Application Infrastructure</td><td>$53</td></tr>
<tr><td>Land Application Land Purchase</td><td>$60</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$318</td></tr>
<tr><td>Y1 O&M</td><td>$6</td></tr>
<tr><td>Net Income per annum</td><td>$0.3</td></tr>
</table>
</td></tr>
<tr><td>l. Key matters</td><td>

Would remain largely a river discharge
Opiki/Oroua confluence River discharge located outside of Palmerston North City boundary
Land application would be in area of high value, productive soils
Relatively small land area and number of land parcels affected
Costs are associated with conveyance and land application rather than treatment
The smaller application area is less impacted by the uncertainty around archaeological sites
Dual discharge points take advantage of the variable assimilative capacity of the River in different locations

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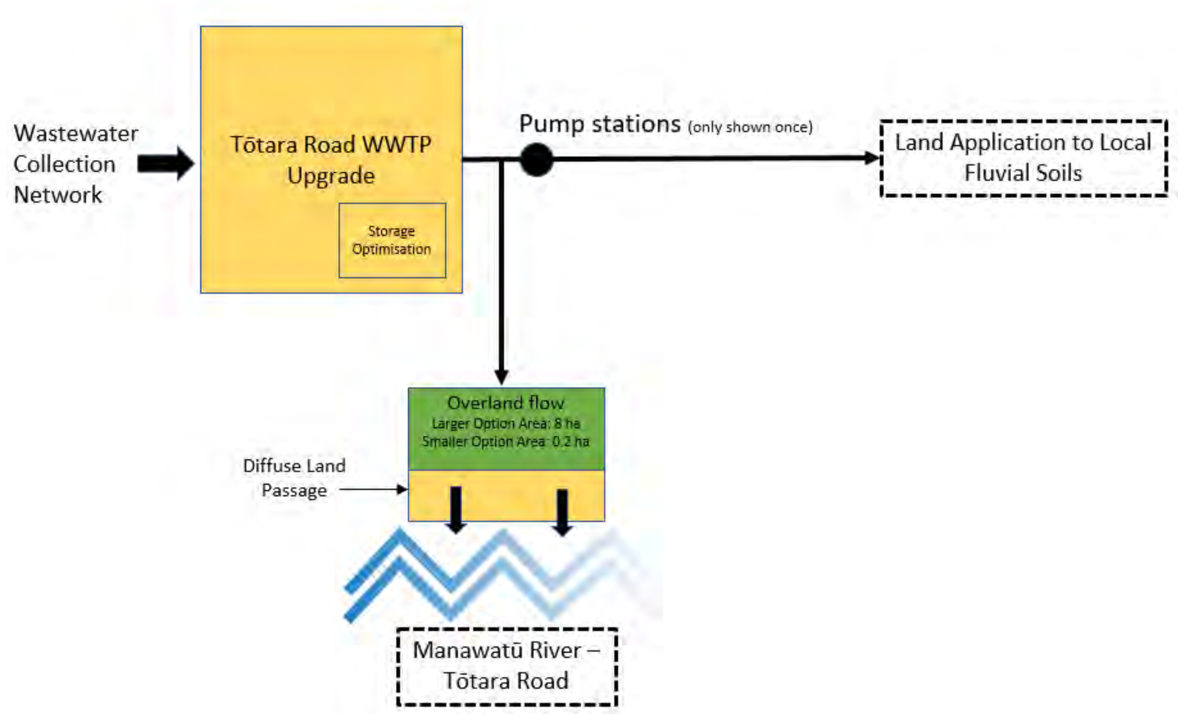
4.4 Option 4: L+R (a) / 97% of time to Land (Inland)

Formerly Option 3 (a)

	
a. Flow triggers for different discharge elements	Treated wastewater would be applied to land approximately 97% of the time. The remaining 3% of the time discharge is to the Manawatū River at Tōtara Rd which equates to approximately 11 days of highest discharge, and 954,000m^3 of volume. These days are expected to be when river flow is also high.
b. Treatment upgrades	Treatment Level One Provides a similar level of treatment to the existing WWTP without chemical phosphorous removal. Would require the following new infrastructure: - New grit removal facilities (replacing existing facilities) - Additional primary sedimentation tanks (for population growth) - New aerators and baffles in existing aerated lagoons - Upgrade of existing UV disinfection facility Alum dosing to remove phosphorus is not required. Existing clarifier will be used for continuous clarification.
c. Wetland / land passage	Overland flow (Land Passage Type 4) and diffuse land passage (Land Passage Type 1) discharge to water.
d. Land application location	Inland, fluvial soils.

<table>
<tr><td>e. Land Use Alternatives</td><td colspan="2">Inland sites typically dominated by High Productivity Soils, i.e. the fluvial/loam soils. The recommended land use is Cut and Carry (Lucerne of Barley).</td></tr>
<tr><td rowspan="3">f. Land application area requirements</td><td>Irrigation Area Required (ha)</td><td>2,890</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>870</td></tr>
<tr><td>Total Area Required (ha)</td><td>3,760</td></tr>
<tr><td>g. Land application infrastructure[8]</td><td colspan="2">• Centre pivot irrigators (80% of area) with solid set irrigators in between (20% of area).
• 160,000 – 200,000 m^3 active volume onsite storage facility (lined), lagoon area 4 ha.
• Rapid Infiltration with a capacity of 60,000 m^3/day, typically used 10-20 days per year.</td></tr>
<tr><td>h. Conveyance upgrades</td><td colspan="2">1300mm dia pipeline in the road reserve (11km long, depending on sites location)
Pump stations including power supply (1 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td colspan="2">Land application hydraulicly limited so would require additional land area which could be difficult for the size of the land areas identified in the inland fluvial sites. Likely treatment would have to be upgraded to a higher level (e.g. BNR plant with alum dosing for phospohorous) to allow greater discharge to the River.
WWTP upgrades would be required for additional flow.
If additional land was purchased for application conveyance system may need to be increased (additional or upsized pipelines).</td></tr>
<tr><td>j. Staging Possibilities</td><td colspan="2">There are limited options for staging of new infrastructure at the WWTP as this option maintains the existing process.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>k. Comparative cost estimate</td><td colspan="2">Comparative Cost Estimate in millions.
<table><tr><th>NPV</th><th>$604</th></tr><tr><td>Treatment</td><td>$50</td></tr><tr><td>Conveyance</td><td>$97</td></tr><tr><td>Overland Flow & Land Passage</td><td>$15</td></tr><tr><td>Land Application Infrastructure</td><td>$182</td></tr></table></td></tr>
</table>

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[8] The areas and volume of storage and rapid infiltration basins are dependant on the site selected, and the balance between irrigation/storage/rapid infiltration is an estimate at this time.

<table>
<tr>
<td></td>
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<table>
<tr><td>Land Application Land Purchase</td><td>$249</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$605</td></tr>
<tr><td>Y1 O&M</td><td>$4</td></tr>
<tr><td>Net Income per annum</td><td>$5</td></tr>
</table>
</td>
</tr>
<tr>
<td>I. Key matters</td>
<td>

Discharge likely to be outside of Palmerston North city boundaries
Still discharges to the River in exceptional flow conditions
Large land area required and would require security on on-going use of land
Includes supplementary storage facilities and rapid infiltration facilities
Large land area required, comprising large number of land parcels and neighbours
In area of High Value land, productive soils, but would manage to enhance crop production at dry weather times
High number of known and identified archaeological sites in areas under investigation
Key matter of groundwater protection of bore supplies in/adjacent to the area
Would be largest land application of municipal wastewater in NZ by far (5 to 6 times the next largest by area)
Minimised discharges to the River – expected to meet Horizons One Plan Policy 5-11, providing the 3% to the River can be accommodated.
Compatible with existing WWTP operation (without need for phosphorous removal clarifier)

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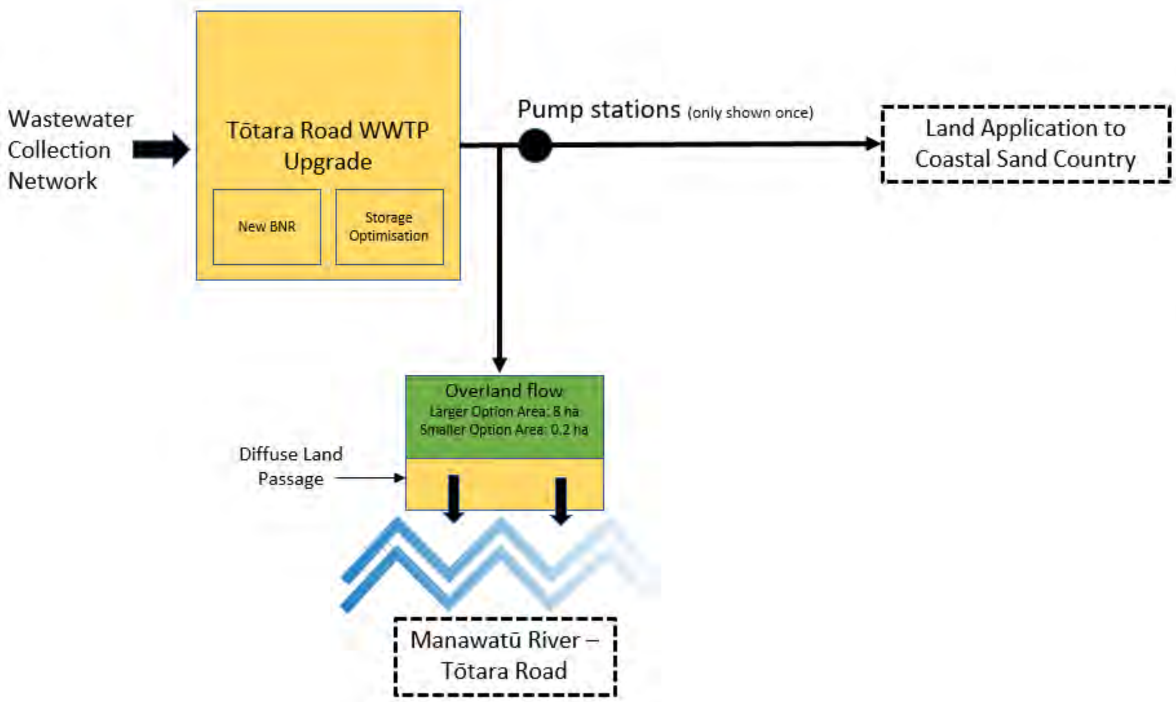
4.5 Option 5: L+R (b) / 97% of time to Land (Coastal)

Formerly Option 3 (b)

<table>
<tr><th></th><th></th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>a. Flow triggers for different discharge elements</td><td>Treated wastewater would be applied to land approximately 97% of the time. The remaining 3% of the time discharge is to the Manawatū River at Tōtara Rd which equates to approximately 11 days of highest discharge, and 954,000m^3 of volume. These days are expected to be when river flow is also high.</td></tr>
<tr><td>b. Treatment upgrades</td><td>Treatment Level 3
Requires nitrogen removal which is not provided by the current treatment plant.
Would require the following new infrastructure:
• New grit removal facilities (replacing existing facilities)
• Additional primary sedimentation tanks (for population growth)
• New activated sludge bioreactors
• 2 x additional secondary clarifiers and return activated sludge pumping
• New waste activated sludge thickeners
• Upgrade of the existing UV disinfection facility
Additional treatment is required for the coastal sites, compared to the inland, fluvial sites, as there is less take up of nutrients by forestry on sand country, and leaching needs to be managed.
Phosphorous removal would not be required when flow is being discharged to land, or with very high flows to the</td></tr>
</table>

	River, so the existing alum dosing clarifier could be removed.
c. Wetland / land passage	Overland flow (Land Passage Type 4) and diffuse land passage (Land Passage Type 1) discharge to water
d. Land application location	Coastal sand country
e. Land use alternatives	The coastal land application sites are typically dominated by sandy soils. Exotic Forestry is the recommended land use for these regions.
f. Land application area requirements	Irrigation Area Required (ha): 1,975 Buffer Area Required (ha): 595 Total Area Required (ha): 2,570
g. Land application infrastructure	• Solid set irrigation. • 160,000 m^3 onsite storage facility (lined), lagoon area 4 ha. • Rapid Infiltration with a capacity of 50,000 m^3/day, typically used 10 days per year.
h. Conveyance upgrades	1300mm dia pipeline in the road reserve (estimated 36km long, depending on sites location) Pump stations including power supply (4 No.)
i. Regional Scheme	Would require additional land area which could be difficult for the size of the land areas identified for this option, but possible in the coastal environment. Alternative is treatment upgraded to a higher level (e.g. BNR plant) to allow greater level of application on to existing land as not hydraulically limited. WWTP upgrades would be required for additional flow. If additional land was purchased for application conveyance system may need to be increased (additional or upsized pipelines).
j. Staging Possibilities	The new activated sludge process can be staged, with two bioreactor trains and one clarifier constructed initially and a third bioreactor train and second clarifier deferred until required. Land application infrastructure could be staged though the land may need to be secured early. Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.
k. Comparative cost estimate	Comparative Cost Estimate in millions. **NPV**: **$836** Treatment: $157 Conveyance: $298

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>Overland Flow & Land Passage</td><td>$15</td></tr>
<tr><td>Land Application Infrastructure</td><td>$170</td></tr>
<tr><td>Land Application Land Purchase</td><td>$81</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$733</td></tr>
<tr><td>Y1 O&M</td><td>$7</td></tr>
<tr><td>Net Income per annum in Y26-30 (tree harvest)</td><td>$13</td></tr>
</table>
</td>
</tr>
<tr>
<td>I. Key matters</td>
<td>

Discharge outside of Palmerston North city boundaries
Large land area required and would require security on ongoing use of land
Uncertainty about archaeological risk in the coastal areas
High capital cost but income stream from forestry
Depending on location groundwater flows likely to be to ocean, so less potential than inland options for (any) contamination of bore water.

</td>
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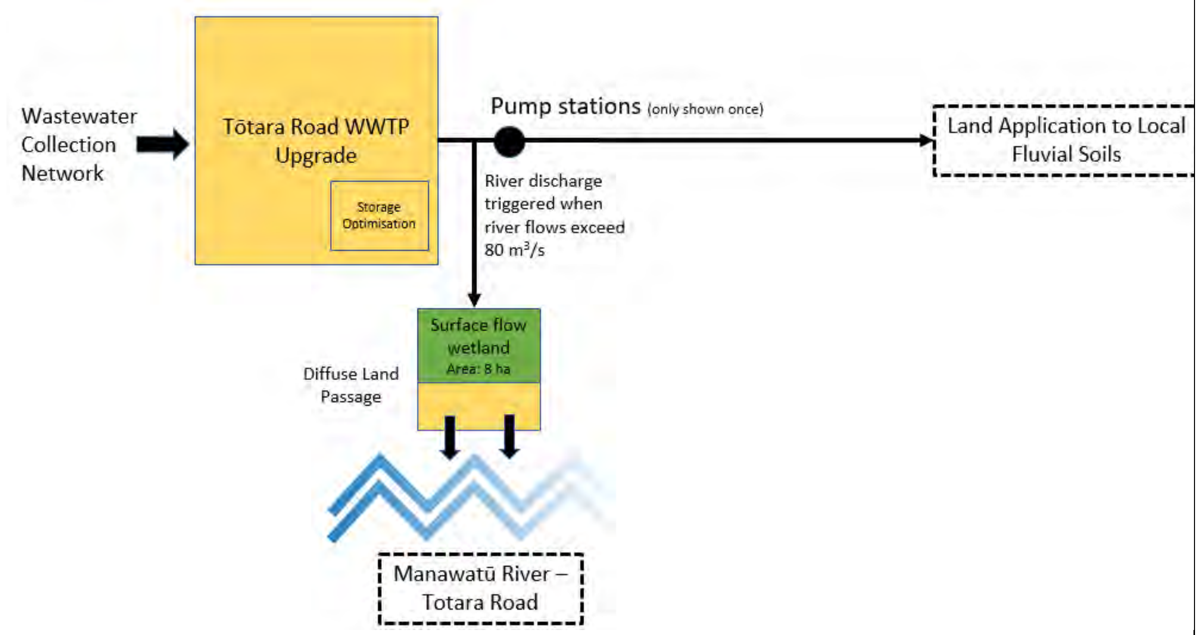
</table>

4.6 Option 6: L+R (d-1) to Land <$80m^3/s$ / 53% of the time to Land (inland)

Formerly Option 4 (d-1)

<table>
<tr><th></th><th colspan="2"></th></tr>
<tr><td colspan="3">
</td></tr>
<tr><td>a. Flow triggers for different discharge elements</td><td colspan="2">Treated wastewater would be applied to land when Manawatū River flow is less than $80m^3/s$, removing flow from the River approximately 53% of the time.

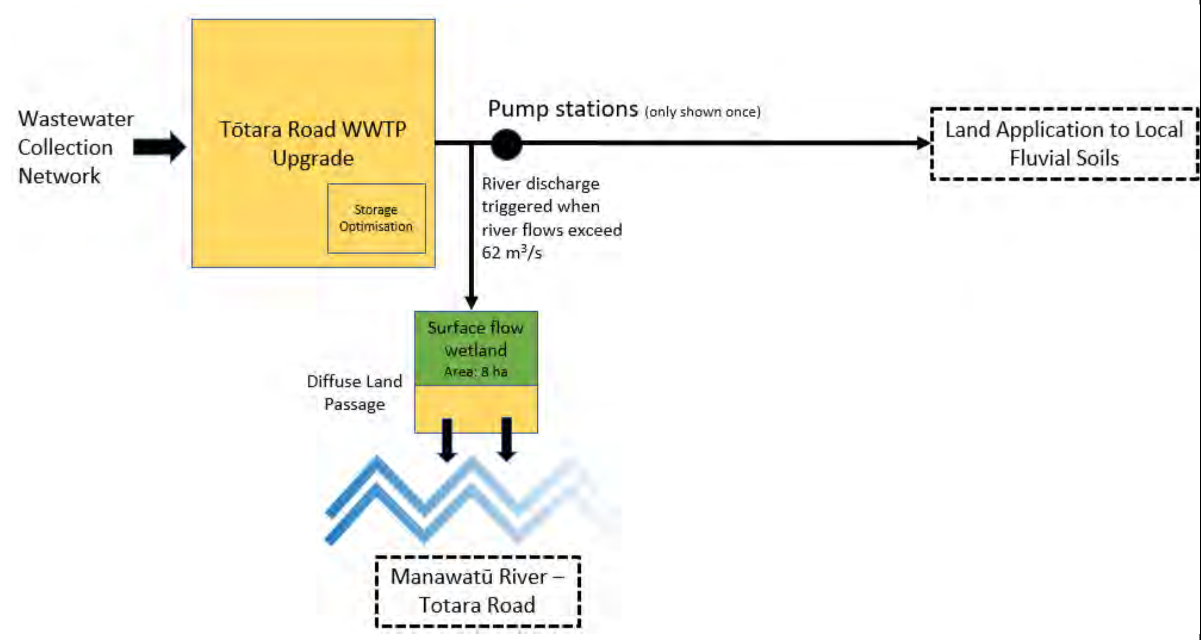
When the River flow is greater than $80m^3/s$, and on the highest 3% of days by WWTP flow (exceptional flow conditions), the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.</td></tr>
<tr><td>b. Treatment upgrades</td><td colspan="2">Treatment Level 2
Provides a similar level of treatment to the existing WWTP with chemical phosphorous removal.
The following new infrastructure is required:
• New grit removal facilities (replacing existing facilities)
• Additional primary sedimentation tanks for growth
• New aerators and baffles in the existing aerated lagoons
• Additional chemical clarifier
• Upgrade of the existing UV disinfection facility</td></tr>
<tr><td>c. Wetland / land passage</td><td colspan="2">Surface flow wetlands (Wetland 1) and Land Passage</td></tr>
<tr><td>d. Land application location</td><td colspan="2">Inland, fluvial soils.</td></tr>
<tr><td>e. Land use alternatives</td><td colspan="2">Inland land application sites typically dominated by High Productivity Soils, i.e. the fluvial/loam soils. The recommended land use is Cut and Carry (Lucerne of Barley).</td></tr>
<tr><td rowspan="2">f. Land application area requirements</td><td>Irrigation Area Required (ha)</td><td>1,540</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>460</td></tr>
</table>

<table>
<tr><td></td><td>Total Area Required (ha)</td><td>2,000</td></tr>
<tr><td>g. Land application infrastructure</td><td colspan="2">• Centre pivot irrigators (60 - 80% of area) with solid set irrigators in between (20 - 40% of area).
• 80,000 – 90,000m^3 onsite storage facility (lined), lagoon area 2 – 2.25 ha.</td></tr>
<tr><td>h. Conveyance upgrades</td><td colspan="2">1300mm dia pipeline in the road reserve (approximately 11km long)
Pump stations including power supply (1 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td colspan="2">Land application hydraulicly limited so would require additional land area. Alternative would be to have additional treatment upgrades to a higher level (i.e., BNR plant with alum dosing for phosphorous) to allow greater discharge to the River.
WWTP upgrades would be required for additional flow.
If additional land was purchased for application conveyance system may need to be increased (additional or upsized pipelines).</td></tr>
<tr><td>j. Staging Possibilities</td><td colspan="2">Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>k. Comparative cost estimate</td><td colspan="2">Comparative Cost Estimate in millions.
<table>
<tr><th>NPV</th><th>$470</th></tr>
<tr><td>Treatment</td><td>$56</td></tr>
<tr><td>Conveyance</td><td>$97</td></tr>
<tr><td>Wetlands & Land Passage</td><td>$9</td></tr>
<tr><td>Land Application Infrastructure</td><td>$99</td></tr>
<tr><td>Land Application Land Purchase</td><td>$136</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$410</td></tr>
<tr><td>Y1 O&M</td><td>$5</td></tr>
<tr><td>Net Income per annum</td><td>$1</td></tr>
</table></td></tr>
<tr><td>l. Key matters</td><td colspan="2">• Discharge outside of Palmerston North city boundaries
• Wetlands would need to be kept alive when discharging to land
• Discharge to the River reduced to around 57% of the time</td></tr>
</table>

	• Significant land area required involving large number of parcels and landowners • Less cost than L+R (a) as there is reduced irrigation in wetter (winter) periods. • Large number of known and identified archaeological sites in areas under investigation • Critical requirement is protection of bore supplies in/adjacent to the area • Compatible with existing WWTP operation (without need for phosphorous removal clarifier)

4.7 Option 7: L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)

Formerly Option 4 (d-2)

<table>
<tr><th></th><th colspan="2"></th></tr>
<tr><td colspan="3">
</td></tr>
<tr><td>a. Flow triggers for different discharge elements</td><td colspan="2">Treated wastewater would be applied to land when Manawatū River flow is less than 62m^3/s, removing flow from the River approximately 43% of the time.

When the River flow is greater than 62m^3/s, and on the highest 3% of days by WWTP flow (exceptional flow conditions), the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.</td></tr>
<tr><td>b. Treatment upgrades</td><td colspan="2">Treatment Level 2
Provides a similar level of treatment to the existing WWTP with chemical phosphorous removal.
The following new infrastructure is required:
• New grit removal facilities (replacing existing facilities)
• Additional primary sedimentation tanks for growth
• New aerators and baffles in the existing aerated lagoons
• Additional chemical clarifier
• Upgrade of the existing UV disinfection facility</td></tr>
<tr><td>c. Wetland / land passage</td><td colspan="2">Surface flow wetlands (Wetland 1) and land passage</td></tr>
<tr><td>d. Land application location</td><td colspan="2">Inland, fluvial soils</td></tr>
<tr><td>e. Land use alternatives</td><td colspan="2">Inland land application sites typically dominated by High Productivity Soils, i.e. the fluvial/loam soils. The recommended land use is Cut and Carry (Lucerne of Barley).</td></tr>
<tr><td></td><td>Irrigation Area Required (ha)</td><td>1,260</td></tr>
</table>

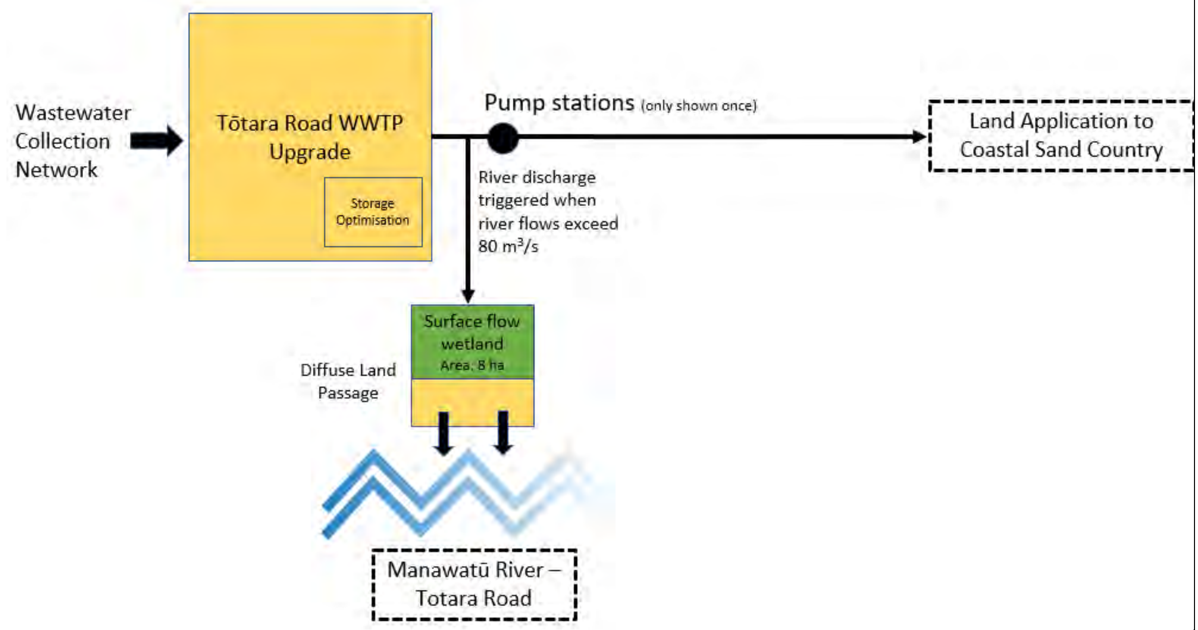
<table>
<tr><td>f. Land application area requirements</td><td><table><tr><td>Buffer Area Required (ha)</td><td>380</td></tr><tr><td>Total Area Required (ha)</td><td>1,640</td></tr></table></td></tr>
<tr><td>g. Land application infrastructure</td><td>• Centre pivot irrigators (60 - 80% of area) with solid set irrigators in between (20 - 40% of area).
• 80,000 – 90,000m^3 onsite storage facility (lined), lagoon area 2 – 2.25 ha.</td></tr>
<tr><td>h. Conveyance upgrades</td><td>1300mm dia pipeline in the road reserve (11km long)
Pump stations including power supply (1 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td>Land application hydraulicly limited so would require additional land area. Alternative would be to have additional treatment upgrades to a higher level (i.e., BNR plant with alum dosing for phosphorous) to allow greater discharge to the River.
WWTP upgrades would be required for additional flow.
If additional land was purchased for application conveyance system may need to be increased (additional or upsized pipelines).</td></tr>
<tr><td>j. Staging Possibilities</td><td>Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>k. Comparative cost estimate</td><td>Comparative Cost Estimate in millions.<table><tr><th>NPV</th><th>$433</th></tr><tr><td>Treatment</td><td>$56</td></tr><tr><td>Conveyance</td><td>$97</td></tr><tr><td>Wetlands & Land Passage</td><td>$9</td></tr><tr><td>Land Application Infrastructure</td><td>$83</td></tr><tr><td>Land Application Land Purchase</td><td>$111</td></tr><tr><td>Total Capex (P50 Contingency)</td><td>$369</td></tr><tr><td>Y1 O&M</td><td>$5</td></tr><tr><td>Net Income per annum</td><td>$1</td></tr></table></td></tr>
<tr><td>l. Key matters</td><td>• Discharge outside of Palmerston North city boundaries
• Wetlands would need to be kept alive when discharging to land</td></tr>
</table>

	• Discharge to the River approximately 57% of the time • Significant land area required involving large number of parcels and landowners • Less cost than L+R (a) as there is reduced irrigation in wetter (winter) periods. • Large number of known and identified archaeological sites in areas under investigation • Critical requirement is protection of bore supplies in/adjacent to the area • Compatible with existing WWTP operation (without need for phosphorous removal clarifier)

4.8 Option 8: L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L

Formerly Option 4 (e-1)

Option 8 has an additional option which utilises a higher level of treatment, Treatment Level 3, and a reduced land area. This option was considered at this stage of the analysis due to the increased in the land costs. It has a NPV of $712M.

<table>
<tr><th></th><th></th></tr>
<tr><td colspan="2">
</td></tr>
<tr><td>a. Flow triggers for different discharge elements</td><td>Treated wastewater would be applied to land when Manawatū River flow is less than 80m^3/s, removing flow from the River approximately 53% of the time.

When the River flow is greater than 80m^3/s, and on the highest 3% of days by WWTP flow (exceptional flow conditions), the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.</td></tr>
<tr><td>b. Treatment upgrades</td><td>Treatment Level 2
Provides a similar level of treatment to the existing WWTP with chemical phosphorous removal.
The following new infrastructure is required:
• New grit removal facilities (replacing existing facilities)
• Additional primary sedimentation tanks for growth
• New aerators and baffles in the existing aerated lagoons
• Additional chemical clarifier
• Upgrade of the existing UV disinfection facility</td></tr>
<tr><td>c. Wetland / land passage</td><td>Surface flow wetlands (Wetland 1).</td></tr>
<tr><td>d. Land application location</td><td>Coastal, sandy soils</td></tr>
</table>

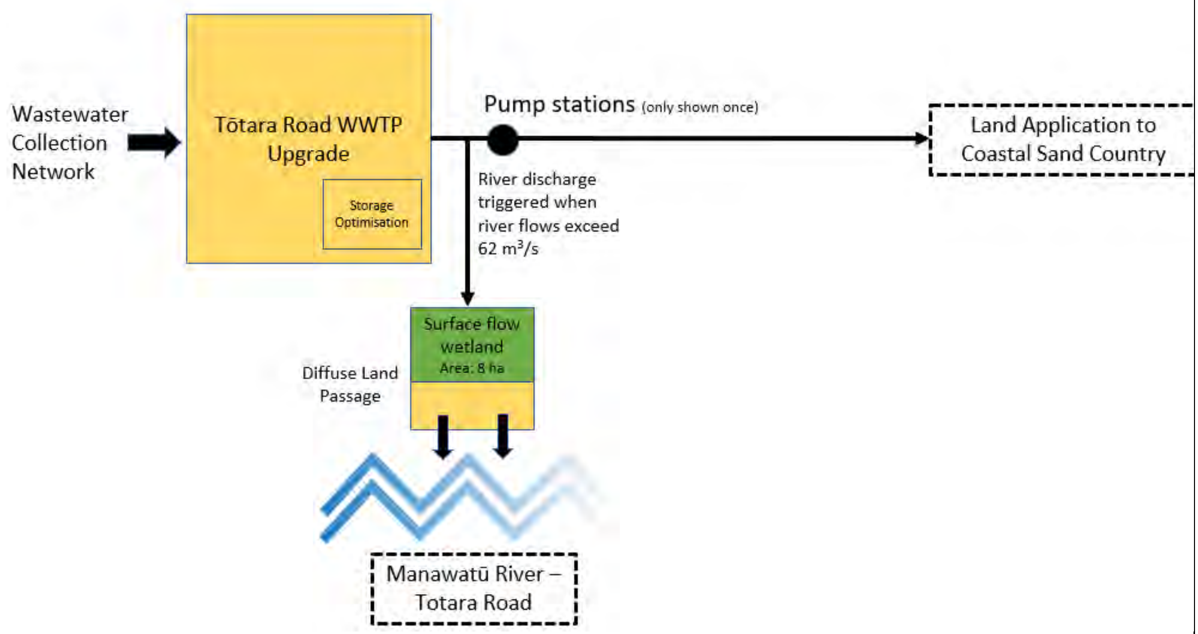
<table>
<tr><td>e. Land use alternatives</td><td colspan="2">The coastal land application sites are typically dominated by sandy soils. Exotic Forestry is the recommended land use for these regions.</td></tr>
<tr><td rowspan="3">f. Land application area requirements</td><td>Irrigation Area Required (ha)</td><td>2,800</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>840</td></tr>
<tr><td>Total Area Required (ha)</td><td>3,640</td></tr>
<tr><td>g. Land application infrastructure</td><td colspan="2">• Solid set irrigation.
• 60,000 m³ onsite storage facility (lined), lagoon area 1.5 ha.
• Rapid Infiltration with capacity of 15,000 m³/day, typically used 1 days per year.</td></tr>
<tr><td>h. Conveyance upgrades</td><td colspan="2">1300mm dia pipeline in the road reserve (36km km long)
Pump stations including power supply (4 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td colspan="2">Would require additional land area which could be difficult for the size of the land areas identified for this option, but possible in the coastal environment. Alternative is treatment upgraded to a higher level (i.e., BNR plant) to allow greater level of application on to existing land as not hydraulically limited. WWTP upgrades would be required for additional flow. Conveyance system may need to be increased (additional or upsized pipelines) for the additional flow.</td></tr>
<tr><td>j. Staging Possibilities</td><td colspan="2">Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td rowspan="9">k. Comparative cost estimate</td><td colspan="2">Comparative Cost Estimate in millions.</td></tr>
<tr><td>**NPV**</td><td>**$786**</td></tr>
<tr><td>Treatment</td><td>$56</td></tr>
<tr><td>Conveyance</td><td>$298</td></tr>
<tr><td>Wetlands & Land Passage</td><td>$9</td></tr>
<tr><td>Land Application Infrastructure</td><td>$218</td></tr>
<tr><td>Land Application Land Purchase</td><td>$114</td></tr>
<tr><td>Total Capex (P50 Contingency)</td><td>$708</td></tr>
<tr><td>Y1 O&M</td><td>$5</td></tr>
</table>

	Net Income per annum in Y26-30 (tree harvest) | $18
I. Key matters	• Discharge outside of Palmerston North city boundaries • Wetlands would need to be kept alive when discharging to land • Discharge to the River reduced to approximately 47% of the time • TN = 35mg/L results in reasonably large land area required and would require security on ongoing use of land. Alternative would be higher level of treatment and smaller land area. • High capital cost but income stream from forestry • Less cost than L+R (b) as less irrigation in wetter (winter) periods. • Depending on location groundwater flows likely to be to ocean, so less potential than inland options for (any) contamination of bore water

4.9 Option 9: L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L

Formerly Option 4 (e-2)

Option 9 has an additional option which utilises a higher level of treatment, Treatment Level 3, and a reduced land area. This option was considered at this stage of the analysis due to the increased in the large costs and it has a NPV of $697M.

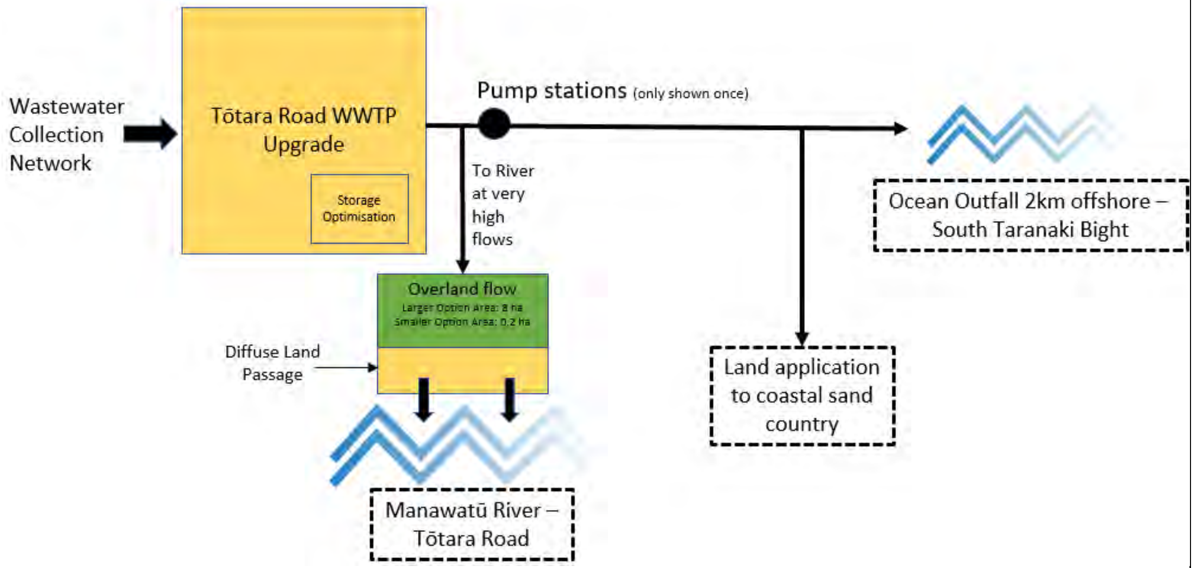
	
a. Flow triggers for different discharge elements	Treated wastewater would be applied to land when Manawatū River flow is less than 62m^3/s, removing flow from the River approximately 43% of the time. When the River flow is greater than 62m^3/s, and on the highest 3% of days by WWTP flow (exceptional flow conditions), the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.
b. Treatment upgrades	Treatment Level 2 Provides a similar level of treatment to the existing WWTP with chemical phosphorous removal. The following new infrastructure is required: • New grit removal facilities (replacing existing facilities) • Additional primary sedimentation tanks for growth • New aerators and baffles in the existing aerated lagoons • Additional chemical clarifier • Upgrade of the existing UV disinfection facility
c. Wetland / land passage	Surface flow wetlands (Wetland 1).
d. Land application location	Coastal, sand dune location

<table>
<tr><td>e. Land use alternatives</td><td>The coastal land application sites are typically dominated by sandy soils. Exotic Forestry is the recommended land use for these regions.</td></tr>
<tr><td>f. Land application area requirements</td><td><table><tr><td>Irrigation Area Required (ha)</td><td>2,315</td></tr><tr><td>Buffer Area Required (ha)</td><td>695</td></tr><tr><td>Total Area Required (ha)</td><td>3,010</td></tr></table></td></tr>
<tr><td>g. Land application infrastructure</td><td>Solid set irrigation.
50,000 m^3 onsite storage facility (lined), lagoon area 1.5 ha.
Rapid Infiltration with capacity of 15,000 m^3/day, typically used 1 days per year.</td></tr>
<tr><td>h. Conveyance upgrades</td><td>1300mm dia pipeline in the road reserve (36km long)
Pump stations including power supply (4 No.)</td></tr>
<tr><td>i. Regional Scheme</td><td>Would require additional land area which could be difficult for the size of the land areas identified for this option, but possible in the coastal environment. Alternative is treatment upgraded to a higher level (i.e., BNR plant) to allow greater level of application on to existing land as not hydraulically limited but nitrogen (leaching) limited.
WWTP upgrades would be required for additional flow.
Conveyance system may need to be increased (additional or upsized pipelines) for the additional flow.</td></tr>
<tr><td>j. Staging Possibilities</td><td>Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>k. Comparative cost estimate</td><td>Comparative Cost Estimate in millions.<table><tr><th>NPV</th><th>$730</th></tr><tr><td>Treatment</td><td>$56</td></tr><tr><td>Conveyance</td><td>$298</td></tr><tr><td>Wetlands & Land Passage</td><td>$9</td></tr><tr><td>Land Application Infrastructure</td><td>$182</td></tr><tr><td>Land Application Land Purchase</td><td>$94</td></tr><tr><td>Total Capex (P50 Contingency)</td><td>$652</td></tr><tr><td>Y1 O&M</td><td>$5</td></tr><tr><td>Net Income per annum in Y26-30 (tree harvest)</td><td>$15</td></tr></table></td></tr>
</table>

l. Key matters	• Discharge outside of Palmerston North city boundaries • Wetlands would need to be kept alive when discharging to land • Discharge to the River approximately 57% of the time • TN = 35mg/L results in reasonably large land area required and would require security on ongoing use of land. Alternative would be higher level of treatment and smaller land area. • High capital cost but income stream from forestry • Less cost than L+R (b) as less irrigation in wetter (winter) periods. • Depending on location groundwater flows likely to be to ocean, so less potential than inland options for (any) contamination of bore water

4.10 Option 10: O+L / Ocean with Land (coastal)

Formerly Option 6.

<table>
<tr><th></th><th colspan="2"></th></tr>
<tr><td colspan="3">
</td></tr>
<tr><td>a. Flow triggers for different discharge elements</td><td colspan="2">Treated wastewater (50% of ADWF) applied to land for an average of 6 months per year (nominally Nov – April inclusive).
All other flows the treated wastewater would be discharged via the Ocean outfall, except on the highest 3% of days by WWTP flow (exceptional flow conditions), when the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.</td></tr>
<tr><td>b. Treatment upgrades</td><td colspan="2">Treatment Level 1
Similar level of treatment to the existing WWTP without chemical phosphorous removal.
Would require the following new infrastructure:
• New grit removal facilities (replacing existing facilities)
• Additional primary sedimentation tanks (for population growth)
• New aerators and baffles in existing aerated lagoons
• Upgrade of existing UV disinfection facility</td></tr>
<tr><td>c. Wetland/land passage</td><td colspan="2">Overland flow (Land Passage Type 4) and diffuse land passage (Land Passage Type 1) discharge to water.</td></tr>
<tr><td>d. Land application location</td><td colspan="2">Coastal, sand dune location</td></tr>
<tr><td>e. Land use alternatives</td><td colspan="2">The coastal land application sites are typically dominated by sandy soils. Exotic Forestry is the recommended land use for these regions.</td></tr>
<tr><td rowspan="2">f. Land application area requirements</td><td>Irrigation Area Required (ha)</td><td>1,130</td></tr>
<tr><td>Buffer Area Required (ha)</td><td>340</td></tr>
</table>

<table>
<tr><td></td><td>Total Area Required (ha)</td><td>1,470</td></tr>
<tr><td>g. Land application infrastructure</td><td colspan="2">• Solid set irrigation.
• 10,000 m^3 onsite storage facility (lined), lagoon area 0.5 ha.</td></tr>
<tr><td>h. Conveyance upgrades[9]</td><td colspan="2">1300mm dia pipeline in the road reserve (38km km long)
Pump stations including power supply to pump stations (4 No.)
1300mm dia outfall, 2km long. Buried a land end, sitting on sea bed, with diffuser arrangement at the end.</td></tr>
<tr><td>i. Offshore ocean outfall</td><td colspan="2">Ocean outfall 2km offshore with diffuser, approximate 20m depth at discharge.</td></tr>
<tr><td>j. Regional Scheme</td><td colspan="2">Would require additional land area. Alternative is treatment upgraded to a higher level (i.e., BNR plant) to allow greater level of application on to existing land as not hydraulically limited but nitrogen (leaching) limited.
WWTP upgrades would be required for additional flow.
Conveyance system may need to be increased (additional or upsized pipelines), including the ocean outfall scheme for the increased flow.</td></tr>
<tr><td>k. Staging Possibilities</td><td colspan="2">Based on projected flows, the additional chemical clarifier can be deferred until required by population growth.
Land application infrastructure could be staged though the land may need to be secured early.
Conveyance pipework would have to be constructed for the future flows required, however pumps could be staged for growth.</td></tr>
<tr><td>l. Comparative cost estimate</td><td colspan="2">Comparative Cost Estimate in millions.
<table>
<tr><th>NPV</th><th>$621</th></tr>
<tr><td>Treatment</td><td>$50</td></tr>
<tr><td>Conveyance (including outfall & diffuser)</td><td>$328</td></tr>
<tr><td>Overland Flow & Land Passage</td><td>$15</td></tr>
<tr><td>Land Application Infrastructure</td><td>$93</td></tr>
<tr><td>Land Application Land Purchase</td><td>$48</td></tr>
</table></td></tr>
</table>

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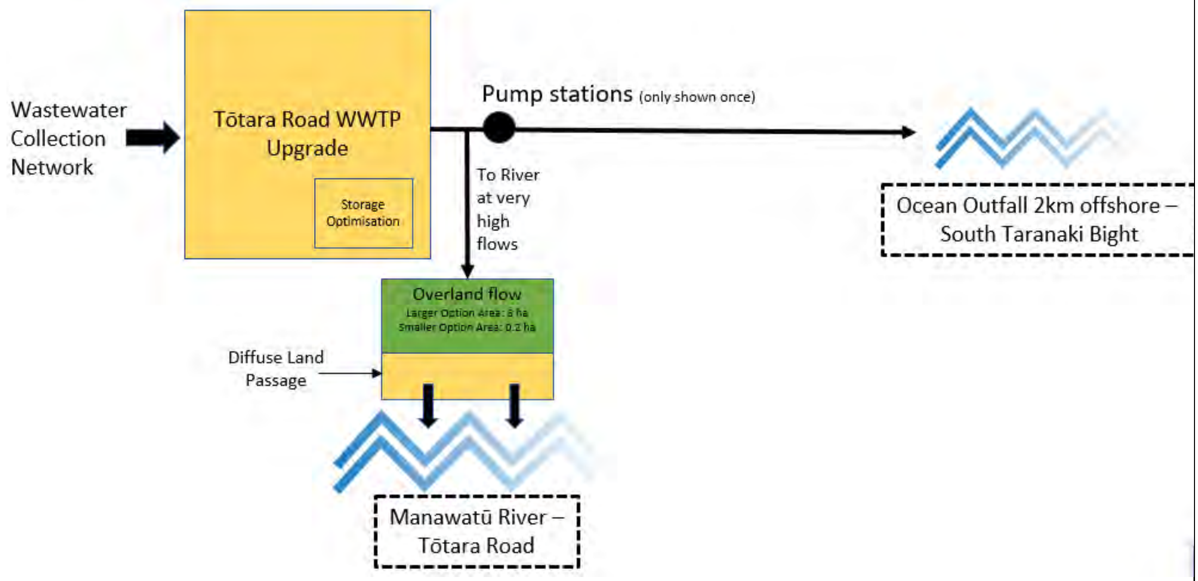
[9] It has been assumed that the land application sites are in near proximity to the ocean outfall starting point in the conveyance estimations.

<table>
<tr><td rowspan="3"></td><td>Total Capex (P50 Contingency)</td><td>$547</td></tr>
<tr><td>Y1 O&M</td><td>$5</td></tr>
<tr><td>Net Income per annum in Y26-30 (tree harvest)</td><td>$7</td></tr>
<tr><td>m. Key matters</td><td colspan="2">• Discharge outside of Palmerston North city boundaries
• Still discharges to the River in exceptional flow conditions
• TN = 35mg/L results in larger land area required and would require security on ongoing use of land. Alternative would be higher level of treatment and smaller land area.
• Small land area required and would require security on ongoing use of land
• Large land parcels in this area so fewer affected parties
• High capital cost but income stream from forestry
• Less cost than L+R (b) 97% of the time to land (coastal) as less, or no, irrigation in wetter (winter) periods.
• Depending on location groundwater flows likely to be to ocean, so less potential than inland options for (any) contamination of bore water
• Compatible with existing WWTP operation (without need for phosphorous removal clarifier)</td></tr>
</table>

4.11 Option 11: Ocean Discharge Only

Formerly a variation of Option 6

	
a. Flow triggers for different discharge elements	All treated wastewater would be discharged via the Ocean outfall, except on the highest 3% of days by WWTP flow, when the treated wastewater would be discharged to the Manawatū River near the Tōtara Rd outfall.
b. Treatment upgrades	Treatment Level 1 Similar level of treatment to the existing WWTP without chemical phosphorous removal. Would require the following new infrastructure: • New grit removal facilities (replacing existing facilities) • Additional primary sedimentation tanks (for population growth) • New aerators and baffles in existing aerated lagoons • Upgrade of existing UV disinfection facility
c. Wetland/land passage	Overland flow grass (Land Passage 4) and diffuse land passage (Land Passage 1) discharge to water.
d. Conveyance upgrades[10]	1300mm dia pipeline in the road reserve (approx. 38km long) Pump stations including power supply to pump stations (approx. 4 No.) 1300mm dia outfall, 2km long. Buried at land end, sitting on sea bed, with diffuser arrangement at the end.

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[10] For the indicative comparative cost estimate calculation it has been assumed that the land application sites are in near proximity to the ocean outfall location in the conveyance estimations.

e. Offshore ocean outfall	Ocean outfall 2km offshore plus diffuser, approximate 20m depth at discharge.
f. Regional Scheme	WWTP upgrades would be required for additional flow. Conveyance system may need to be increased (additional or upsized pipelines), including the ocean outfall scheme, for the increased flow.
g. Staging Possibilities	Limited opportunities for staging new infrastructure at the WWTP or conveyance system. Some pump costs could be deferred.
h. Comparative cost estimate	Comparative Cost Estimate in millions.
i. Key matters	• Discharge outside of Palmerston North city boundaries • Still discharges to the River in high flow conditions • High capital cost, no income stream • Compatible with existing WWTP operation (without need for phosphorous removal clarifier)

NPV	$480
Treatment	$50
Conveyance including outfall & diffuser	$328
Overland Flow & Land Passage	$15
Land Application Infrastructure	-
Land Application Land Purchase	-
Total Capex (P50 Contingency)	$406
Y1 O&M	$5
Net Income per annum in Y26-30 (tree harvest)	$0

Appendix 1: Glossary of Terms

Technical Glossary of Terms and Abbreviations
(Scientific and Resource Management)

Prepared as part of WP2

Term	Abbreviation	Meaning
Accrual Period		The period of relatively stable river flow conditions between one high flow event and the next, during which **periphyton biomass** can increase
Acute Toxicity		
alum		Aluminium sulphate
Average Daily Flow	ADF	Average Daily Flow
Average Dry Weather Flow	ADWF	Average Dry Weather Flow
Assessment of Effects on the Environment		This document is required under the Resource Management Act to support new resource consent applications.
Ash-Free Dry Weight	AFDW	Ash Free Dry Weight can be used as a measure for algae biomass
Algae		Simple chlorophyll-bearing cells. Most are aquatic and unicellular. Some may link to form colonies or filaments and become macroscopic. They are an evolutionary early form of plants.
Alkalinity		The chemical content of water/wastewater in terms of the carbonates, biocarbonates and hydroxides containing elements of calcium magnesium, sodium, potassium and ammonia.
Ammonia	NH^3	Measured as total ammonia NH_4 or as Ammonia N
Ammoniacal - nitrogen	NH^4 - N	
Australian and New Zealand Guidelines for Fresh and Marine Water Quality	ANZECC	
Benthic-Macroinvertebrates		Bottom-dwelling animals without backbones in streams (e.g. snails, works, caddisflies, mayflies, etc.)

Term	Abbreviation	Meaning
Best Practicable Option	BPO	As interpreted in the RMA, best practicable option in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to— (a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and (b) the financial implications, and the effects on the environment, of that option when compared with other options; and (c) the current state of technical knowledge and the likelihood that the option can be successfully applied
Biomass		The weight of living matter of an algae, plant or animal. For stream periphyton, this weight is usually expressed in terms of Ash-Free Dry Weight of chlorophyll *a* on an aerial basis
Biosolid		
Biota		Any assemblage of living organisms in a specific area
Biological Nutrient Removal (BNR)	BNR	This refers to the biological nitrogen and phosphorus removal process
Carbonaceous Biochemical Oxygen Demand (cBOD$_5$)		This is a measure of the organic strength or load of wastewater (measured as a five-day standard test)
cfu/100mL		A measure of colony forming units of micro-organisms per 100mL of liquid sample
Chemical Clarifier		A quiescent (settling) tank in which fine solids, usually measured as suspended solids are removed, aided by the addition of chemicals. In Council's phosphorus removal clarifier the chemical is alum (aluminium sulphate)
Chlorophyll *a*	Chl *a*	Chlorophyll is a pigment in algae and plants responsible for capturing energy from light to drive metabolic processes and the synthesis of organic matter from inorganic substances. Chlorophyll *a* can be used as a measure of algae biomass (the *a* stands for algae)
Chlorination		The disinfection of wastewater using chlorine chemicals
Chronic Toxicity		

Term	Abbreviation	Meaning
Coagulation		Coagulation (also known as flocculation) is a treatment process to precipitate phosphorous and flocculate the solids usually undertaken in a chemical clarifier.
Contaminant		As defined in the RMA, contaminant includes any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat— (a) when discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or (b) when discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged
Chemical Oxygen Demand (COD)	CO	Chemical Oxygen Demand is a measure of the organic strength of the waste when measured chemically
Cumecs		Cubic metres per second (m^3/sec) – a flow rate for river and / or wastewater flow
Cumulative Effects		Those effects arising over time, and those effects that arise in combination with other effects. Any one incremental change may be insignificant in itself, but at some point in time or space, the accumulation of insignificant effects becomes significant
Cyanobacteria		Filiamentous bacteria containing chlorophyll and capable of full autotrophy (that is, capable of making nutrient from inorganic materials). Previously grouped with the algae, cyanobacteria are now recognised as a distinct group of organisms more closely related to bacteria. They are one of the most primitive groups of organisms
Dissolved Air Floatation	DAF	xxxxx
Diatoms		A large sub-group of algae containing a specific set of pigments and an internal shell
Decholorination		A chemical or physical process in which residual chlorine is partially or completely reduced.
Denitrification		A biological process in which nitrates are reduced to nitrogen gas

Term	Abbreviation	Meaning
Dissolved Inorganic Nitrogen	DIN	This is a combination of ammonia nitrogen + nitrate nitrogen
Disk Filter		A filtration system with rotating disks covered with cloth or other type of membrane to filter fine solids from the wastewater
Discharge Permit		A discharge permit refers to a consent to do something that would otherwise contravene section 15 of the RMA. In other words, a discharge permit is a consent to discharge contaminants into the environment.
Dissolved Oxygen	DO	
Dissolved Reactive Phosphorus	DRP	Dissolved Reactive Phosphorus (typically about 80% to 90% of Total Phosphorus (TP) in domestic wastewater) DRP = SRP (Soluble Reactive Phosphorus)
Dry Weather Flow	DWF	Average daily flow during a period without rain
Effect		As defined in the RMA, unless the context otherwise requires, the term effect includes— (a) any positive or adverse effect; and (b) any temporary or permanent effect; and (c) any past, present, or future effect; and (d) any cumulative effect which arises over time or in combination with other effects— regardless of the scale, intensity, duration, or frequency of the effect, and also includes— (a) any potential effect of high probability; and (b) any potential effect of low probability which has a high potential impact.
Enterococci		The presence of enterococci bacteria is used as an "indicator micro-organism" for pathogenic micro-organism, and is measure as a number of n/100mL of water or wastewater sample.
Environment		As defined in the RMA, environment includes— (a) ecosystems and their constituent parts, including people and communities; and (b) all natural and physical resources; and (c) amenity values; and

Term	Abbreviation	Meaning
		(d) the social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) or which are affected by those matters
Escherichia Coli	E.coli	This is a species of bacterium normally present in the intestinal tract of humans and other animals. The presence of E.coli means is used as an indicator of faecal contamination, and as a “micro-organism indicator” for pathogenic micro-organisms.
Ethanol		A chemical carbon source used as supplementary carbon for denitrification in the biological treatment process
Faecal Coliform	FC	The presence of faecal coliform bacteria is used as an “indicator micro-organism” for pathogenic micro-organisms measured as number of n/100mL of water or wastewater sample.
Flocculation		Flocculation (also known as coagulation) is a treatment process to precipitate phosphorous and flocculate the solids usually undertaken in a chemical clarifier.
g/m^3 = mg/L		Grams per cubic metre being a concentration measure of a contaminant in liquid, g/m^3 is the same as mg/L and is in effect the same as parts per million (ppm)
Hectare	ha	Land area unit equating to $10,000m^2$
Importance Level 3	IL3	Importance Level 3 – Structures that may contain crowds, have contents of high value to the community or pose a risk to large numbers of people in close proximity, such as conference centres, stadiums and airport terminals.
Indicator micro-organisms		There are a number of these identified above – expand definition
Litres per second	L/s	A measure of flow rate
Managed Aquifer Recharge	MAR	
Marcophytes		Larger, multi-celled aquatic plants (e.g. > 100cm) with differentiation of tissue to form distinct stems and leaves / pinnules. They include mosses, liverworts and true vascular aquatic plants such as oxygen weed and *Typha*
Moving Bed Bioreactor	MBBR	A Moving Bed Bioreactor is a compact integrated fixed film activated sludge system that contains thousands of polyethylene biofilm carriers which are mixed in an aerated tank

Term	Abbreviation	Meaning
Macroinvertebrate Community Index	MCI	This is used as an indicator of organic pollution
Mana Whenua		means customary authority exercised by an iwi or hapu in an identified area
Median Flow		The middle value of all river flows over a yearly period
Modified Ludzack-Ettinger	MLE	Modified Ludzack-Ettinger refers to a wastewater treatment process configuration which incorporates an anoxic-aerobic activated sludge process for biological nitrogen removal.
Most Probable Number	MPN	Statistical method of counting bacterial colonies.
Multi-Criteria Assessment (MCA)	MCA	
Net Present Value	NPV	
Nitrate (NO^3) and Nitrite (NO^2)		Nitrate and nitrite are oxidation states of nitrogen.
Nitrogen		
Nitrification		A biological process in which ammonia is converted first to nitrite and then to nitrate
Nitrifying Trickling Filter	NTF	Nitrifying Trickling Filter is an aerobic treatment process in which partially treated wastewater flows across a bed of highly permeable media to nitrify the wastewater, that is to convert the ammonia to nitrates
Nephelometric Turbidity Unit	NTU	Used for measuring turbidity
Nutrients		Organic or inorganic chemicals needed by organisms for growth and reproduction. In this, and as with most projects, the principle nutrients are the various forms of nitrogen and phosphorous.
O & M		Operation and Maintenance
One Plan		The Consolidated Regional Policy Statement, Regional Plan and Regional Coastal Plan for the Manawatu-Wanganui Region
Palmerston North City Council	PNCC	

Term	**Abbreviation**	**Meaning**
Pathogens		Disease causing microorganisms
Peak Dry Weather Flow	PDWF	Peak Dry Weather Flow for wastewater is the flows in litres per second, or cubic metres per second (cumecs)
Periphyton		A group of organisms in aquatic environment specialised to live on and exploit much larger (usually inert) surfaces. Groups of organism include fungi, bacteria, protozoa and algae. The most conspicuous group is the algae and this group is usually the focus of most studies of periphyton.
Phosphorous	P	
Peak Flow	PF	On an hourly basis (m^3/h
Population Equivalent	PE	
Potential of Hydrogen	pH	Measure of acid or base nature of liquid
Photosynthesis		The process which starches and sugars are produces within plan (or plant-like) cells using carbon dioxide, inorganic nutrients and sunlight. Sunlight is captured with the chlorophyll molecules.
Peak Wet Weather Flow	PWWF	
Quantitative Macroinvertebrate Community Index	QMCI	Quantitative Macroinvertebrate Community Index is used as an indicator of organic pollution based on full counts on individual invertebrates
Receiving Environment		The environment into which a contaminant discharge is made.
Reduced Level	RL	Reduced Level is the height above a sea level datum point
Soluble Inorganic Nitrogen	SIN	Soluble Inorganic Nitrogen is Ammonia + Nitrate + Nitrite
Soluble Reactive Phosphorous	SRP	Soluble Reactive Phosphorous is Dissolved Reactive Phosphorus = SRP = DRP
Stigeclonium sp		A genus of filamentous green algae
Suspended Solids	SS	Suspended Solids equals Total Suspended Solids
Total Suspended Solids	TSS	

Term	Abbreviation	Meaning
Taxa		Groups to which organisms are assigned according to the principles of taxonomy including species, genus, family, etc.
Total Dissolved Phosphorous	TDP	
Total Phosphorous	TP	
Trickling Filter		An aerobic, fixed-film treatment process in which wastewater flows across a bed of highly permeable media
Ultra Violet	UV	Ultra violet light irradiation used as a wastewater disinfection technique
Wastewater		The mix of domestic sewage, trade waste (industrial wastewater) and occasional rainwater and ground water during rainfall and/or high water table periods
Water Quality		The chemical and physical attributes of water such as turbidity, phosphorous concentrations, temperature and major ion concentrations
Water Quality Target		As defined by the One Plan, “Water Quality Target” means an objective or result for water quality towards which efforts are directed. The word “target” in the One Plan does not have the same meaning ascribed to it by the National Policy Statement for Freshwater Management 2011

Appendix 2: Cost Estimate Summaries

Appendix 2	
Project Name	PNCC WW BPO Technical Advisor
Project Number	310003011
Title	Short List Options Comparative Costs
Date	Aug-21
Notes	All costs exclude GST

Option Number	**Option Code and Title**	**Treatment Level**	**Capital Costs ($M)**							**Y1 Operating and Maintenance (no income) $M**	**Net Income pa (Land Application) Y26-30 pa for Coastal Land $M**	**Net Present Value (NPV) $M**
			Treatment Including P&G, Design and Contingency $M	**Conveyance** Including P&G, Design and Contingency $M	**Wetlands & Land Passage** Including Land Purchase, P&G, Design and Contingency $M	**Land Application Infrastructure** Including P&G, Design and Contingency $M	**Land Application Land Purchase (Land Application)** Including P&G, Design and Contingency $M	**Planned Works** Including P&G, Design and Contingency $M	**Total** Including P&G, Design and Market Contingency $M			
1	R2 (b) River Discharge with Enhanced Treatment	4	$183	$1	$45	$0	$0	$12	$241	$6	$0.0	$337
2	R2(b) River discharge with Enhanced treatment, 75% ADWF to Land at low River flow	4	$183	$58	$44	$36	$52	$12	$387	$7	-$0.3	$496
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	$56	$117	$21	$53	$60	$12	$318	$6	-$0.3	$419
4	L+R (a) 97% of time to Land (inland)	1	$50	$97	$15	$182	$249	$12	$605	$4	-$4.5	$604
5	L+R (b) 97% of time to Land (Coastal)	3	$157	$298	$15	$170	$81	$12	$733	$7	-$13.0	$836
6	L+R (d-1) to land <80m^3/s / 53% of the time to land (inland)	2	$56	$97	$9	$99	$136	$12	$410	$5	-$1.4	$470
7	L+R (d-2) to land <62m^3/s / 43% of the time to land (inland)	2	$56	$97	$9	$83	$111	$12	$369	$5	-$0.9	$433
8	L+R (e-1) to land <80m^3/s / 53% of the time to land (coastal) TN = 35 mg/L	2	$56	$298	$9	$218	$114	$12	$708	$5	-$18.0	$786
9	L+R (e-2) to land <62m^3/s / 43% of the time to land (coastal) TN = 35 mg/L	2	$56	$298	$9	$182	$94	$12	$652	$5	-$15.0	$730
10	O+L / ocean with land (coastal)	1	$50	$328	$15	$93	$48	$12	$547	$5	-$7.0	$621
11	Ocean discharge	1	$50	$328	$15	$0	$0	$12	$406	$5	$0.0	$480

Notes

1. Average annual operating and maintenance cost is the average over 35 years
2. Operating and maintenance costs are from "Shortlist Options O&M Estimate 20210624"
3. Capex costs are from "PNCC WW Capital Cost Estimates for Review June 2021"
4. NPV discount rate 6%

Palmerston North Wastewater
Best Practicable Option (BPO) Review

Comparative Cost Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Jim Bradley

Report Details

Prepared by:	Jim Bradley/Melaina Voss	16/07/2021
Checked by:	Jim Bradley / Anna Bridgman	29/07/2021
Reviewed by:	Anna Bridgman / Simpson Grierson	4/08/2021
Approved & Issued by:	Roger Hulme	5/08/2021

Executive Summary

This comparative cost assessment of the short list options has been undertaken to help inform the process of determining the BPO for the Palmerston North City wastewater management solution.

Considerable technical investigation has been undertaken to estimate costs for each option, including peer review. The costs used in this assessment are the most recent and up to date costs.

Banding - on NPV			Cost/Affordability
<$350M	5	🟩	Lowest NPV range/most affordable
$350 - $450M	4	🟩	Second lowest NPV range
$450 - $550M	3	🟨	Medium NPV range
$550 - $650M	2	🟧	Higher NPV cost
>$650M	1	🟥	High NPV cost/least affordable

Table 1 Band & Score Criteria

This assessment uses the Net Present Values (NPV) over a 35-year operating period, to align with the 35-year resource consent duration to be sought.

An outline of the methodology used to undertake this assessment is provided in Section 3 of this Report. A score between 1 and 5 has been allocated to each option based on the cost and its position with $100m bands ranging from <$350m to >$650m.

Option No.	Option Code and Title	Treatment Level[1]	Score
1	R2 (b) River Discharge with Enhanced Treatment	4	5
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow	4	3
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	4
4	L+R (a) 97% of time to Land (inland)	1	2
5	L+R (b) 97% of time to Land (Coastal)	3	1
6	L+R (d-1) to land <80m³/s / 53% of the time to Land (inland)	2	3
7	L+R (d-2) to Land <62m³/s / 43% of the time to Land (inland)	2	4
8	L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35 mg/L	2	1
9	L+R (e-2) to Land <62m³/s / 43% of the time to Land (coastal) TN = 35 mg/L	2	1
10	O+L / Ocean with Land (coastal)	1	2
11	Ocean discharge	1	3

Table 2 Shortlist Options Scores

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[1] Refer to Treatment Options Report and Shortlist Options Report, May 2021.

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1 Introduction

1.1 Overview of Assessment Process

A comparative cost assessment of the short list options has been undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the comparative cost assessment integrates with the other assessments and processes involved in determining the BPO.

Figure 1 BPO Assessment Process

The comparative cost assessment considers how each of the Short List Options compares with each other on the basis of cost and affordability. The comparison uses the Net Present Value (NPV) for each option based on a 35-year operating period, to align with the maximum allowable resource consent duration under the Resource Management Act 1991. An outline of the methodology used to undertake this assessment is provided in Section 3 of this Report.

1.2 Shortlist Options

Table 3 lists the shortlisted options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, July 2021.

Table 3 Options Description / Reference

Option No.	Option Summary Description
1	**R2(b) River discharge with Enhanced Treatment**
2	**R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow**
3	**Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow**
4	**L+R (a) 97% of the time to Land (inland)**
5	**L+R (b) 97% of the time to Land (coastal)**
6	**L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)**
7	**L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)**
8	**L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L**
9	**L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L**
10	**O+L / Ocean with Land (coastal)**
11	**Ocean discharge**

1.3 Supporting Project Information

The following technical documents, have been prepared to inform the shortlist options development and assessment process to date:

- Wastewater BPO – Engagement Feedback Report – June 2021 – Just Add Lime
- Wastewater BPO Treatment Options Report – September 2020
- Treatment Shortlist Addendum Report – March 2021
- Draft Carbon Footprint Assessment Report – May 2021
- Wastewater BPO MCA Comparative Assessment Report & Appendices – February 2021
- Wastewater BPO Shortlist Options Report – July 2021

2 Comparative Costs

2.1 Overview & Key Aspects

As the BPO Project has developed from the Long List to the Short List of Options, high level indicative comparative capital (to build), annual operating and maintenance, and Net Present Value (NPV) lifecycle costs have been further refined and developed. It has been stressed throughout the project that while these costs are high level and indicative, they allow for comparisons to be made between options. They also allow for indicative domestic/property rates and trade waste charges to be determined.

The most recent (July 2021) assessment of the costs is based on the November 2020 cost estimates adjusted on the basis of the following additional work:

1. Review of capital costs by Alta Consulting.
2. Review of land purchase costs by the Property Group following feedback at the comparative assessment workshops that the land values may no longer reflect the current market situation.
3. Revised population forecasts used by Palmerston North City Council (PNCC) in its 10-year plan process which required re-calculation of capital and operational costs due to the dependency of option scope and particularly land area on projected populations
4. Review of land application infrastructure construction cost rates.
5. Review of capital cost estimates leading to identification of some work items not previously included.
6. Review of electricity supply requirements for specific options leading some additional allowance for electrical network upgrades.

The July 2021 costs are summarised in Table 4 in Section 2.2 below.

Once a preferred/BPO option is identified the cost estimate will be further developed as that option is further developed and refined.

2.2 Indicative Capital Cost Summary

This high-level summary of the July 2021 cost assessment is included in Table 4. It is based on the updated population ("add popn") forecasts recently supplied by Palmerston North City Council and incorporates changes arising from the assessments listed in Section 2.1 above. Note Operation and Maintenance costs are for Y1 and do not include net income from land use activities.

The NPV shown is based on the P50 estimate. The P50 estimate represents a cost that is likely to be exceeded half of the time, i.e. it is estimated that the actual project cost has an equal chance of being under or over this value. The P95 estimate represents a cost that is likely to be exceeded in only 5% of the outcomes. The P95 is therefore a conservative estimate at this stage of the Project. Figure 2 shows the split between the P50 estimate and the Operations and Maintenance costs over the proposed 35-year consent duration. This includes income from any land application schemes. Note Option 4 includes an estimated income that balances the Operation and Maintenance costs, hence there are no NPV Operation and Maintenance costs for this option in the Figure.

Table 4: Summary of Comparative Indicative Costs - June 2021 Basis

Option No.	Option Code and Title	Treatment Level	NPV (P50, 35 year) $ June 21 (add popn)	Base Capex Cost (no P&G, Professional Services, PNCC & Contingencies) June 21 (add popn)	P&G, Professional Services, PNCC & Contingencies $M June 21 (add popn)	Capital Cost (P50 contingency) $M June 21 (add popn)	Capital Cost (P95 contingency) $M June 21 (add popn)	Year 1 Operating & Maintenance Costs $M June 21 (add popn)	Income pa $M Y26-30 pa for Coastal Land June 21 (add popn)	Land Application Land Area Total Gross ha June 21 (add popn)	Land Purchase (with Contingency) $M June 21 (add popn)
1	R2 (b) River Discharge with Enhanced Treatment	4	$337	$120	$121	$241	$269	$6	$0	0	$3
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow	4	$496	$206	$174	$387	$426	$7	$0.3	760	$55
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	$419	$177	$141	$318	$356	$6	$0.3	870	$61
4	L+R (a) 97% of time to Land (inland)	1	$604	$389	$216	$605	$679	$4	$4.5	3760	$249
5	L+R (b) 97% of time to Land (Coastal)	3	$836	$392	$341	$733	$822	$7	$13	2570	$81
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inLand)	2	$470	$249	$161	$410	$459	$5	$1.4	2000	$136
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inLand)	2	$433	$221	$149	$369	$413	$5	$0.9	1640	$112
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L	2	$786	$392	$316	$708	$795	$5	$18	3640	$115
9	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L	2	$730	$357	$295	$652	$732	$5	$15	3010	$95
10	O+L / Ocean with Land (coastal)	1	$621	$287	$261	$547	$613	$5	$7	1470	$49
11	Ocean discharge	1	$480	$201	$201	$406	$455	$5	$0	0	$1

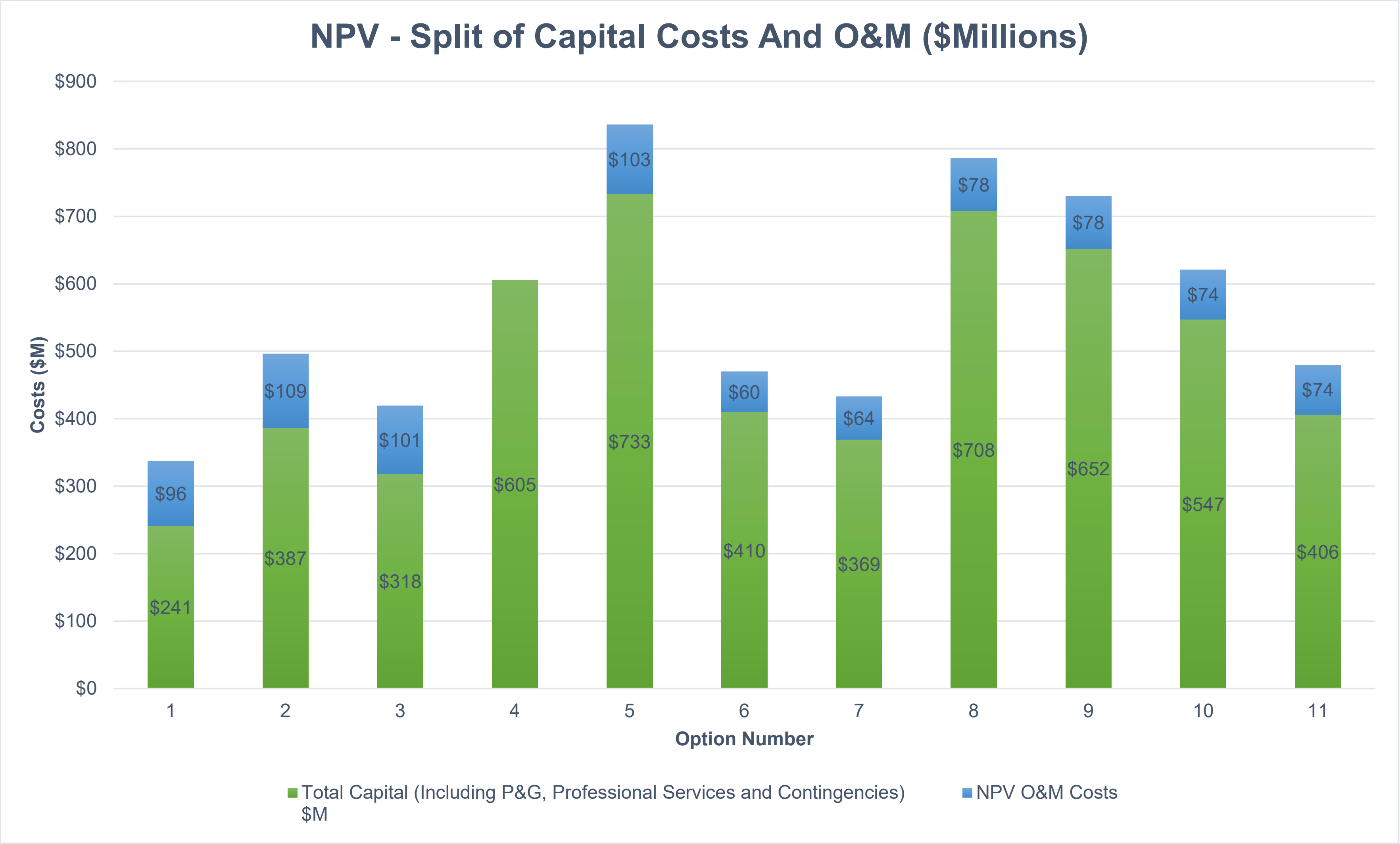

Figure 2 NPV Split into Capital Costs (P50) and Operations & Maintenance (NPV)

3 Methodology for this Assessment

3.1 Classification Process

The technical advisors determined that a Net Present Value (NPV) lifecycle cost over a 35-year operating and maintenance period should be used to compare the options. Based on the 1 to 5 scoring approach adopted for all the assessments in the overall BPO assessment (refer Figure 1) the NPV costs have been banded as shown in Table 5 below.

An NPV approach includes consideration of capital (to build), annual operating and maintenance costs, as well as renewal costs. Because of the discounting of future costs, the total capital cost still represents the largest portion of the NPV cost.

3.2 Scoring of the Net Present Value Cost

Table 5 sets out the suggested 1 to 5 banding/scoring of the NPV costs. Table 6 lists the allocated score applied to each shortlist option, based on the bands and scores set out in Table 5 and using the June 2021 updated growth forecast ("add popn"), NPV over 35 years and P50 cost estimates.

Table 5 Band & Score Criteria

Banding - on NPV			**Cost/Affordability**
<$350M	5	🟩	Lowest NPV range/most affordable
$350 - $450M	4	🟩	Second lowest NPV range
$450 - $550M	3	🟨	Medium NPV range
$550 - $650M	2	🟧	Higher NPV cost
>$650M	1	🟥	High NPV cost/least affordable

Table 6: Option Comparative Cost Scores

Option No.	**Option Code and Title**	**Treatment Level**	**Band**
1	R2 (b) River Discharge with Enhanced Treatment	4	5
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to Land at low River flow	4	3
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	4
4	L+R (a) 97% of time to Land (inLand)	1	2
5	L+R (b) 97% of time to Land (Coastal)	3	1
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inLand)	2	3
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inLand)	2	4
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L	2	1
9	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L	2	1
10	O+L / ocean with Land (coastal)	1	2
11	Ocean discharge	1	3

4 Overall Recommendation

The technical advisors recommend an NPV cost calculated over a 35-year operating and maintenance period to align with the maximum 35-year consent duration be used to compare shortlist option costs in this assessment. The recommended costs are the July 2021 updated costs incorporating the most recent amendments for population growth rates, Land values and contingency provisions.

The technical advisors further recommend that the banding and scoring framework as set out in Table 5 be used for the Comparative Cost assessment.

Palmerston North Wastewater
Best Practicable Option (BPO) Review

MCA Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Melaina Voss / Jim Bradley

Report Details

Prepared by:	Melaina Voss	27/07/2021
Checked by:	Jim Bradley	4/08/2021
Reviewed by:	Simpson Grierson / Jim Bradley / Client	4/08/2021
Approved & Issued by:	Roger Hulme	5/08/2021

Executive Summary

This report has been prepared to assist the Council in identifying preferred options as part of the final Best Practicable Option (BPO) assessment. This assessment forms one of seven assessments being carried out, prior to confirming the BPO with Horizons Regional Council.

This Report documents the methodology and outputs of the Multi-Criteria Assessment (MCA) completed in November 2020 by the Council.

The MCA has been undertaken with the involvement of technical experts, Rangitāne o Manawatū and key stakeholders, who have advised the Council on options development and assessments throughout the Project and prepared the MCA comparative assessments (refer Appendix A).

Each of the 11 shortlisted options was assessed against the following 8 criteria:

- Public Health
- Natural Environment
- Maori Cultural Values
- Social and Community Considerations
- Financial Implications
- Technology and Infrastructure
- Resilience
- Growth & Economic Development

Following the agreement by decision makers and experts on the scores applied to each option, a total of 11 weighting scenarios were developed applied to the options scoring.

The outcome of the MCA process was inconclusive in terms of identifying a preferred group of options that could be considered for the next phase of the BPO Assessment process. Key feedback, messages and outcomes from the MCA process are captured in the MCA Outcomes Report, provided in Appendix A of this report.

On the basis that 5 scenarios tested are representative of the weighting scenarios considered at the MCA workshop, 5 have been included in the assessment process considered in this final phase of the Projects evaluation (Table 5). The scores for each scenario have been averaged to determine an overall score and rank for the 11 options.

The following table depicts the overall ranking of the options considered:

Option Description		**Ranking**
1	R2 (b)	5
2	R2 (b) (75% DWF land): 760 ha.	8
3	Dual R+L (b) (75% DWF to land): 870 ha.	4
4	L+R(a): 3760 ha	3
5	L+R(b): 2570 ha.	7
6	L+R(d-1) 80 m3/s trigger: 2000 ha.	6
7	L+R(d-2) 62 m3/s trigger: 1640 ha.	2
8	L+R(e-1) 80 m3/s trigger: 3640 ha.	10
9	L+R(e-2) 62 m3/s trigger: 3010 ha.	11
10	O+L: 1470 ha	9
11	O no land	1

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APPENDICES

1 Introduction

1.1 Overview of Assessment Process

In November 2020, the Council undertook a Multi-Criteria Assessment (MCA) of the short list options. The MCA was undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the MCA integrates with the other assessments and processes involved in determining the BPO.

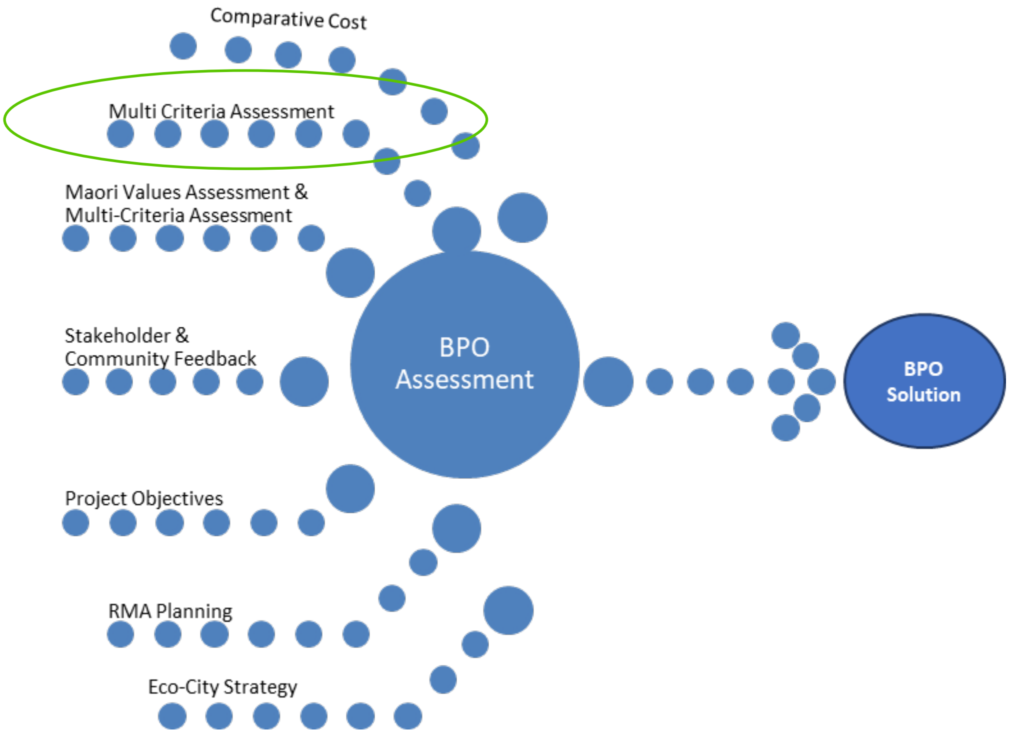

Figure 1 BPO Assessment Process

The MCA was completed between September 2020 and November 2020, including the preparation of comparative assessments across 8 criteria, prepared by technical experts and Iwi, followed by 2-days of workshops held in November. A full description of the MCA process and the outcome of the workshops is outlined in the 'MCA Outcomes Report', February 2021 provided in Appendix A of this Report.

1.2 Shortlist Options

The following table lists the shortlist options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, May 2021. The Options considered at the MCA were based on the shortlist Options developed to September 2021. These options are consistent with the update report of May 2021.

Table 1 Options Description / Reference

Option No.	Option Summary Description
1	**R2(b) River discharge with Enhanced Treatment**
2	**R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow**
3	**Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow**
4	**L+R (a) 97% of the time to Land (inland)**
5	**L+R (b) 97% of the time to Land (coastal)**
6	**L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)**
7	**L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)**
8	**L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L**
9	**L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L**
10	**O+L / Ocean with Land (coastal)**
11	**Ocean discharge**

1.3 Supporting Project Information

The following technical document has been referred to in preparation of this Assessment Report:

- Wastewater BPO MCA Process Report and appended Comparative Assessment assessments (Appendix A), February 2021.

2 Methodology for this Assessment

2.1 Overview of the MCA

Multi-Criteria Analysis (MCA) is a tool to assist in decision making. For this project, the MCA methodology was used to provide an auditable and defensible evaluation of the six main short-listed options (a total of 11 options). A copy of the MCA Process Report is provided in Appendix A of this report. The report clearly outlines the methodology and process for completing the MCA between September and November of 2020.

In summary, an MCA process allows for rating of options, by assigning scores to a set of chosen criteria or attributes for the options under consideration. Criteria are typically chosen to cover key issues of concern and can cover tangible (e.g. cost) and intangible (e.g. opportunities and benefits) factors. The criteria scores are then combined, usually via a weighted sum, to arrive at a ranking of the options. The contribution that each criterion gives to the weighted sum is typically weighted to reflect the decision makers' judgement of the relative importance of the different criteria.

The scores are surrogates for measures of value for the criteria, allowing the effects of diverse criteria, with different units, to be combined in a single assessment. The weightings represent judgements about what is important in a particular situation or to a particular group of individuals.

A total of eight criteria were used to assess the options, these included:

Table 2 MCA Criteria Descriptions

Public Health	Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)
Natural Environment	Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology
Māori Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, waters, the sky father (Ranginui), sites, waahi tapu, taonga species and other taonga
Social and Community Considerations	Potential adverse effects on social and community values relating to amenity, recreation and food gathering

Financial implications	Comparative capital, operational, whole of life costs of the options. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.
Technology and infrastructure	Degree to which the option: • uses reliable and proven technology • can be staged • is able to be constructed • is able to be constructed within an appropriate timeframe • allows for resource recovery / beneficial re-use
Resilience	Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.
Growth and Economic Development	Will the option support the population and economic growth anticipated for the City by Council?

2.2 Classification Process

For each of the eight criteria, scoring was undertaken by specialist technical advisors. This scoring was defined within a scale of 1 (extreme adverse effects) or 5 (minimal to no adverse effects). Definitions of these criteria and the alignment to the scale, are specific to the criteria and were determined by technical experts in their relative field of expertise. Iwi provided the cultural values assessment and, in some cases,, where applicable, stakeholders provided review of contribution to the assessments and scoring process. This is outlined in Section 3.2 of the MCA Outcomes Report (Appendix A). Table 3 sets out the banding/scoring used in the assessment as described in the MCA Outcomes Report.

Table 3 Scoring Criteria

Level of alignment	Score
No Adverse Effects	5
Low Adverse Effects	4
Medium/Moderate Adverse Effects	3
High Adverse Effects	2
Extreme Adverse Effects	1

2.3 Options Scoring

Scoring was initially assigned across all criteria by technical experts. At the MCA workshop, decision makers, stakeholders and technical experts discussed the scoring to reach a consensus. Table 4 below shows the agreed scoring applied to each of the 11 options against the 8 criteria (Refer Section 4.1 of the MCA Report, Appendix A). Commentary is also provided in Section 4.3 of the MCA Process Report, highlighting the key basis for scores applied to each option by experts and the workshop attendees.

Table 4 MCA Scoring of Options

Options	Option Description	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development
1: R2(b)	River discharge with enhanced treatment	4	3	1	4	2.8	4	4	2
	River discharge with enhanced treatment, and a small % to land	3.5	3.5	1	3.5	2.1	4	3.5	2.5
2: Dual R + L	Two river discharge points and a small % to land	3.5	4	1	3.5	2.7	3	3.5	2.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	3.5	4	2.5	2.4	3	3	2
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	4	4	3	2.5	1.1	3	3	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	2.5	3	3	3.5	3
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	2.5	2.8	3	3.5	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	2	2.5	3	2.5	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	2	2.2	3	2.5	2
6: Ocean	Ocean discharge, with a small % to land	3	4.5	1	2	1.9	2.5	3	4
	Ocean discharge	5	4	1	3.5	2.4	2.5	3.5	4

2.4 Weighting Scenarios

The need to assign different weightings to each criterion was agreed by Councillors and Stakeholders who attended the MCA workshop (November 2020). This was based on the consensus that all the criteria were not considered to be of equal importance.

A total of ten different weighting scenarios were developed at the workshop. Several weighting scenarios were considered, which are reflective of different groupings of the workshop participants namely Councillors and Stakeholders described as "Councillor Agreed" and the technical experts described as "Technical Group" (Table 5 below). Justification for the weightings was based on the agreement reached following discussion amongst workshop attendees and is included in Appendix A. Several common themes, priorities and concerns were identified, and these are documented in Section 4.3 of the MCA Outcomes Report (Appendix A). Table 5 outlines the weighting scenarios considered at the MCA.

Table 5 Weighting Scenarios from the MCA Workshop

	Weighting Scenarios	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development	Explanation
1	Base workshop weighting scenario	**15.0%**	**15.0%**	**20.0%**	**15.0%**	**15.0%**	**0.0%**	**5.0%**	**15.0%**	**Scenarios 1-5 have been selected to progress to the Assessment process as they are considered to include the agreed weightings within the MCA workshop.** **Scenarios 6 – 12 are scenarios that are paralleled to Scenarios 1-5 and if included, would be perceived as 'double counting' within the assessment. It is noted a small % difference has minimal to no impact on the evaluation between criteria.**
2	Alternative workshop weighting scenario – Highest weighting to Social and Community	**10.0%**	**10.0%**	**15.0%**	**40.0%**	**10.0%**	**0.0%**	**5.0%**	**10.0%**	
3	Equal weight to all criterion	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**	**12.5%**	
4	No weight to financial implications	**17.6%**	**17.6%**	**23.5%**	**17.6%**	**0.0%**	**0.0%**	**5.9%**	**17.6%**	
5	50% weight to financial implications	**8.8%**	**8.8%**	**11.8%**	**8.8%**	**50.0%**	**0.0%**	**2.9%**	**8.8%**	
6	Councilor Agreed - Without Finance	**18.0%**	**20.0%**	**22.0%**	**12.0%**	**0.0%**	**0.0%**	**13.0%**	**15.0%**	Parallel to Option 4
7	Technical Group - Without Finance	**20.0%**	**20.0%**	**20.0%**	**20.0%**	**0.0%**	**5.0%**	**5.0%**	**10.0%**	Parallel to Option 4
8	Agreed Combined without finance	**20.0%**	**20.0%**	**20.0%**	**15.0%**	**0.0%**	**0.0%**	**10.0%**	**15.0%**	Parallel to Option 1
9	Agreed Combined with Finance	**15.0%**	**15.0%**	**20.0%**	**15.0%**	**15.0%**	**0.0%**	**5.0%**	**15.0%**	Parallel to Option 1
10	Agreed combined highest finance weight - Option 2	**10.0%**	**10.0%**	**15.0%**	**10.0%**	**50.0%**	**0.0%**	**0.0%**	**5.0%**	Parallel to Option 5
11	Councilor Agreed - With Finance	**15.0%**	**15.0%**	**20.0%**	**10.0%**	**15.0%**	**0.0%**	**10.0%**	**15.0%**	Parallel to Option 1
12	Technical Group - With Finance	**17.5%**	**17.5%**	**17.5%**	**17.5%**	**15.0%**	**3.8%**	**3.8%**	**7.5%**	Parallel to Option 1

3 Recommendation

3.1 Weighting Scenarios

Based on the observation that 5 of the scenarios were essentially equivalent to other scenarios tested at the workshop (Table 5), only 5 of the weighting scenarios have been carried forward into the overall MCA assessment to be considered in the final BPO assessment process. This avoids any duplication of scenarios.

Table 6 below shows the ranking achieved within the weighting scenarios and the outcome of the combined weighting scenarios. The overall average score is also listed and further breakdowns of scores is provided in the MCA Process Report (Appendix A). It should be highlighted that the options have scored relatively close together, which indicates there is no 'leading option' nor an option that there is a huge variation in option scoring. This is an underlying reason for undertaking multiple assessments in conjunction with the MCA, to assist Council in its decision-making process and maintain a robust evaluation process.

Table 6 Ranking of Options within applied weighting scenarios

		Rank of Option within Weighting Scenario's						
	Option	Base	Alternate	W/O Finance	50% Finance	Equal	**Average Score**	**Overall Rank**
1	R2 (b) (Level 4)	7	2	9	5	2	2.9	5
2	R2 (b) (75% DWF land): 760 ha. (Level 4)	8	4	7	7	5	2.8	8
3	Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	6	3	5	4	4	2.9	4
4	L+R(a): 3760 ha. (Level 1)	3	6	3	6	7	3.0	3
5	L+R(b): 2570 ha. (Level 3, TN=10)	4	7	2	11	8	2.8	7
6	L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	5	8	6	2	6	2.9	6
7	L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	2	5	4	1	2	3.0	2
8	L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	10	10	8	10	2.3	10
9	L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	11	10	10	11	2.2	11
10	O+L: 1470 ha. (Level 1)	9	9	8	9	9	2.6	9
11	O no land (Level 1)	1	1	1	3	1	3.2	1

3.2 Recommended Options

Overall, the outcomes of the workshop are included in the MCA Report provided in Appendix A of this Report. In summary, there is limited direction from the output of the MCA to enable the Council to determine a preferred option through the various weighting scenarios.

Based on the methodology described in Section 3.1 above, Table 7 below shows the ranked order of options based on the average score provided across the range of weighting scenarios (Table 6).

Table 7 Options ranking across 5 weighting scenarios from the MCA

Option Description		**Treatment Level**	**Combined Ranking**
1	R2(b) River discharge with Enhanced Treatment	4	5
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow	4	8
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	4
4	L+R (a) 97% of the time to Land (inland)	1	3
5	L+R (b) 97% of the time to Land (coastal)	3	7
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)	2	6
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)	2	2
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L	2	10
9	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L	2	11
10	O+L / Ocean with Land (coastal)	1	9
11	Ocean discharge	1	1

It is recommended that all options are considered in conjunction with the wider assessment approach before being recommended for assessment through the BPO Criteria. This will be determined in the BPO Recommendation Report

Appendix 1: MCA Outcomes Report February 2021

PALMERSTON NORTH WASTEWATER
BEST PRACTICABLE OPTION (BPO) REVIEW

Alternative Assessment – MCA Process Report

10 FEBRUARY 2021

Prepared for Palmerston North City Council with involvement of:

Stantec

pdp
PATTLE DELAMORE PARTNERS LTD

RiverLake

Aquanet Consulting Limited

JUST ADD LIME

PROJECT DETAILS

Project Manager:	Melaina Voss
Project Sponsor:	Robert van Bentum

Report Details

Prepared by:	Melaina Voss / Jim Bradley	29/01/2021
Reviewed by:	Robert van Bentum	1/02/2021
Approved & Issued by:	Robert van Bentum	2/02/2021

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APPENDICES

Executive Summary

Palmerston North City Council (the Council) currently treats and discharges the city's wastewater at the Totara Road Wastewater Treatment Plant into the Manawatu River. The wastewater discharge was consented by Horizons Regional Council in 2006 expires 2028. In 2013, Horizons Regional Council (as the consenting authority), determined the wastewater discharge had more than minor effects on the Manawatu River. In 2013, the Council agreed with Horizons Regional Council to pursue a new resource consent for the Best Practicable Option (BPO) by June 2022. A Preferred Option 'BPO' must be determined by the Council before 1 June 2021.

In early 2017 the Council commenced the process of identifying and determining the BPO. A range of technical assessments and decision making, or evaluation tools have been used to assist Council with making its decision. The process is explained visually in Figure 1 of this Report, however in summary a phased approach has been followed to narrow potential options from 36 (long list options) to 6 shortlisted options. Significant work has been undertaken by the Council's technical experts to refine the shortlist options since they were identified in June 2019. This development work was necessary to inform and undertake a Multi-Criteria Assessment to robustly review the short list options and identify one or more preferred options. The MCA process is a decision-making tool commonly used and accepted in Resource Management Act (RMA) consenting processes for projects such as this BPO Project.

Following completion of the technical work, in November 2020 the Council undertook the Multi-Criteria Assessment phase of the options selection process (refer Figure 1). This report summarises the MCA process and outlines the framework adopted by Council in undertaking this MCA assessment (refer Figure 2). This report also provides recommended next steps within the broader assessment process (refer Figure 3 below).

The MCA process was carried out over several days of workshops summarised:

Workshop Description	Purpose
MCA Briefings: October 2020	- Attended by Technical Experts only: To work with all attendees on understanding the options, workshop format and purpose of the MCA evaluation workshop. - Attended by Councillors and Stakeholders only: To brief the Councillors and Stakeholders on the MCA workshop format and pre-reading material.
MCA Evaluation: 9 & 10 November 2020	Attended by both technical experts, Councillors, Council Officers and Stakeholders: To agree criteria scoring and undertake weighting of the criteria to determine overall scoring of options. The objective of this process was to identify if there are potential options for elimination and prioritisation in the broader assessment process.

Attendance at the various workshops has included expert technical advisors, key stakeholders and decision makers. A full list of participants is included in Appendix B and in summary includes:

- Technical experts, who also prepared the comparative assessments for the MCA.
- Limited number of Councillors and Executive Leadership Team.

- Project Steering Group members for the BPO Project.
- Rangitane o Manawatu and Muaopoko Iwi representatives
- Key stakeholder representatives from Federated Farmers, Environment Network Manawatu & Ministry of Health.
- An external facilitator; and
- Council staff to assist in formalities of the day.

In summary, the MCA process confirmed the following for the Council:

- No single option was identified out of the MCA assessment process as a preferred BPO. Sensitivity testing involving changes to the weightings of the criteria confirmed that scoring changes of less than 0.3 did not change the top-ranking options.
- As no one option emerged as being preferred across a range of weighting scenarios, the additional assessments included within the broader evaluations (MCA with Iwi and further round of engagement and consultation) will be important to guiding Council's selection of the BPO
- From the MCA Option 6 'Ocean discharge' ranked the highest with Option 1 'River Discharge' and Option 4 '45% discharge to land inland land /Fluvial soils', ranked closely behind.
- While the MCA process was not conclusive, several options emerged as consistently scoring well across a range of criteria and weightings. These options are considered most appropriate to be considered in the next stage of the assessment process. These options include:
    - Option 1 - A majority of the treated wastewater being discharged to the Manawatu River with substantially high treatment and a portion to land. This will closely meet One Plan targets. While this option was not well supported by Iwi, considerations of a higher standard of treatment were proposed by several key stakeholders and decision makers.
    - Option 4 - A 45% discharge to inland fluvial soils. However, this option should seek to reduce the land area requirements and providing a high standard of treatment 55% of the time for the River discharge component.
    - Option 6 - A Ocean discharge. This option scored well due to its ability to provide a regional or sub-regional scheme. Feedback from the workshop suggested that a higher level of treatment may need to be considered than currently proposed to allay concerns of Iwi and other stakeholder feedback.
- During the workshop, some agreed positions emerged among the workshop participants that warrant further investigation during the next phase of the process, including:
    - The natural environment is highly valued by the Council. Attendees supported selection of higher treatment standards for discharges to river or ocean than proposed for some options presented at the MCA. Providing a higher level of treatment would represent a departure from the premise underpinning option development to date which was that treatment should be sufficient to mitigate effects for the receiving environment given this will be necessary to gain a consent under One Plan.
    - Options requiring significant land areas (2,500ha to 3,500ha) i.e Option 3 '97% to land', would be considered problematic and likely not feasible due to the significant quantity of. Class 1 soils required. The consumption of significant areas of Class 1 agricultural soils and areas suitable for urban development was considered a significant disbenefit. There was strong support for exploring options

  that reduced land areas and provided higher treatment as a mitigation strategy to negative impacts on productive land capacity.
  - Concern that the true costs of large areas of land purchase in the region, along with the complexity of purchasing such large areas, have been insufficiently assessed to date. Further work was recommended by suitably qualified property experts to confirm the true cost of options requiring a land component.
  - Concern that the MCA process did not understand or adequately weight the effects on individuals and the community of large-scale land irrigation systems, therefore a pre-cautionary approach was preferred when considering land-based options.
  - Concern that the extent of social impacts for each option, particularly land-based options, is not fully understood at this stage of the process. In particular Options 2, 3 and 4, which requires more than 1,000ha and up to 3,500ha of land, may have substantial effects and therefore confidence is generally low in terms of scoring.
  - Concern that the information presented in respect of the ocean discharge options, including the treatment standards and effects of a wastewater discharge of this volume and quality was not adequate. This was reinforced by the absence of an ocean expert at the workshop to provide context around these options and the expert scoring.

The participants requested that additional technical work should be undertaken prior to deciding on the BPO and to inform the wider assessment process (refer Figure 3). The information would assist Council with refining shortlist options and provide stakeholders and decision makers with greater confidence in respect to effects on the river and ocean, social and community and costs of the options, as well as mitigation of potential adverse effects.

Work packages identified from the MCA as being able to provide additional information to inform the next steps in the assessment process, included:

- Updated land costs to provide more robust total costs for options including land.
- Revision of the target treatment standards for each option with consideration of targeting higher treatment standards being those required to meet minimum One Plan standards
- Assessment of alternative land use and revenue streams particularly for land-based options to improve the robustness of option costs.
- Modelling of the River to identify if a ‘staged ‘option could be developed for staged achievement of compliance standards to all for gradual acquisition of land and/or implementation of treatment improvements.
- Reconfirm the growth assumptions over the 30- and 50-year period including the assumed contributions from industry and particularly wet industry. This work needs to identify the growth rates being considered for consent i.e low, medium and high and align with the Councils growth strategy under the District Plan.
- Continue to explore a region wide solution in the context of the national water reform agenda and recognition that a shared solution would meet Councils growth aspirations for residential and industry, as well as provide for wastewater from neighbouring Councils. This would require assessment for each of the shortlist options of how additional flows and loads could be accommodated.
- Further work on the ocean environmental effects of the ocean discharge options including an update of the experience of ocean outfalls in a New Zealand context which comparable to the option being considered by Council.

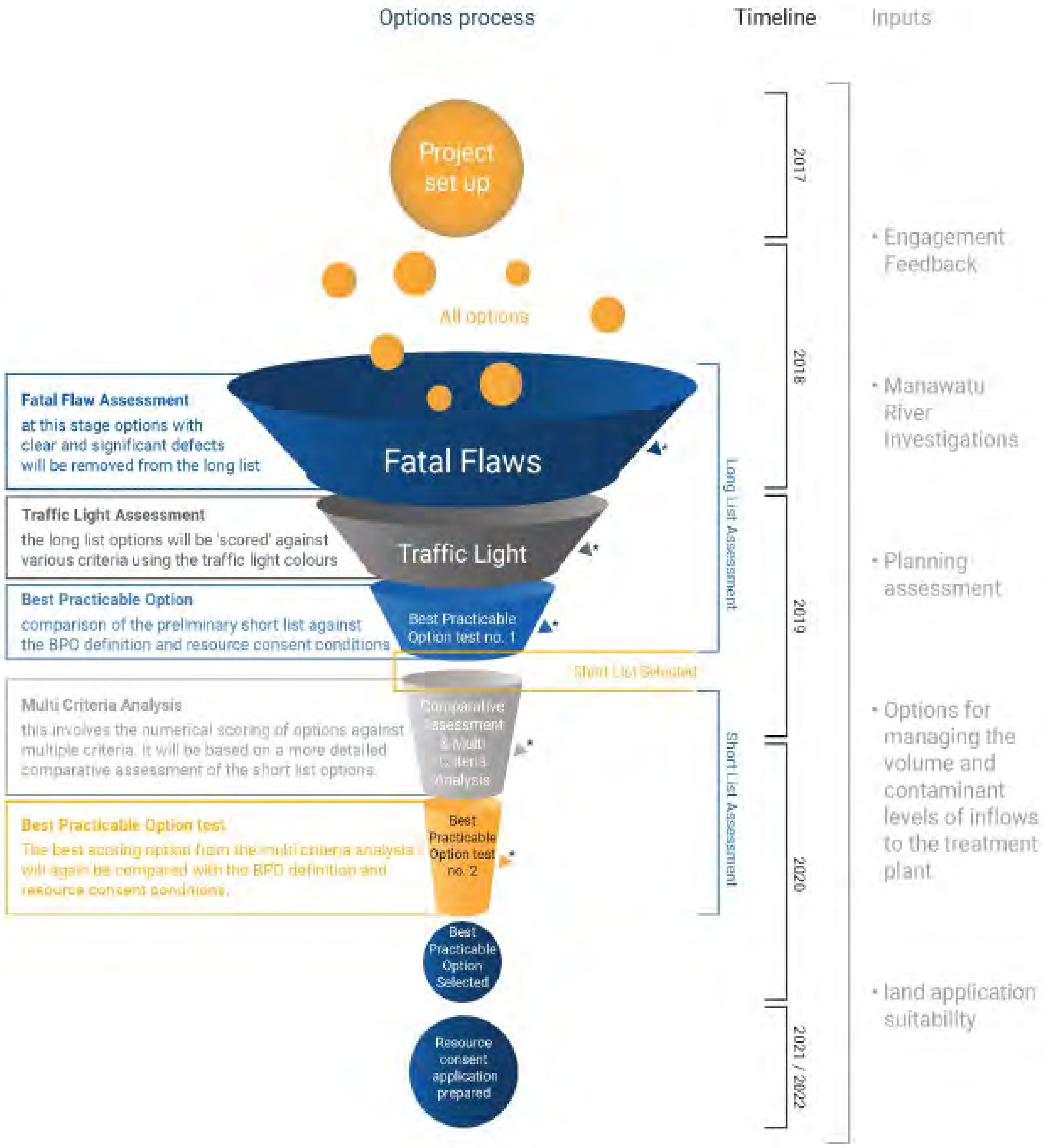
The outcome of the MCA process to date has highlighted that while Council is not yet able to confirm a preferred option, there were several options which scored consistently well across a range of criteria and weightings. Not with standing this it is recommended that:

- Completion of the remaining assessments (refer Figure 3) is necessary to guide Council in its decision-making process to select a Best Practicable Option by June 2021.
- Further consultation and engagement process with stakeholders and the community is necessary, in conjunction with the Long-Term Plan process, to provide Council with further feedback on community and stakeholder preference.
- Although there was no clear preferred option, it is recommended that Council highlight the smaller number of options which rank more highly and seek specific feedback on clear trade-offs.
- Given the additional information which has been assembled for each of the short list options, consultation and engagement should include information on all options, with more emphasis on the higher-ranking group.
- Before the consultation process is commenced, it is recommended that the further technical work identified out of the MCA process is completed. This will further assist Council in framing the consultation strategy and assessment process being undertaken.

1 Introduction

1.1 Background to the Assessment Process

In early 2017 the Council embarked on the journey of identifying a BPO for the cities wastewater management. The decision-making process carried out since this time has been confirmed through a series of assessment tools, workshops and technical evaluations. The methodology adopted for the Project is outlined in Figure 1.



Fatal Flaw Assessment
at this stage options with clear and significant defects will be removed from the long list

Traffic Light Assessment
the long list options will be 'scored' against various criteria using the traffic light colours

Best Practicable Option
comparison of the preliminary short list against the BPO definition and resource consent conditions

Multi Criteria Analysis
this involves the numerical scoring of options against multiple criteria. It will be based on a more detailed comparative assessment of the short list options.

Best Practicable Option test
The best scoring option from the multi criteria analysis will again be compared with the BPO definition and resource consent conditions.

To date, the Council has successfully delivered the Fatal Flaw Assessment, Traffic Light Assessment and Best Practicable Options Assessment (on the proposed shortlist).

Figure 1 BPO Assessment Methodology

The Multi-Criteria Assessment (MCA) forms one of a number of assessments determined as part of the 'broader assessment methodology' being adopted to determine a BPO (refer Section 1.2 below). A key determinant for the broader methodology has been developed under the conditions on the existing wastewater discharge resource consent. Under condition 23B of that consent, PNCC is required to *'…determine the best practicable option for treating and disposing of wastewater (including land disposal systems).'.* In defining 'best practicable option' condition 23B adopts the definition from the Resource Management Act 1991 (RMA) but adds detail that has specific relevance to the current discharge from PNCC's wastewater treatment plant (WWTP). In this regard Condition 23B defines the 'best practicable option' as:

- *the best method for preventing or minimising the adverse effects on the environment of that discharge having regard, among other things, to -*

  (i) The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

  (ii) The financial implications, and the effects on the environment, of that option when compared with other options; and

  (iii) The current state of technical knowledge and the likelihood that the option can be successfully applied.

- The Best Practicable Option shall be directed at preventing or minimising any adverse effects of the discharge on the life supporting capacity of the Manawatu River and in particular at minimising any adverse effects in relation to each of the following:

  (i) Growth of cyanobacteria and excessive periphyton;

  (ii) Changes to the structure and/or composition of macro-invertebrate communities; and

  (iii) The migration and habitat of trout and native fish.

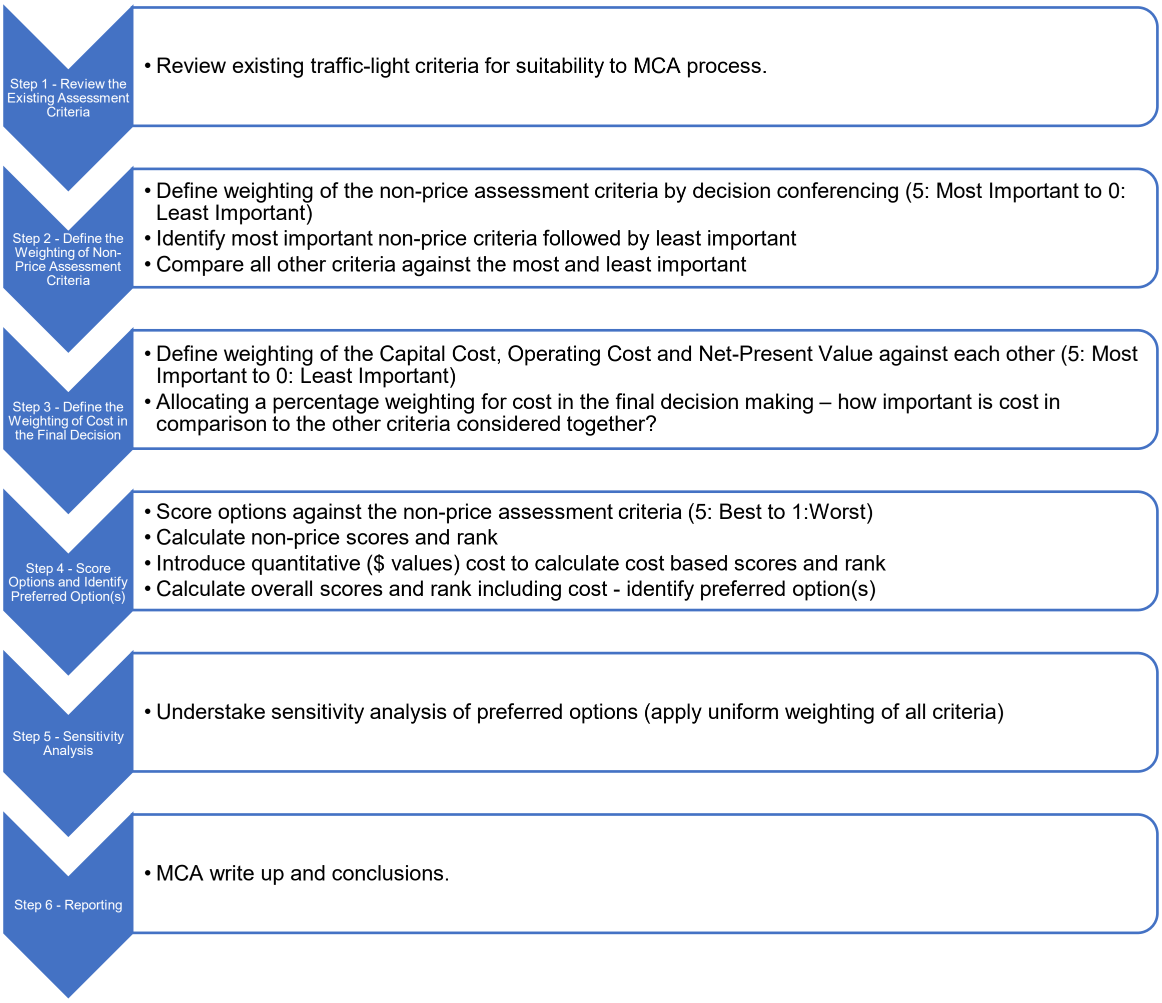
- *In determining the Best Practicable Option, the Permit Holder shall have regard to minimising the frequency, magnitude and duration of any exceedances of applicable standards, limits or targets in National Policy Statements, National Environmental Standards and any relevant Regional Plan, caused by the discharge and shall take into account the principles in Part 2 of the Resource Management Act 1991, and the considerations contained in sections 104, 105 and 107 of that Act.*

1.2 Purpose of the MCA Process

Multi-Criteria Analysis (**MCA**) is a tool to assist in decision making. It is used in a wide range of infrastructure projects, such as wastewater schemes, roading alignment selection, water supply options, water demand management and powerline route selection. Multi-Criteria Analysis is a well-accepted tool for decision makers and has been tested through various large scale Environment Court hearings.

The International Infrastructure Management Manual 2011, as adopted by local authorities in New Zealand, describes MCA as "*a decision technique that considers more than one criterion (not just monetary units). It is commonly used where the benefits and costs are more difficult to accurately define and are both quantitative and qualitative in nature".*

For this project, the MCA methodology was used to provide an auditable and defensible evaluation of the six main short-listed options. Figure 2 below illustrates the steps taken by the Council's technical team to progress the MCA process to completion.



Step 1 - Review the Existing Assessment Criteria

- Review existing traffic-light criteria for suitability to MCA process.

Step 2 - Define the Weighting of Non-Price Assessment Criteria

- Define weighting of the non-price assessment criteria by decision conferencing (5: Most Important to 0: Least Important)
- Identify most important non-price criteria followed by least important
- Compare all other criteria against the most and least important

Step 3 - Define the Weighting of Cost in the Final Decision

- Define weighting of the Capital Cost, Operating Cost and Net-Present Value against each other (5: Most Important to 0: Least Important)
- Allocating a percentage weighting for cost in the final decision making – how important is cost in comparison to the other criteria considered together?

Step 4 - Score Options and Identify Preferred Option(s)

- Score options against the non-price assessment criteria (5: Best to 1:Worst)
- Calculate non-price scores and rank
- Introduce quantitative ($ values) cost to calculate cost based scores and rank
- Calculate overall scores and rank including cost - identify preferred option(s)

Step 5 - Sensitivity Analysis

- Understake sensitivity analysis of preferred options (apply uniform weighting of all criteria)

Step 6 - Reporting

- MCA write up and conclusions.

Figure 2 MCA process

Decisions are guided by rating the options, which is achieved by assigning scores to a set of chosen criteria or attributes of the options considered. Criteria are typically chosen to cover all issues of concern and can cover tangible (e.g. cost) and intangible (e.g. opportunities and benefits) factors. The criteria scores are combined in some way (usually a weighted sum) to rank the options. The contribution that each criterion gives to the sum of scores for an option is weighted to reflect the decision makers' judgement of the relative importance of the different criteria.

The scores are surrogates for measures of value for the criteria, allowing the effects of diverse criteria, with different units, to be combined. The weightings represent judgements about what is important in a particular situation or to a particular group of individuals.

The method used to derive the MCA weightings and scores has been considered with the involvement of an independent facilitator (Sara Dennis of Just Add Lime).

The criteria used in the fatal flaw and traffic lighting assessment were revisited, redefined, and fine-tuned by the technical team and endorsed by the Project Steering Group (refer *BPO Traffic Light Assessment Report* 2019, prepared by Stantec).

1.3 Broader Assessment Approach

To meet the requirements of Condition 23B of the existing Resource Consent, it is proposed that multiple assessment tools are used. The information gained from these assessment tools will be brought together and aligned with the requirements of condition 23B using an assessment matrix. The purpose of this assessment matrix is to provide PNCC with an overall picture of the merits of each option to assist in determining the BPO. This broad assessment approach is illustrated in Figure 3.

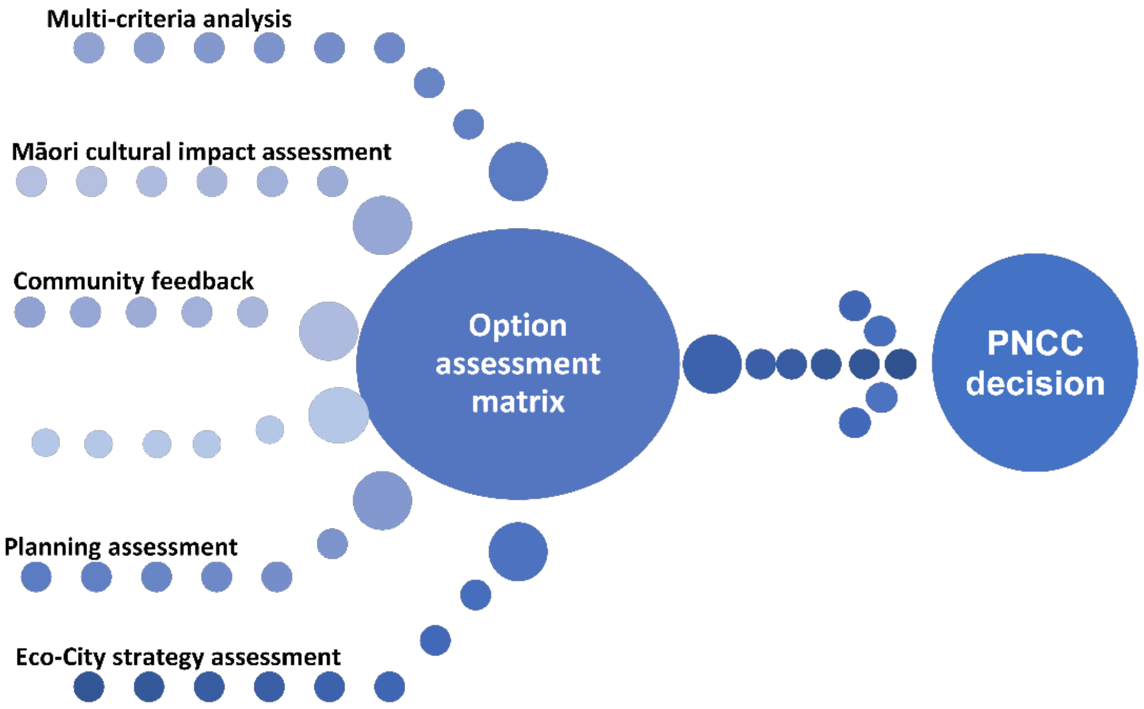


Figure 3 Broad assessment approach

This report describes the process and outcomes of the MCA process, within the context of this broader assessment. An Alternatives Assessment Report will be prepared encompassing the outcomes of each of the assessment tools and consultation process, identified in refer Figure 3.

1.4 Project Vision, Objectives & Options Assessment Principles

The BPO Review's vision, objectives and assessment principles are key elements that guide the whole project. These were established in earlier phases of the project and should inform not only PNCC's decision on the best practicable option, but also its decision on the short list assessment approach. For reference, these are set out below:

Project Vision

Management of the City's wastewater which enables growth, protects and enhances the environment and contributes to improving the health and mauri of the Manawatū River.

Project Objectives

A best practicable option wastewater management solution that is developed in partnership with Rangitāne o Manawatū which:

1. *Protects public health and minimises public health risks*
2. *Minimises adverse environmental effects on air, land and water*
3. *Is sustainable, enduring, and resilient*
4. *Contributes to improving the health and mauri of the Manawatū River*
5. *Takes an integrated approach to the management of the Manawatū River Catchment including understanding cumulative effects*
6. *Enhances peoples use and enjoyment of the Manawatū River*
7. *Is affordable and cost effective*
8. *Minimises whole of life carbon emissions and optimises resource recovery*
9. *Is innovative while being evidence based*
10. *Facilitates long term growth and economic development*
11. *Is developed with the active engagement of the community and key stakeholders.*

Assessment principles

The assessment approach should be:

- *Fit for purpose, i.e. meets RMA requirements and best practice*
- *Simple and readily replicable*
- *Transparent and easily understood*
- *Well documented, with a clear auditable trail*
- *Evidence based*
- *Collaborative.*

The project objectives have been used in determining the assessment criteria used in the MCA process.

1.5 Technical Input

The following experts have been involved in the MCA process, including preparation of the comparative assessment and presenting at the MCA workshop. Note that in all cases, a majority of the assessments have been prepared with more than one author. Refer to the comparative assessments in Appendix 1 for further details. During the workshops, only one expert in their field was asked to attend.

Public Health - Jim Bradley (Stantec)

Resilience, Technology & infrastructure, Financial - Anna Bridgman (Stantec)

Groundwater - Aslan Perwick (PDP)

Freshwater quality and ecology – Olivier Ausseil (Aquanet) & Keith Hamill (Riverlake)

Social and community - Julie Boucher (Just Add Lime)

RMA Planning advice and guidance to MCA process - Paula Hunter (Stantec)

1.6 Purpose of this Report

This report summarises the Multi Criteria Analysis (MCA) completed to determine the preferred options for consultation in early 2021. This report has been prepared with references to project documents and record, including:

- *BPO Shortlist Options Summary Report, September 2020*
- *BPO MCA Briefing Report, October 2020* (Appendix 1)
- *BPO MCA Workshop material and meeting record notes* (Appendix 2)

2 The Short List Options

Table 1 below summarises the short list of options, which is made up of 5 options. For detailed information supporting each of the shortlist options refer to the *Shortlist Options Summary Report, September 2020*. This document was used by each of the comparative assessment authors to undertake their MCA assessments.

As an overview, each option represents an alternative approach to address the known adverse effects of the current wastewater discharge to the Manawatū River. For example, option 1 would involve the use of significantly enhanced treatment technology to produce a high-quality treated wastewater, as well as a wetland, before discharging to the Manawatū River. Alternatively, option 3 would involve applying nearly all of the wastewater to land at either an inland (fluvial soil) or ocean (sand country) location.

Options 1, 3, 4, and 6 all have multiple variants. Across all options 11 variants have been brought forward to the MCA workshop. Each of these variants is assessed in the comparative assessments attached to this report. It is acknowledged that an almost infinite number of variants could be identified. However, for practical reasons the number of variants assessed through the MCA has been limited to 11. Once the BPO has been selected it is anticipated that further refinement and optimisation of the option will occur, together with mitigation measures for (any) residual adverse effects. This will occur prior to the lodgement of the necessary resource consent applications.

Finally, it is noted that former Option 5, which was a mixed ground water and land application option, has been removed from the short list. The option has been removed because as it had been refined over the past 12 months, it had become evident that the option involved numerous significant negatives (such as high treatment requirements, relatively direct discharge to freshwater and large land areas) and did not present any benefits relative to the other options.

Table 1: Short list of options

Option	Description of Variant
1	River discharge with enhanced treatment
	River discharge with enhanced treatment, and a small % to land
2	Two river discharge points and a small % to land
3	97 % applied to an inland land application site and a discharge to river in exceptional circumstances
	97 % applied to a ocean land application site and a discharge to river in exceptional circumstances
4	45 % applied to an inland land application site and a river discharge for the remainder of the time
	55 % applied to an inland land application site and a river discharge for the remainder of the time
	45 % applied to a ocean land application site and a river discharge for the remainder of the time
	55 % applied to a ocean land application site and a river discharge for the remainder of the time
6	Ocean discharge, with a small % to land
	Ocean discharge

3 Evaluation of Assessment Criteria

This section outlines the evaluations undertaken by the project team. These assessments were presented at the MCA workshop and are included in Appendix 1 of this Report.

As with the Traffic Light Assessment phase of the Project and consistent with carrying out an MCA process, this MCA was undertaken through a workshop process. Follow up review by the technical team, to ensure further outcomes of the MCA were being addressed, has also been undertaken. The outcomes of the MCA workshop and conclusion are provided later in this Report.

3.1 Summary Criteria

The first step in the process was endorsement by the Council for Assessment Criteria. Based on the Traffic Light Assessment process completed in 2019, the Project Steering Group supported the ongoing use of those criteria in the MCA process. There are benefits to utilising these criteria, which includes: consistency in the evaluation, broad range of applied criteria, covers the range of agreed project objectives well and can be applied to the Resource Management Part 2 assessment as set out in Section 4.4 of this Report.

The criteria were however refined from the earlier process and are outline in Table 2 below.

Table 2: Traffic Light Criteria

Criteria	Description
Public Health	Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)
Natural Environment	Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology
Māori Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, waters, the sky father (Ranginui), sites, waahi tapu, taonga species and other taonga
Social and Community Considerations	Potential adverse effects on social and community values relating to amenity, recreation and food gathering
Financial implications	Comparative capital, operational, whole of life costs of the options. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.
Technology and infrastructure	Degree to which the option: • uses reliable and proven technology • can be staged • is able to be constructed • is able to be constructed within an appropriate timeframe • allows for resource recovery / beneficial re-use
Resilience	Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.
Growth and Economic Development	Will the option support the population and economic growth anticipated for the City by Council?

3.2 Criterion Scoring

In preparation of the workshop held in November, the experts were asked to consider the scoring each option (in their specialist area only) against each criterion. The higher the score the better the option was considered to be for a particular criterion (5: Best to 1: Worst).

At the MCA workshop, the scores were brought together into an interactive spreadsheet and discussed amongst the attendees. This discussion was necessary to draw out any concerns or issues decision makers may have. It was then facilitated to reach an agreed score by both technical experts and the decision makers in Day 1 of the workshop and prior to any weighting being undertaken. The following table outlines how each of the criterion was scored. Detailed comparative assessments are provided for in Appendix 1 of this Report for reference.

Table 3 Criterion Scoring Overview

Criterion	Description	1	2	3	4	5
Public Health	Degree of health risk to the public because of exposure to treated wastewater (including through land application)	Extreme	High	Medium	Low	None
Natural environment	Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils and aquatic ecology.	Very High adverse effects. Major loss or alteration of baseline conditions (in absence of current discharge)	High adverse effect. Major alteration of baseline conditions (in absence of current discharge)	Moderate adverse effects. Alteration to existing baseline conditions. Generally, effects are moderate but acceptable in the context of magnitude, spatial scale, duration, and frequency.	Low adverse effects. Minor shift from baseline conditions or ecological populations (in absence of current discharge).	Very Low adverse effects. Very slight change in baseline conditions.
Māori Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga	Destruction of Rangitāne culture, connections and kaitiakitanga. Critical effect on Rangitāne o Manawatū	Significant effect or impact on all aspects of Rangitāne Mana, Toanga, Atua and natural resources	Major impact on all aspects of Rangitāne significant sites and natural resources	Minimal impact on Rangitāne significant sites and natural resources	Minimal to no effect on Rangitāne o Manawatū
Social and Community Considerations	Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option	Severe	Major	Moderate	Minor	Insignificant
Financial implications		Financial implication scores have been calculated using a formula explained in the report.				
Technology and infrastructure	Degree to which the option: • can be staged • is able to be constructed and operational within 5 years of the commencement of the consent • allows for resource recovery / beneficial re-use • infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme • involves Operational Complexity • involves Operational Risk	Low degree of alignment with sub-criteria and/or High Operational Complexity and Risk	Low – Medium degree of alignment with sub-criteria and/or Medium-High Operational Complexity and Risk	Medium degree of alignment with sub-criteria and/or Medium Operational Complexity and Risk	Medium – High degree of alignment with sub-criteria and/or Low-Medium Operational Complexity and Risk	High degree of alignment with sub-criteria and/or Low Operational Complexity and Risk
Resilience	Degree to which the option is resilient to • natural hazards • climate change	**Low degree of resilience**	**Low – Medium degree of resilience**	**Medium degree of resilience**	**Medium – High degree of resilience**	**High degree of resilience**
Growth & Economic Development	The degree to which the options will: • Support the population and economic growth anticipated for the City by Council? • Support / restrict further up-scaling to accommodate a sub-regional scheme?	**Low degree of**	**Low – Medium degree**	**Medium degree**	**Medium – High degree**	**High degree**

3.3 Applied Scores

Table 4 below presents the scoring made by technical experts who prepared the comparative assessments (refer Appendix 1). The scored represent the work undertaken prior to MCA workshop and do not show any potential changes, as there were made at the workshop with decision makers and are represented in Table 5.

Table 4 Preliminary Scoring as recommended by experts only

Options	Option Description	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development	TOTAL AVERAGE (No Weight)
1: R2(b)	River discharge with enhanced treatment	4	3	1	2	2.8	4	4	2	2.7
	River discharge with enhanced treatment, and a small % to land	2.5	3.5	1	1	2.1	4	3	2.5	2.4
2: Dual R + L	Two river discharge points and a small % to land	4	4	1	1	2.7	3	3.5	2.5	2.6
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	3.5	4	1	2.4	3	3	2	2.7
	97 % applied to an ocean land application site and a discharge to river in exceptional circumstances	4	4	3	1	1.1	3	3	3	2.5
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	1	3	3	3.5	3	2.8
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	1	2.8	3	3.5	3	2.9
	45 % applied to an ocean land application site and a river discharge for the remainder of the time	2	3	2	1	2.5	3	2.5	2	2.4
	55 % applied to an ocean land application site and a river discharge for the remainder of the time	2	3	2	1	2.2	3	2.5	2	2.5
6: Ocean	Ocean discharge, with a small % to land	2.5	4.5	1	1	1.9	2.5	3	4	2.6
	Ocean discharge	5	4	1	2	2.4	2.5	3.5	4	3

4 MCA Workshop

The workshop involved relevant experts such as engineers (land discharge, irrigation, wastewater treatment design and public health), environmental scientists with expertise in science and freshwater ecology, land use and strategic planners, maori cultural values (Rangitane as mana whenua), and social impacts specialists. A copy of the workshop briefing material is provided in Appendix 1 of this Report.

The main workshop was attended by whom Council considered decision makers and key stakeholder representatives. The full list of attendees is included in Appendix C (workshop notes), however in summary did include: Councillors, Rangitane o Manawatu and Muaopoko representatives, PSG members, Councils Executive Leadership Team, Stakeholder representatives from the Regional District Health Board, Federated Farmers and Environment Network Manawatu.

The MCA was completed over 2 days, with preparatory days prior to this, made up of the following:

- Preparation Day 1: Meeting of technical experts only to present the shortlist options (briefing material) and identify any gaps in information needed to complete comparative assessments.

- Preparation Day 2: Meeting of Councillors and Stakeholders (decision makers) to present the options an provide guidance on the MCA workshop process.

- MCA Workshop Days 1 & 2: MCA Assessment workshop attended by technical experts and decision makers. The first of the two days involved the presentation of scoring and working through each options collective scoring results. The second day involved the weighting of criteria and completing sensitivity scoring as determined by the attendees for comparison purposes only.

The MCA workshop began with a discussion of each of the technical assessments that were completed with relevant scoring against the options being assessed. This was also an opportunity to discuss anomalies in this scoring or information that had been circulated prior to the meeting. The scoring was then confirmed or refined by the group to ensure they were representative of issues likely to be of concern.

Next each expert presented information on the various aspects and for which they were responsible and for. This was followed by a group discussion on each of the aspects and an assignment of scores according to the relative importance of that aspect for each section of each option.

4.1 Agreed Scoring

Table 5 below shows the scoring allocated and agreed at the workshop with decision makers on Day 1 (9th November 2020). Note that the red numbers depict where scoring was changed at the workshop in red. The basis for these changes is captured in the commentary provided in Section 4.2 below.

Table 5 MCA Agreed Scoring undertaken on 9-10 November 2020

Options	Option Description	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development
1: R2(b)	River discharge with enhanced treatment	4	3	1	4	2.8	4	4	2
	River discharge with enhanced treatment, and a small % to land	3.5	3.5	1	3.5	2.1	4	3.5	2.5
2: Dual R + L	Two river discharge points and a small % to land	3.5	4	1	3.5	2.7	3	3.5	2.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	3.5	4	2.5	2.4	3	3	2
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	4	4	3	2.5	1.1	3	3	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	2.5	3	3	3.5	3

Options	Option Description	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	2.5	2.8	3	3.5	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	2	2.5	3	2.5	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	2	2.2	3	2.5	2
6: Ocean	Ocean discharge, with a small % to land	3	4.5	1	2	1.9	2.5	3	4
	Ocean discharge	5	4	1	3.5	2.4	2.5	3.5	4
Red font is used to show any changes agreed from the specialist recommendations. This will aid with transparency.									

4.2 Commentary

Following the presentation of scores by experts, the workshop attendees were broken into 5 groups. The groups were made up of councillors, experts, council officers to ensure there was availability of technical support alongside decision makers. Representatives of each group were then asked to present the collective findings from each Option for consideration by the wider group. Table 6 below, notes key discussion points with a copy of the workshop notes provided in Appendix 2 of this Report.

Table 6 Workshop Commentary on each option

Option Reference		Commentary / Discussion
1. R2(b)	River Discharge with enhanced treatment	There are further treatment enhancements available to Council with this option in time ie reverse osmosis. However, this was fatally flawed in the long list because of costs. Land based schemes have flooding risks and an assumption the land would be in a floodplain, making the options less resilient overall. Variant 1b changed scoring to 3.5 (less resilient that Option 1).
	River Discharge with enhanced treatment with a small portion to land	The differences in the public health scores are due to the mitigation put in place for land treatment e.g. buffers, access restrictions. Jim Bradley went through all pathways and agreed that the score could change 2.5 to a 3.5. Note that the level of treatment is the same for land as for the river. The land discharge will provide some additional removal of nitrogen. From a cultural perspective, the land is only a minor component and the overall impact of the option on the river is more concerning. With respect to social impacts, the scores do not reflect the size of the footprints – hard to assess as depends on land uses – if discharging to a forest potentially no impact but if discharging to productive land could be a big impact. Subsequently there may be consideration needed of these scores changing. Amend the resilience scoring from a 3 to a 3.5 on the basis there is greater ability to provide for discharging to land as an alternative to the river as the city grows. Agreement by the group to amend the Public health scores for the plus land option as these were considered harsh in comparison to some other options when you take the enhanced treatment into account and the treatment provided by land. Based on the number of critical pathways – comfortable to change from a score of 2.5 to a 3.5
2. Dual R+L	Two river discharge points and a small portion to land	When comparing the public health score for Options 1 and 2, why have both options scored 4 when Option 2 has a lesser level of treatment. In comparison with option 1, there are an increased number of receptors and therefor risk. Agreed scoring change from a 4 to a 3.5 on this basis.

		Environmental scoring is based on how well the One Plan targets are met. The discharge at Opiki avoids river gravels, periphyton risk is lower, other issues to be considered although treatment levels are not as high. Scored better that Option 1 but very little difference. It was noted that the Totara Road location is very good at growing periphyton, hence very low nitrogen limit. This compares less favourable (only slightly) that this option given the environment at Opiki. Confidence in the social score (because it does not consider number of communities affected) is a concern. Infrastructure scored a 3 for this option because there is a high element of potential resource recovery, scores lower for upscaling for a sub-regional scheme can address this from a treatment perspective but not from an infrastructure perspective.
3. L+R(a) & (b)	97% Applied to land (inland location) and discharge to the River in exceptional circumstances	The inland site is driven by effects on ground water, the ocean effects are on ocean streams and lakes. Targets are used in determining the toal land area required ie 21-25kg/ha/year leaching targets. This will ensure the lrate of discharge is at a level that will be acceptable for receiving environment. Inland soils are less ideal and will not require irrigation in winter. On this basis, if 97% driving negative outcomes what about 80-70% - is this a linear thing? Experts noted that once get into wet months, 'we really want to get off those soils' Hydraulic loading plays a major contributing role in the rate and timing of discharges. Consideration may be given on 70/80% loading. There are financial implications of ocean areas versus inland areas and further financial modelling should be completed to fully understand the impact of these options on options costs and the region economy. With growth and the region's economy, understanding what the potential loss of jobs with farming land use change are needed. PNCC's reputation could be challenged by farming community – should the scores be higher for ocean areas but lower for the inland areas? This option would this be the largest land application scheme in New Zealand. Currently, Taupo is currently the largest scheme at 500ha Scoring has also considered the ability to adapt to a sub-regional scheme in time.
	97% Applied to land (ocean location) and discharge to the River in exceptional circumstances	
4. L + R (d) & (e)	45% of the time discharge to land (inland) and remainder of the time to the River	The ocean sands options did not score well from an environment perspective because of effects on ocean lakes and streams, soils less effective removing nutrients.

	55% of the time discharge to land (inland) and remainder of the time to the River	In terms of public health - inland areas only 5 critical pathways, ocean areas have 8 critical pathways because of shellfish and ocean lakes and streams. The differences in land costs seems too low. What are the differences in income between cut and carry and forestry? Aslan Perwick - $2,000/ha/year for inland soils (cut and carry) and $1,200ha/year for forestry. Agreed that this requires further explanation and potentially more up to date analysis.
	45% of the time discharge to land (ocean) and remainder of the time to the River	
	55% of the time discharge to land (ocean) and remainder of the time to the River	
5. Ocean	Ocean discharge with small portion to land (ocean)	There are limited environmental benefits to including land as part of this option. There can be commercial benefits if it involves the right land use, but costs associated with land purchase. This is a good option from an environmental perspective, potential land effects good as only a small area of land required and in summer taking out nutrients. Because of the small area of land required able to avoid sensitive lakes. From a public health perspective, the option without the land component scored a 5 because it had the least critical pathways. The land component could be a dilemma depending on where it is located. It was then agreed to increase this criterion from a 2.5 to 3 based on further comparison with other option scores. Noted that Option 1 has a higher quality treatment than Option 6. Option 6 does however provide some improvements. If the discharge is half the flow half the year, a smaller land area is required and can avoid streams and lake catchments. It is very difficult to get to these streams and lakes and further investigation is needed to explore how many people are potentially affected ie activities such as gathering watercress. On this basis it was further supported to increase the public health score from a 2.5 to a 3. An ocean discharge is low risk on aquatic life primarily because of the length of the outfall – 2km offshore, involves some nitrogen removal as diverting half the flow to land in the summer. However further information is needed by Iwi before this can be considered further. Growth and economics have scored highly primarily because it is the most acceptable for a sub-regional scheme (based on information presented so far). Noted that for sub regional schemes the treatment does not have to all be at Totora Road, could be Feilding etc. This detail is yet to be explored and could be considered as part of some further options refinement.
	Ocean Discharge 100% of time.	

4.3 Weighting

The need to give relative weighting to each criterion was agreed by decision makers at the end of Day 1 of the MCA workshop. This was largely driven by the consensus that scoring alone did not provided Council with clear direction on a single preferred option. Day 2 was then focused on exploring weightings, reflecting decision maker views, and allowing for debate and discussion during the workshop. Experts were deliberately removed from the decision makers during the weighting scenarios portion of the workshop to ensure there was no technical expertise influencing the process. They were asked to develop their own two alternative weighting scenarios in a separate room based on their professional and technical expertise, one being without financial weighting and one with an agreed financial weight of 15%. These weightings are presented below (refer Table 7).

A total of ten different weighting scenarios were developed by both Councillors and Stakeholders (decision makers), and the technical experts as a separate group. Within the agreed weightings identified, the following themes and considerations were discussed by the group:

- There are two scenarios being considered, including with a weighting on finance and without. It was agreed to put 15% of the weighting to finance, which has had little to no impact on the overall results because of the close range of all weightings calculated across the criterion. For example, a weighting of 40% to a criterion was necessary to alter the outcomes of the top ranked 3 options.
- A consistently low weighting was given to the Technology and Infrastructure criterion. This was because the preferred option is expected to deliver on the technology and of the options presented, all provided improvements to the current treatment levels.
- Maori Cultural Values was the highest weighted criteria (consistently), which was an agreement by a majority of attendees.
- Growth and Economic Development, along with Public Health were considered of almost equal weighting importance. This is because the solution being adopted must ensure people's health are not impacted and a long terms solution for the city's growth, with the potential for the region's growth to be considered was important to the council.
- A level of confidence was low in relation to the social and community criterion. This was because the assessment to date was limited to a desk top exercise and it was recommended by experts that site specific investigations would be suitable to determine the full scale of impacts associated with each option.

Table 7 MCA Base Weightings considered at workshop

Weighting Scenarios	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development
Base workshop weighting scenario	15.0%	15.0%	20.0%	15.0%	15.0%	0.0%	5.0%	15.0%
Alternative workshop weighting scenario (if required)	10.0%	10.0%	15.0%	40.0%	10.0%	0.0%	5.0%	10.0%
Councilor Agreed -Without Finance	18.0%	20.0%	22.0%	12.0%	0.0%	0.0%	13.0%	15.0%
Technical Group-Without Finance	20.0%	20.0%	20.0%	20.0%	0.0%	5.0%	5.0%	10.0%
Agreed Combined without finance	20.0%	20.0%	20.0%	15.0%	0.0%	0.0%	10.0%	15.0%
Agreed Combined With Finance	15.0%	15.0%	20.0%	15.0%	15.0%	0.0%	5.0%	15.0%
Social and Community- With Finance	10.0%	10.0%	15.0%	40.0%	10.0%	0.0%	5.0%	10.0%
Agreed Combined with Finance-Option 2	10.0%	10.0%	15.0%	10.0%	50.0%	0.0%	0.0%	5.0%
Councillor Agreed- With Finance	15.0%	15.0%	20.0%	10.0%	15.0%	0.0%	10.0%	15.0%
Technical Group- With Finance	17.5%	17.5%	17.5%	17.5%	15.0%	3.8%	3.8%	7.5%
No weight to financial implications	17.6%	17.6%	23.5%	17.6%	0.0%	0.0%	5.9%	17.6%
50% weight to financial implications	8.8%	8.8%	11.8%	8.8%	50.0%	0.0%	2.9%	8.8%
Equal weight to all criterion	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%
Part 2 RMA	20.0%	20.0%	20.0%	10.0%	5.0%	5.0%	15.0%	5.0%
confidence	50	70	60	20		80	50	30

4.4 RMA Part 2 Assessment

In addition to the weighting outlined in the workshop, a further assessment against the RMA Part 2 'Purpose and Principles' has been undertaken (Table 7 below). This table summarises how each of the relevant sections of the RMA are being applied across the criteria developed for the MCA and the relevant weighting that should be applied. The outcome of this weighting is included in Table 9 below for comparison against options weightings from the workshop.

Table 8 Assessment of RMA Part 2 'Purpose & Principles

Criteria	Relevance of criterion to Pt 2	Weight
Public health	Where is it covered in Pt 2? s5 – enabling people & communities to provide for health & avoid, remedy & mitigate adverse effects Assessment Critical RMA Pt 2 issue to address in a wastewater project, but specific relevance is confined to s5.	20
Natural environment	Where is it covered in Pt 2? s5 - safeguard life supporting capacity, avoid remedy or mitigate adverse effects; s6 - preserve natural character & significant habitats; s7 intrinsic values or ecosystems, and the maintenance & enhancement of quality of the environment Assessment Critical Part 2 issue to address in a wastewater project, and the criterion has specific relevance to most sections of Pt 2 (except s8).	20
Māori cultural values	Where is it covered in Pt 2? s5 - enabling people & communities to provide for cultural wellbeing; s6 - relationship of Māori and culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga; s7 - kaitiakitanga; s8 - principles of the Treaty of Waitangi Assessment Critical Part 2 issue to address in a wastewater project, and the criterion has specific relevance to all sections of Pt 2.	20
Social & community	Where is it covered in Pt 2? s5 - enabling people & communities to provide for social wellbeing, & avoid, remedy and mitigate adverse effects; s7 - the maintenance and enhancement of amenity values Assessment Important, but less critical Part 2 issue to address in a wastewater project. Specific reference is only made to the criterion in s5 and it	10

	has relevance to the s7 amenity reference. TBC - Social considerations associated with recreation, are in part captured under the Public Health criterion.	
Financial implications	Where is it covered in Pt 2? s5 - enabling people & communities to provide for... Assessment Of only general relevance under Pt 2 of the RMA	5
Technology & infrastructure	Where is it covered in Pt 2? s5 - enabling people & communities to provide for... Assessment Of only general relevance under Part 2 of the RMA	5
Resilience	Where is it covered in Pt 2? s5 - enabling people & communities to provide for...; s6 - the management of significant risks from natural hazards; s7 - the effects of climate change Assessment The criterion has specific relevance to most sections of Pt 2. However, while ensuring a resilient wastewater system is important, to a certain degree this is a design consideration and not as critical as some other factors.	15
Growth & economic development	Where is it covered in Pt 2? s5 - enabling people & communities to provide for... Assessment Of only general relevance under Part 2 of the RMA	5

4.5 Analysis

The scoring of the eleven different options, using the seven different weighting schemes is given in Table 9 below. The average score for each option and their relative rank compared to other options are also given for weighting scenario developed (refer Table 8 above).

It should be emphasised that scores represent an assessment of the likely scale of the impact. Scores can range from “0” for absolutely no impact, through to a maximum of “5” for extreme difficulty. In reaching decisions about which option is preferred it is therefore useful to compare scores between options and hence the rank of the scores is also given in Table 8.

Table 9 MCA Overall Weighted Scores

Options	Option Description	Base workshop weighting scenario	Rank	Alternative workshop weighting scenario	Rank	No weight to financial implications	Rank	50% weight to financial implications	Rank	Equal weight to all criterion	Rank	Part 2 RMA	Rank
1: R2(b)	River discharge with enhanced treatment	2.8	7	3.1	**2**	2.8	8	2.8	4	3.1	**2**	3.0	5
	River discharge with enhanced treatment, and a small % to land	2.6	9	2.9	5	2.7	9	2.4	7	3.0	6	2.9	8
2: Dual R + L	Two river discharge points and a small % to land	2.8	6	3.0	**3**	2.8	6	2.8	5	3.0	5	3.0	7
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3.0	**3**	2.8	6	3.1	4	2.7	6	2.9	8	3.2	4
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	2.9	4	2.8	7	3.3	2	2.2	11	3.0	6	3.3	**2**
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	2.9	5	2.8	8	2.9	5	2.9	**2**	3.0	4	3.0	6
	55 % applied to an inland land application site and a river	3.1	**2**	2.9	4	3.1	**3**	3.0	**1**	3.1	**2**	3.2	**3**

Options	Option Description	Base workshop weighting scenario	Rank	Alternative workshop weighting scenario	Rank	No weight to financial implications	Rank	50% weight to financial implications	Rank	Equal weight to all criterion	Rank	Part 2 RMA	Rank
	discharge for the remainder of the time												
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2.3	10	2.2	10	2.2	10	2.4	8	2.4	10	2.4	10
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2.2	11	2.1	11	2.2	10	2.2	10	2.3	11	2.3	11
6: Ocean	Ocean discharge, with a small % to land	2.7	8	2.4	9	2.8	7	2.3	9	2.7	9	2.8	9
	Ocean discharge	3.2	**1**	3.3	**1**	3.4	**1**	2.9	**3**	3.2	**1**	3.3	**1**

4.6 Sensitivity Review

In general, the differences in scores between the options are relatively small. This suggests that results will be more sensitive to changes in the individual scores. Typically, a change in one score point will result in slightly less than a 0.1 change in an option score. Therefore, it will take a “2” or “3” point score to significantly change the relative ranking of options for a particular weighting scheme. I it is therefore likely to take substantially more score point changes within a single option, to give a different preferred option.

5 Discussion

The following section summarises key discussion points for each of the five options following the completion of scoring and discussion at the MCA workshop on the 9th and 10th of November.

Table 10 Summary Conclusions and Discussion of options at completion of the MCA Workshop

Options	Option Description	Discussion
1: R2(b)	River discharge with enhanced treatment	Similarly, with the Ocean Discharge option (Option 6), Option 1 is one of the top 3 ranked options. Largely because of the high treatment standard/method adopted for this option, compared to all other options, the criteria for public health, social and community, technology and infrastructure, resilience have all scored 4 out of 5. This is because it ensures the public health and environment are protected with less risk than other options that public health and the environment will not be compromised. One Plan standards are met most of the time with this option (still not met 10 days/year). Further investigations are needed to confirm how Council may be able to discharge some treated wastewater to land to ensure compliance is met 365 days a year ie no non-compliance under One Plan. This may require more land and/or frequency of the discharge to land increased. From a Maori cultural values perspective, this option is scored the lowest as it is considered completely unacceptable to discharge wastewater to the River.
	River discharge with enhanced treatment, and a small % to land	Comparatively, this option has not been ranked in the top 3 or the bottom 3 of the 11 ranked options. A constraining factor to this option is the portion of land explored with this option increases costs and therefore, the option is scored relatively low for costs. From a Maori cultural values perspective, this option continues to discharge most of the treated wastewater to the River and therefore is scored low (consistent with Option 1 '100% to river' and Option 6.
2: Dual R + L	Two river discharge points and a small % to land	Option 2 has ranked in the middle consistently. The scoring provided for Public Health and Natural Environment is 4. This is because there is a higher treatment method adopted for this option in conjunction with discharges occurring where there is less sensitivity to public health and the environment is less sensitive. From a social and community perspective, the option is ranked 3.5 as consistent with Option 1 'river and small % to land'. The option essentially discharges into 3 locations, presenting effects on multiple individuals and communities. As with Option 1 and Option 6, this option is not considered a viable solution from a Maori Cultural Values perspective as it is not acceptable to discharge wastewater to the River.
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river	This option was not considered a top rankikng option compared to Options 1, 4 and 6. However was identified as a preferred option through the public consultation process held in early 2020 and noted at the workshop by key stakeholders.

Options	Option Description	Discussion
	in exceptional circumstances	The discharge to land a majority of the time (97%) is the most favourable from a Maori Cultural Values perspective, scoring 4 and 3.5 respectively (inland and coastal soils). The preference from Iwi for the inland option (compared to coastal sands), is based on the strong desire for mitigating effects on neighbouring Iwi. This would be achieved through identifying land that is within the Rohi of Rangitane and within the Councils land jurisdiction as much as possible (if feasible). However social and community criteria, and growth and economic development criteria were both scored low (2.5 and 2). This low scoring is based on the likely severe impact on individuals and community groups caused by the significant land area (3,5000ha of land) necessary to implement this solution. The area is likely to sever communities and cease activities that have occurred in areas for some time. The well being of people may also be impacted where the way they used to control their day-to-day activities will no longer happen ie no longer farming. This scoring however was given low confidence on the basis the site is not yet confirmed, and further investigation is needed by experts. It was still very much recognised as a major concern by decision makers and key stakeholders. This option was scored mid-range across the remaining criteria. Therefore, the option was not consistently scored as a top 3 option and was also not falling in the lowest 3 options.
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	Similarly, with the 97% to inland land, the coastal sands option was favourable to Iwi in comparison to river and ocean options being assessed. However, the coastal sands option is the least affordable and scored the lowest for a financial implications' perspective. This option also has a mid-range score from a social and community impact due to the size of the land required and proximity to the coastline. The same reasoning identified for the inland option is considered in this option for social and community impact. This option does score slightly better for Public Health and Environmental standards on the basis the receiving environments are less sensitive and there are less receptors potentially impacted (both scoring 4).
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time 55 % applied to an inland land application site and a river discharge for the remainder of the time	The 45-55% inland fluvial soils option has been identified as top-ranking options, more favourably the 55% discharge to inland fluvial soils, across each of the weighting scenarios. From a Maori cultural values position, the option provides some improvement to the River by accommodating a majority (or large proportion) of the wastewater to land (which is preferred). Therefore, the score of 3 has been applied from Iwi. A score of 4 was provided for the Natural environment and scores of 3 or above (up to 3.5) for the Public health, technology, resilience and a growth and economic development assessment. The large land area and infrastructure requirements for this option contribute to the lower scoring for financial costs. In addition to this, the social and community implications are consistent with Option 3, in there are communities

Options	Option Description	Discussion
		and individuals with land holdings that are likely to be adversely impacted by this option. It was then agreed that further investigation was needed to identify the full extent of adverse impacts on individuals and the community as well as up to date land costs.
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	Option 4 '45% - 55% coastal land application' have consistently ranked 10 and 11 (out of 11) across the range of criteria weightings explored at the MCA workshop. Scoring that has heavily influenced this outcome is Public Health, Maori Cultural values, social and community, growth and economic development, financial implications were all scored less than 3 for the scoring provided by experts. In addition, this option requires significant investment in infrastructure, increases overall costs for this option. There is also increased risk of infrastructure failure when considering resilience (natural hazard/climate change) and therefore did not score highly under these criteria. The workshop attendees agreed with low confidence scoring to financial, social and community criteria. the social and community implications are consistent with Option 3, in there are communities and individuals with land holdings that are likely to be adversely impacted by this option. It was then agreed that further investigation was needed to identify the full extent of adverse impacts on individuals and the community as well as up to date land costs.
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	
6: Ocean	Ocean discharge, with a small % to land	As is identified with Option 4 "45% - 55% coastal land application", this option presented low confidence for decision makers as it is consistently in the lowest 3 ranked options. As outlined in Option 4 'coastal sands' options, this option scored lower across the financial, social and community, public health, growth and economic development and Maori cultural values assessments. It was agreed by decision makers that this option was not considered a viable option to take forward given the range of impacts, risks and high costs identified .
	Ocean discharge	The 100% Ocean discharge option is recognised as consistently in the top 3 ranked options when reviewed across each of the weighting scenarios. The criteria that scored the highest included public health, natural environment, growth and economic development and resilience. This was largely on the basis technical experts identified there are less receptors and a less sensitive receiving environment that treated wastewater can be discharged to when discharging into coastal waters. It is however recognised that there are further effects assessments needed before the confidence given to this option is acceptable. This option is also considered the most favourable to adopt a regional or sub-regional scheme, whereby Councils growth and neighbouring councils' wastewater, can be incorporated into a sub-regional scheme over time. Alternatively, the remaining options may be less viable solutions given the constraints of the receiving environment (to accommodate increased flows and loads within the consent duration and/or beyond 50 years).

Options	Option Description	Discussion
		This option is considered to the one of the least favourable from an Iwi perspective (in addition to River options). A point made by Iwi at the workshop concluded that significantly more work is needed before a position from Iwi can be revised. It was also noted that consideration of Iwi not represented at the workshop will be very important and the scoring does not represent the value wider Iwi have on the coast. Awareness was raised by Rangitane that Iwi (including those not represented at the workshop) will not be supportive of this option.

5.1 Additional Investigations

Following the MCA workshop held on the 9th and 10th of November, the following technical work was agreed to be undertaken by Councils' Project Team and presented back to the Project Steering Group for the Project:

- Updating options with Councils latest growth projections and incorporation of updated growth projections from neighbouring Councils and major industry (MCA/HDC). This work is to further identify the growth rates (low/medium/high) to assist decision makers in understanding the option that provides the optimal solution for Councils planned growth rates as well as contingency within the consent duration being applied for.
- Update the land values that have been incorporated into financial information used. This is to give confidence to par5ticipants that the cost of options is as accurate as possible through the evaluation process.
- Further assessment of potential effects from a coastal outfall (in the proposed coastline) is needed and this is then to be shared with decision makers, Rangitane Iwi and key stakeholders.
- Explore whether there is a 'staged implementation' available for options including a discharge (or partial discharge) to the River. This was discussed towards the close of Day 2 of the workshop and is considered a potential solution that achieves higher standards of wastewater treatment over time, staged implantation of land-based discharge over time and potentially reducing costs to Council.
- Investigate if options requiring a discharge to the River and ocean can be optimised. This may include higher treatment standards being adopted or the refinement between land and River discharge being made. This work will involve further modelling of River contaminants and information researched on local ocean environments that are.
- Assessment of alternative land use and revenue streams particularly for land-based options to improve the robustness of option costs.

6 Conclusion

6.1 Overview

Significant technical work has been undertaken by the Council to refine the shortlist options since they were identified in June 2019. The 5 shortlisted options (with variants) have been assessed through a Multi-Criteria Assessment, assisting the Council to determine one or more preferred options. The MCA has been adopted by the Council as one tool within a range of tools, assisting Council decide on the BPO (Figure 3).

This MCA process was attended by most Councils elected members, Rangitane and Muaupoko Iwi representatives, and key stakeholders. Briefing material and workshops were held prior to the two-day MCA scoring and weighting workshop to ensure attendees were well informed leading into the evaluation process (refer Section 3). Following the two-day workshop held in November 2020, the Council was unable to identify a single preferred option however were able to recognise the top-ranking options for further consideration.

Significant steps were however made by completing the MCA process, as this has guided the Council towards a BPO through identifying additional work that will assist in options refinement and increasing the robustness of the information used in the assessment process.

6.2 Key Outcomes of the MCA

In summary, the MCA process confirmed the following for Council:

- No single option has been identified out of the MCA assessment process as a preferred BPO. Sensitivity testing involving changes to the weightings of the criteria confirmed that scoring changes of less than 0.3 did not change the top-ranking options.
- Even when assessed against a range of weighting scenarios, the top 3 options are consistent. Options with the lowest ranking scores were also consistent across the weighted scenarios. The favourable options
    - Option 1 - Most of the treated wastewater being discharged to the Manawatu River with substantially high treatment and a portion to land. This will closely meet One Plan targets. While this option was not well supported by Iwi, considerations of a higher standard of treatment were proposed by several key stakeholders and decision makers.
    - Option 4 - A 45% discharge to inland fluvial soils. However, this option should seek to reduce the land area requirements and providing a high standard of treatment 55% of the time for the River discharge component.
    - Option 6 - Ocean discharge. This option scored well due to its ability to provide a regional or sub-regional scheme. Feedback from the workshop suggested that a higher level of treatment may need to be considered than currently proposed to allay concerns of Iwi and other stakeholder feedback.
- Additional technical work should be undertaken prior to deciding on the BPO and to inform the wider assessment process. This technical work is outlined in Section 5.1 above. The information will assist Council with refining shortlist options and provide stakeholders and decision makers with greater confidence in respect to effects on the river and ocean, social and community and costs of the options, as well as mitigation of potential adverse effects.

In summary, the MCA has provided with further direction in the options assessment process. The receiving environments that have been identified as potential options include a combined option of river and land (inland fluvial soils) options or an ocean discharge. The treatment levels proposed for these options are driven by meeting One Plan Standards and when assessed against the range of criteria used in the MCA process to score each option, it is the options with the higher standard of treatment that is preferred and options including the least amount of land necessary that is inland (fluvial soils).

6.3 Next Steps

Out of this MCA, the Council confirmed that the MCA with Iwi and a further round of engagement and consultation with stakeholders and the community will be valuable in guiding Council's selection of the BPO. In addition to this, the assessments identified in Figure 3 will also be important for the completion of the alternative's assessment process under the RMA and Councils overall recommendation for the BPO (by June 2021).

As such, the following conclusions drawn from the MCA process are considered relevant in the upcoming engagement processes include:

Preferred Options 1, 4 and 6 and reasoning:

- Although there was no clear preferred option, it is recommended that Council highlight the smaller number of options which rank more highly and seek specific feedback on clear trade-offs, these being:
    - Option 1 '97% to River'
    - Option 4 '55% to fluvial soils and remainder to River'
    - Option 6 'Ocean'
- The natural environment is highly valued by the Council and options considered in the top 3, propose the highest levels of treatment being considered by Council across all the options.
- There was strong support for exploring options that reduced land areas and provided higher treatment as a mitigation strategy to negative impacts on productive land capacity, hence Option 4 being preferred.
- Providing a higher level of treatment would represent a departure from the premise underpinning option development to date which was that treatment should be sufficient to mitigate effects for the receiving environment given this will be necessary to gain a consent under One Plan.

Options not considered preferable and the reasoning behind this includes:

- Options requiring significant land areas (2,500ha to 3,500ha) i.e Option 3 '97% to land', would be considered problematic and likely not feasible due to the significant quantity of. Class 1 soils required. The consumption of significant areas of Class 1 agricultural soils and areas suitable for urban development was considered a significant disbenefit.
- Concern that the true costs of large areas of land purchase in the region, along with the complexity of purchasing such large areas, will be a challenge for the Council to overcome. Therefore the 97% to land options are considered less desirable to proceed with.
- Although provisional, the scoring for land-based options (particularly 97% to land and coastal sands areas), these effects are still a risk to Council in proceeding with an

option with confidence the effects can be mitigated or minimal on the environment. While these effects on individuals and the community of large-scale land irrigation systems, will be refined at the AEE stage, a pre-cautionary approach is preferred when considering land-based options.

- Concern that the extent of social impacts for each option, particularly land-based options, is not fully understood at this stage of the process. Options 2, 3 and 4, which requires more than 1,000ha and up to 3,500ha of land, may have substantial effects and therefore confidence is generally low for Council.

The outcome of the MCA process to date has highlighted that Council while Council is not yet able to confirm a preferred option, there were several options which scored consistently well across a range of criteria and weightings.

Appendix 1: MCA Briefing Material

PALMERSTON NORTH
NATURE CALLS

Wastewater BPO

Understanding the Assessment Criteria

5th November

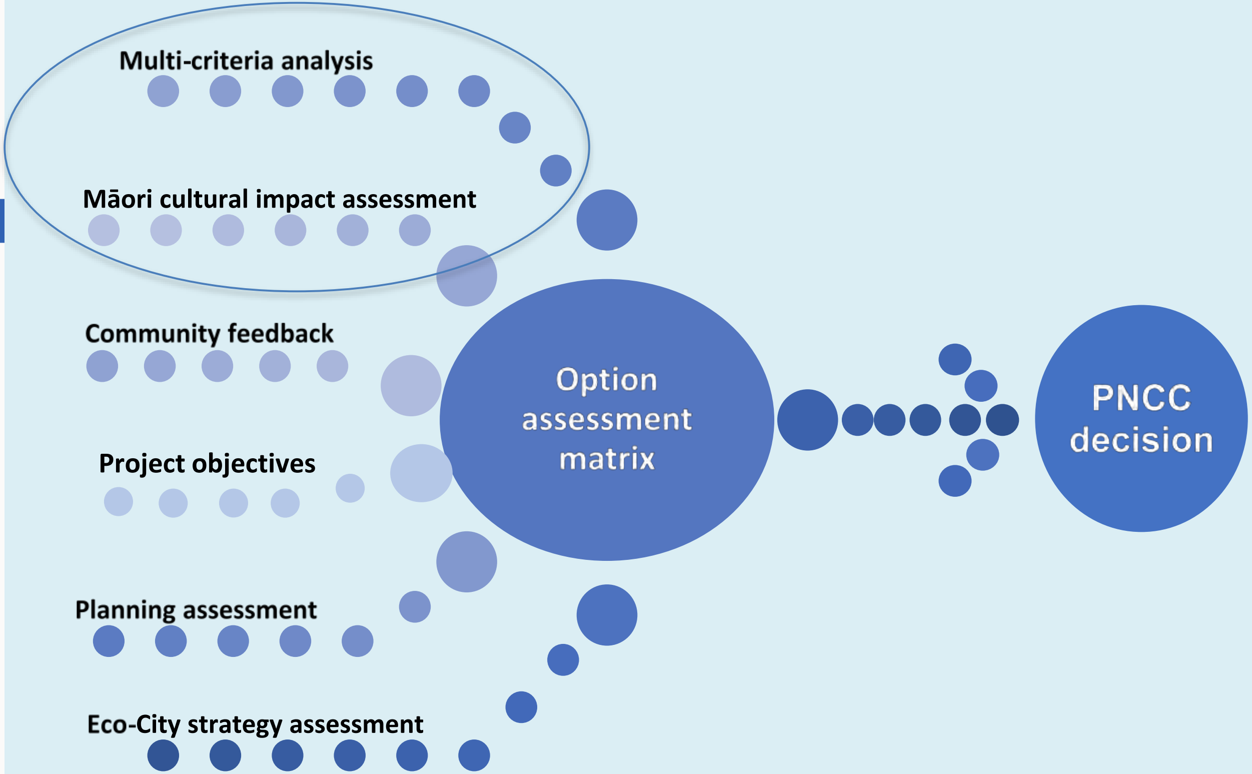
HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Welcome Councillors & Stakeholder Representatives

What to expect today:

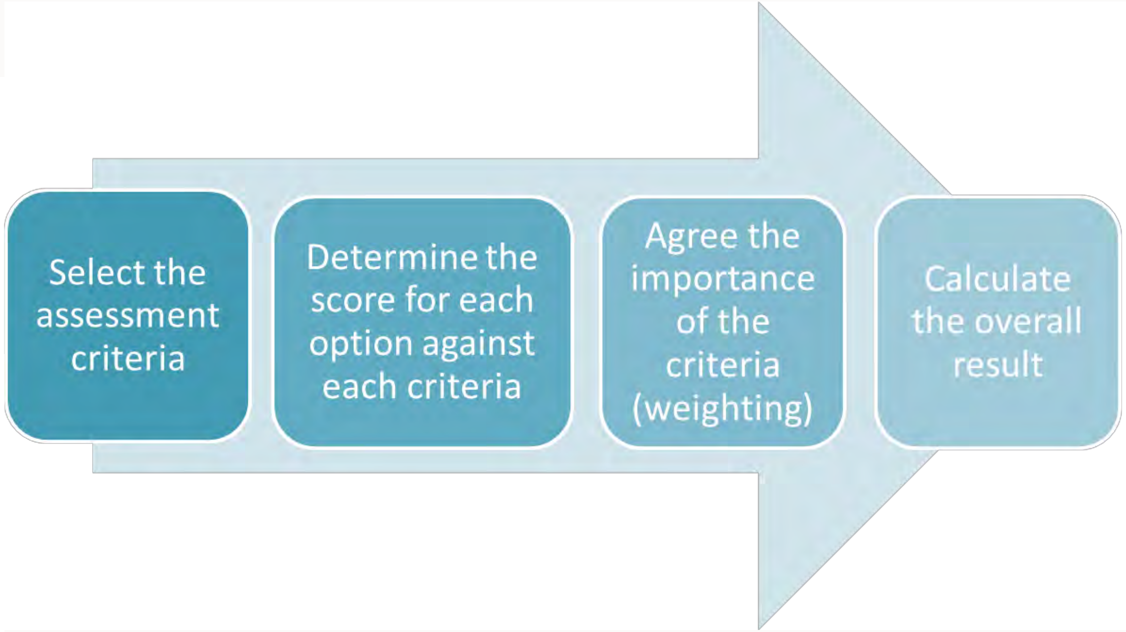
- Understand the Assessment Criteria in preparation for 9th - 10th Nov
- Workshop on 9th - 10th Nov
  - General flow of the day
  - Who is attending
- Questions and Answers

Overall Approach



Multi-Criteria Analysis (MCA)

- Systematic way of comparing options using a range of criteria
- For complex problems it provides a **relatively** simple way of comparing their merits
- MCA does have limitations that need to be kept in mind - inherent 'subjectivity' and unconscious bias of the participants – sensitivity testing
- Use a collaborative workshop process, involving partners and stakeholders



Select the assessment criteria

Determine the score for each option against each criteria

Agree the importance of the criteria (weighting)

Calculate the overall result

Public Health

What does this mean?

Degree of public exposure to health risks in treated wastewater (including through land application):

- qualitative assessment of public health risk based on critical exposure pathway
- potential degree of difficulty in controlling public health risk

Example of what it is...

- Pathogens (germs, viruses & bacteria)
- Water supply protection (nitrogen)
- Pathways through which people can be exposed
  - Recreation
  - Food gathering & consumptions
  - Drinking water
  - Spray drift

Example what it’s not ...

- Work safety
- Emerging contaminants
- Risks from beneficial re-use
- Risks from treatment plant failures or malfunction

Natural Environment

What does this mean?

Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology

Example it is...

Potential effects on nutrient loads, algae growth, macroinvertebrates and fish in the Manawatu River, small streams near irrigation areas and the coastal environment.

Potential effect on soil health and structure.

Example it's not ...

Effects on recreational bathing water quality, drinking water, cultural values, or economic costs.

Māori
Cultural Values

What does this mean?

Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga

Example of what it is...

- Assessment by Rangitāne o Manawatū
- Assesses options against key parameters of concern for Rangitāne:
  - Values: their mana, their taonga, mauri and wairua in their rohe
  - Landscapes
  - Atua domains
  - Acceptable to Rangitāne people

Example of what it's not …

- While the assessment had input from some neighbouring iwi, the report does not speak on their behalf
- Other iwi speak for themselves and may choose to provide separate feedback on options

Resilience

What does this mean?

Degree to which the option is resilient to natural hazards and climate change

Example it is…

- Natural hazard risks from:
    - earthquakes
    - land movement & erosion
    - flooding
    - storm surge/tsunami
- Climate Change / Adaption
    - High intensity rainfall
    - Prolonged wet weather
    - Prolonged dry periods
    - Increased period of low flows
    - Sea and groundwater level rise

Example it's not …

- Operation resilience
- Wild fire risk
- Climate change risk to crops on land application areas

Financial Implications

What does this mean?

Comparative capital, operational, whole of life costs of the options.

Example it is…

Objective assessment of the cost of the options, including:

- Treatment plant upgrades
- Conveyance pipes & pump stations
- Purchase of land application areas and irrigation infrastructure
- Wetland & land passage costs
- Operational & maintenance costs
- Land use & ETS income

Example it's not …

- Its not a subjective assessment of 'affordability'
- Its not an assessment of the financing opportunities for the different options
- Its not an assessment of the benefits and costs to the city or regional economy

Technology & Infrastructure

What does this mean?

Degree to which the option:

- can be staged
- is able to be constructed and operational within 5 years of the commencement of the consent
- allows for resource recovery / beneficial re-use
- infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme
- involves Operational Complexity
- involves Operational Risk

Example it is…

- Takes account of the need to acquire land in some options
- Otherwise focusses mainly on the complexity and flexibility of the infrastructural elements of each option

Example it's not …

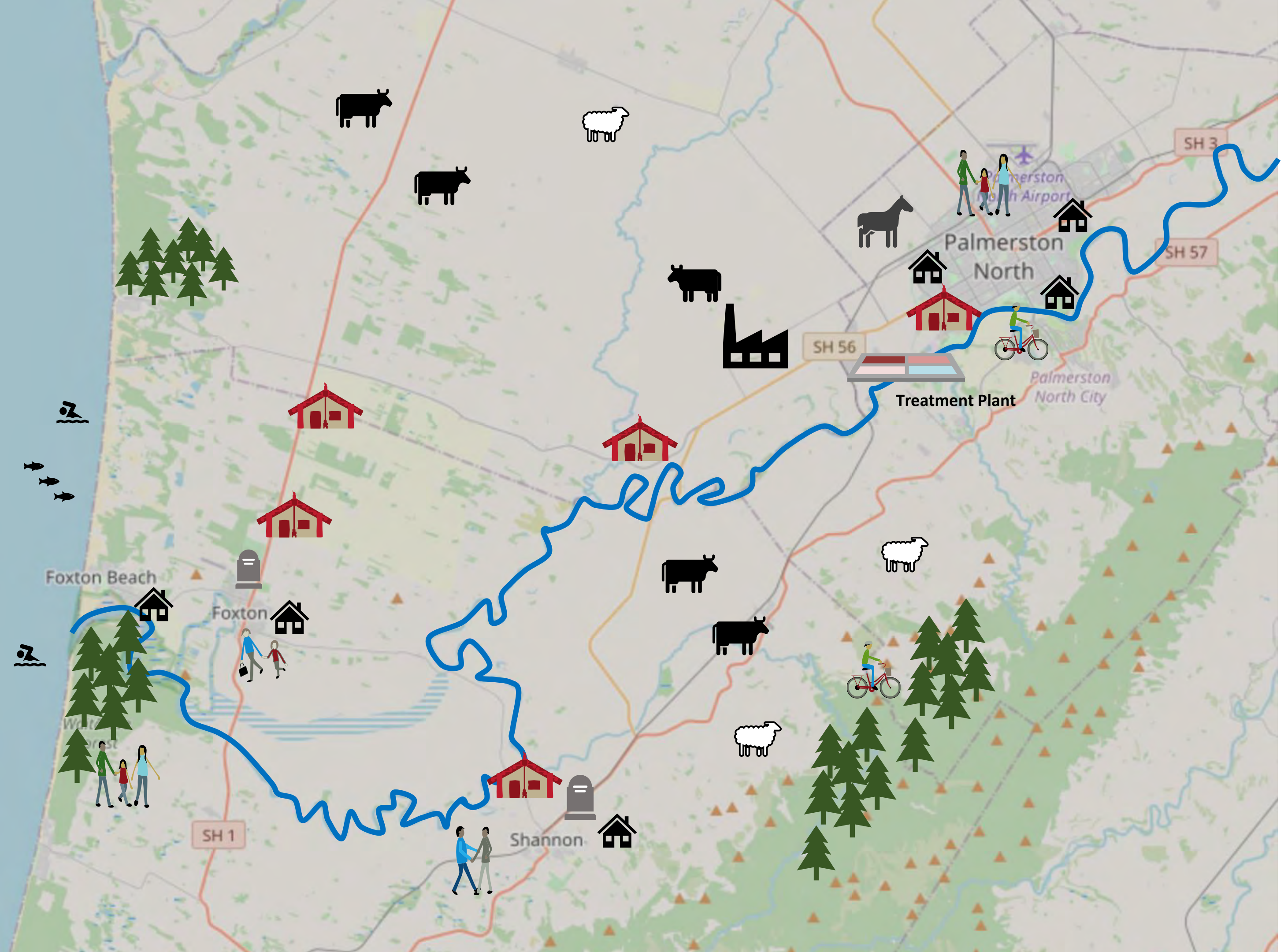
- Receiving environment limits on sub-regional schemes not considered under this criterion

Growth & Economic Development

What does this mean?	Example it is…	Example it's not …
Will the option support the population and economic growth anticipated for the City by Council?	The ability for an option to meet future growth demands and a sub-regional option	The effect of the option on economic losses due to public health effects.
	The effect an option has on the ability for the city and region to growth	The effect on property values
	The effect an option has on the Regions economy	

Social & Community Considerations

What does this mean?	Example it is...	Example it's not ...
Potential adverse effects on social and community values relating to amenity, recreation and food gathering	Effect of an option on people's quality of life and access to basic necessities of life ie education and livelihoods The effects on ecosystems that contribute to peoples well being Community support or dislike	The effect of a solution on individuals' property values Changes in occupation or land use



Public Health

Māori Cultural Values

Natural Environment

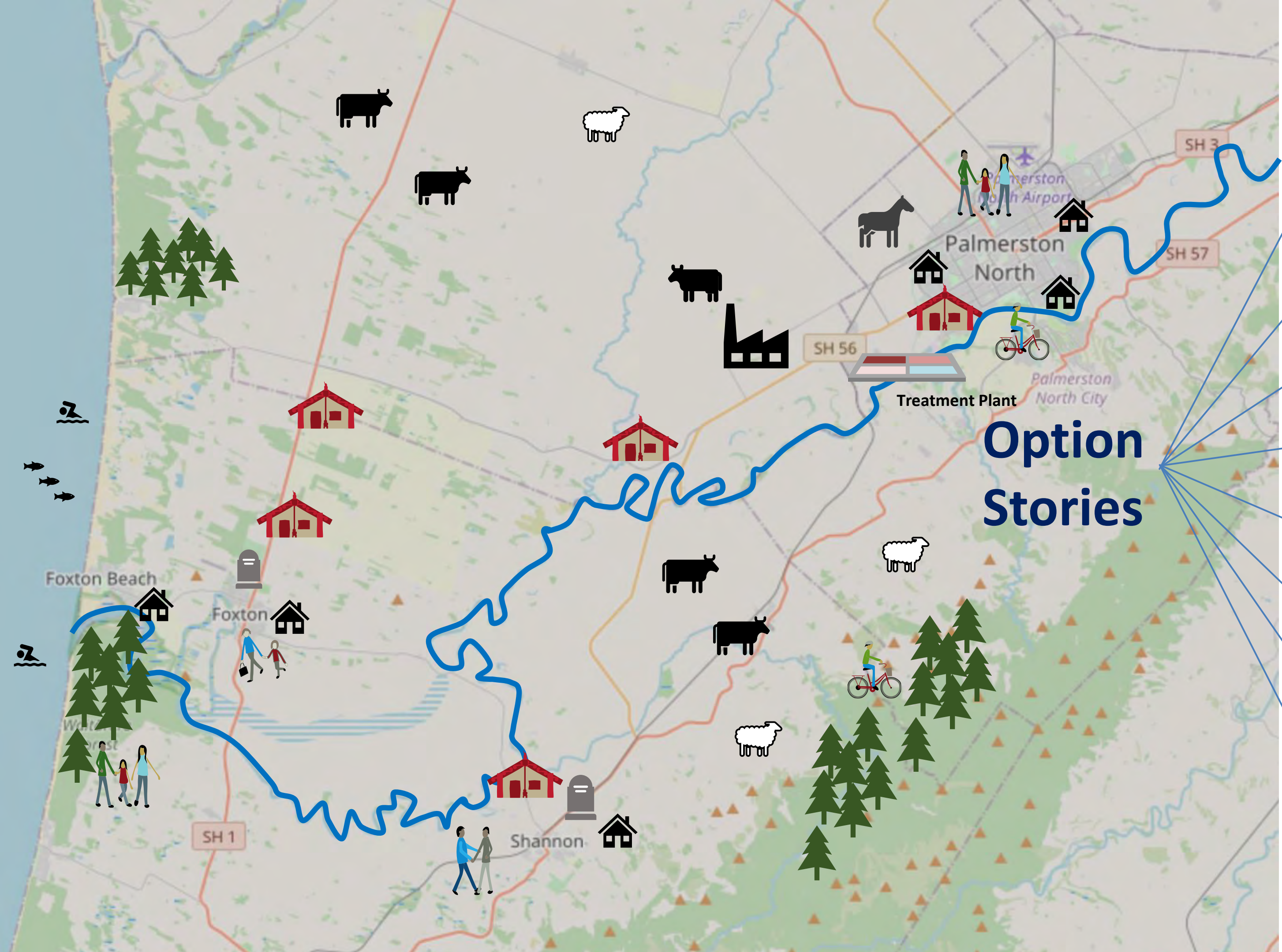
Resilience

Financial Implications

Technology & Infrastructure

Growth & Economic Development

Social & Community Considerations



Option Stories

- Public Health
- Māori Cultural Values
- Natural Environment
- Resilience
- Financial Implications
- Technology & Infrastructure
- Growth & Economic Development
- Social & Community Considerations

The MCA Workshop Nov 9/10 – What to expect

Qualitative conversation supported by a **quantitative** MCA assessment

Day 1 – Gain Insight and shared understanding

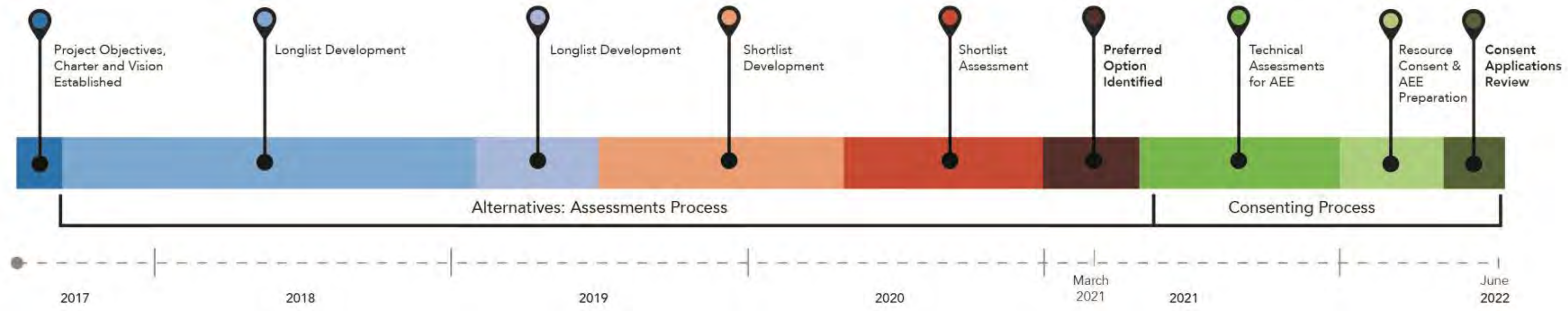
- Technical specialist- present how they went about scoring specific criteria & why (15 mins each criteria)
- Understanding the Options
  - Consolidated scores from specialist's
  - Discus to collectively understand/further group input
  - Build up an integrated story about each option - integrated specialist view
- Overall option score variation – scoring high/low
- Collectively agree weighting (if any, will apply overnight)
- Refresh MCA scores based on collective inputs/enhanced understanding (if any, will apply overnight)

Day 2 - Trade-offs between the options

- Weighting Sensitivity Testing
  - Weighted option scoring results
- Lock in the weighting(if any)
- Can we shortlist a preferred option(s)?
- Summary wrap up – option story
- Next steps - what further information do we need going forward

Timeline of Events

MILESTONES AND HIGH LEVEL PROJECT PROGRAMME NGĀ PAE TUTUKI ME TE HŌTAKA TIRO WHĀNUI



Appendix 2: MCA Comparative Assessments

Palmerston North City Council

Wastewater BPO Project - Summary Document of Comparative Assessments Criterion and Scoring

Introduction

This report sets out a summary of the comparative assessments and specialist scoring that have been prepared to inform the wastewater BPO Multi-Criteria Assessment workshop being held on the 9th and 10th of November 2020. Each Comparative Assessment Report sets out the assessment methodology used, assumptions applied and criterion scores as recommended by the specialists. Refer to each comparative assessment report for this detailed information. The Criteria includes the following:

- Public Health
- Natural Environment
- Māori Cultural Values
- Social and Community
- Resilience
- Growth and Economic Development
- Technology and Infrastructure
- Financial Implications

The following tables provide the consolidated output presented in each comparative assessment. Please refer to the comparative assessment for the detailed assessment information for each assessment.

Consolidated Criterion for Scoring

The methodology behind the scoring of each option against each criterion is outlined in the table below.

Criterion	Description	1	2	3	4	5
Public Health	Degree of health risk to the public as a result of exposure to treated wastewater (including through land application)	Extreme	High	Medium	Low	None
Natural environment	Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils and aquatic ecology.	Very High adverse effects. Major loss or alteration of baseline conditions (in absence of current discharge)	High adverse effect. Major alteration of baseline conditions (in absence of current discharge)	Moderate adverse effects Alteration to existing baseline conditions. Generally, effects are moderate but acceptable in the context of magnitude, spatial scale, duration and frequency.	Low adverse effects. Minor shift from baseline conditions or ecological populations (in absence of current discharge).	Very Low adverse effects. Very slight change in baseline conditions.
Māori Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga	Destruction of Rangitāne culture, connections and kaitiakitanga. Critical effect on Rangitāne o Manawatū	Significant effect or impact on all aspects of Rangitāne Mana, Toanga, Atua and natural resources	Major impact on all aspects of Rangitāne significant sites and natural resources	Minimal impact on Rangitāne significant sites and natural resources	Minimal to no effect on Rangitāne o Manawatū
Social and Community Considerations	Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option	Severe	Major	Moderate	Minor	Insignificant
Financial implications	Capital cost, operational and maintenance costs and whole-of-life cost (determined as the net present value (NPV) of the option)	Financial implication scores have been calculated using a formula explained in the report.				
Technology and infrastructure	Degree to which the option: • can be staged • is able to be constructed and operational within 5 years of the commencement of the consent • allows for resource recovery / beneficial re-use • infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme • involves Operational Complexity • involves Operational Risk	Low degree of alignment with sub-criteria and/or High Operational Complexity and Risk	Low – Medium degree of alignment with sub-criteria and/or Medium-High Operational Complexity and Risk	Medium degree of alignment with sub-criteria and/or Medium Operational Complexity and Risk	Medium – High degree of alignment with sub-criteria and/or Low-Medium Operational Complexity and Risk	High degree of alignment with sub-criteria and/or Low Operational Complexity and Risk
Resilience	Degree to which the option is resilient to • natural hazards • climate change	Low degree of resilience	Low – Medium degree of resilience	Medium degree of resilience	Medium – High degree of resilience	High degree of resilience
Growth & Economic Development	The degree to which the options will: • Support the population and economic growth anticipated for the City by Council? • Support / restrict further up-scaling to accommodate a sub-regional scheme?	Low degree of	Low – Medium degree	Medium degree	Medium – High degree	High degree

Consolidated Draft Scores

The following table shows the consolidation of the final draft scores provided by each of the technical experts.

Options	Option Description	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development
1: R2(b)	River discharge with enhanced treatment	4	3	1	2	2.8	4	4	2
	River discharge with enhanced treatment, and a small % to land	2.5	3.5	1	1	2.1	4	3	2.5
2: Dual R + L	Two river discharge points and a small % to land	4	4	1	1	2.7	3	3.5	2.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	3.5	4	1	2.4	3	3	2
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	4	4	3	1	1.1	3	3	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	1	3.0	3	3.5	3
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	1	2.8	3	3.5	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.5	3	2.5	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.2	3	2.5	2
6: Ocean	Ocean discharge, with a small % to land	2.5	4.5	1	1	1.9	2.5	3	4
	Ocean discharge	5	4	1	2	2.4	2.5	3.5	4

1 Financial Implications Comparative Assessment of Short-listed options

1.1 Introduction

This report sets out the Financial Implications comparative assessment of the short-listed options for the Palmerston North Wastewater Best Practicable Option (BPO) project ("Nature Calls"). This report is an assessment of the relative cost to construct and run the options, it does not consider wider economic effects, nor does it include a subjective consideration of affordability. This report focuses on the development of draft scores for the multi-criteria assessment (MCA) of shortlisted options.

The report was prepared by:

Overall assessment of options
- Michelle Chew – Stantec Civil Engineering Technologist
- Anna Bridgman – Stantec Group Manager/Senior Civil Engineer
- Jim Bradley – Stantec Technical Specialist

Assessment of treatment
- Andrew Slaney – Stantec Senior Process Engineer
- Michael Tan – Stantec Process Engineer

Assessment of land application
- Aslan Perwick - PDP Groundwater Services Leader

Please note the costs outlined in this Comparative Assessment report are indicative, comparative costs only, and should not be used for budgeting purposes.

1.2 Criterion and scoring approach

Financial criteria scores have been derived from the estimated costs (capital, operational and maintenance (O&M) and Net Present Value (NPV) costs) of each option. This was done using the following approach. It should be noted renewals are treated as operational and maintenance costs.

1. Assign weighting to each of the three sub-criteria (capital, O&M and Net Present Value (NPV) costs).
2. Identify the options with the highest cost estimate for each of the three sub-criteria and give these options a score of 1

3. Calculate the three sub-criteria scores for all options using this formula:
   Sub-criteria score for Option X = ((1 – (cost of option X / highest cost)) x 4) + 1
4. Calculate an overall score by multiplying the sub-criteria score for each option with the weighting of each sub-criteria and summing the total
5. From the overall score determine the MCA score

The formula creates a ratio for each sub-criteria between the option cost estimates and the highest cost. It then inverts this ratio by subtracting it from 1. This is done to ensure that an option with a high cost for any sub-criteria is awarded a low score. The formula then converts the ratio into a score between 1 and 5 by multiplying it by 4 and adding 1 (the score already awarded to the option with the highest cost). Finally, an overall score rounded to 1 decimal place is assigned to each option based on the weighting of each sub-criteria.

The three sub-criteria were used for the following reasons:

a) Capital – this allows a comparison of the up-front costs required to get a new scheme operational
b) Operational & Maintenance – this allows a comparison of the annual running costs of each option
c) NPV – this gives an indication of how the whole of life costs (over the 35-year consent sought period) compare to each other

For this draft assessment, the highest weighting has been assigned to the capital cost sub-criteria (37% of the total cost score), 30% for the operating cost sub-criteria and 33% for the NPV sub-criteria (10, 8 and 9 out of a total of 27 respectively). It has been assumed that the initial capital investment needed to implement the selected scheme will have a significant impact on the ratepayers of Palmerston North, and therefore this has been given the highest weighting. Whilst the operational and maintenance costs will be an increase on the existing, the difference between the options of the effect on ratepayers is expected to be less and therefore it has been given the lowest weighting. These weightings will be confirmed as part of the Multi-Criteria Assessment workshop.

1.3 Assumptions and Comparative Cost Estimating Information applied in the assessment

1.3.1 General

- Proposed capital costs all on Day One (2025). Possible deferrals[1] for options R2(b), L+R(b), L+R(e) and O+L are covered in Table 6.
- 35-year NPV assessment. This is based on the duration of the consent sought.

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[1] Deferrals consist of staging of specific treatment and land components applicable for certain options resulting in possible initial cost savings.

- 6% discount rate has been used through for the option development in the longlist and shortlist phases. It is noted Treasury now recommends a 5% discount rate for infrastructure projects https://www.treasury.govt.nz/information-and-services/state-sector-leadership/guidance/financial-reporting-policies-and-guidance/discount-rates. Changing the discount rate to 4% and 8% increased or decreased the NPV between 3 - 10% higher and 2 - 7% lower respectively for the options, with the greatest change for the River with enhanced treatment options. The level of change was dependent on operational and maintenance costs and the return received from crops/forestry for the option.
- Comparative estimated costing information has been completed under the following categories – capital, O&M and NPV.

1.3.2 Capital

The following are all as set out in Work Package 15.7 which sets out the comparative costs for each option.

1.3.2.1 Conveyance

- The method of bulk conveyance for all short list options comprises pump stations and pressure mains, with a long (approx. 2km) sea outfall for the ocean options. Where discharge is to the existing Tōtara Road river outfall, no conveyance cost has been included in the assessment, or any modifications to the existing outfall.
- Pipe alignments are within road corridors and are buried.
- Pipe reinstatement – 50% road and 50% verge.
- Distances to the land application sites are taken as to the centroid of potential sites, with the co-ordinate provided by PDP.
- No major river crossings are allowed for.
- A single pipeline is required.
- HDPE pipe material for diameters up to DN1200 - PE100 SDR13.6 PN12.5.
- GRP pipe material for diameters larger than DN1200 - GRP SN10,000.
- Minimum cover of 900mm and maximum depth to invert of 3m.
- Geotechnical conditions are assumed good (no running sands or rafting required), with minimal groundwater encountered.
- The 'Cost Data for Project Care Strategic Review' (2017) has been used for calculating pump station rates:
  - Pump Station Civil, Structural and Mechanical Formula is $y = 2410.7x + 2{,}000{,}000$ where x = PS flowrate (l/s)
  - Pump Station Electrical Formula is $y = 815.62x + 212666$, where x = PS power rating (kW)
- Pump stations are assumed to be submersible wet well type[2].
- Odour treatment has been excluded from the PS rates.
- The 'Cost Data for Project Care Strategic Review' (2017) has been used for calculating pipeline rates. The formula is $y = 2.2706x+336.58$, where x = pipe diameter. These rates have then been compared to actual data from previous Stantec designed projects and the rate averaged across the data set.

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[2] There may be potential for consideration of "inline" pumping as design is progressed.

- Pipe cost rates include all fittings, air valves, scour valves, hydrants etc.
- Rates have been inflated to 2019 rates in accordance with Reserve Bank of NZ CPI.
- Pipe diameters have been selected based on velocity between 1-1.5 m/s and total head per pump station < 60m. Pump stations spaced to achieve < 60m head.
- The topography is generally flat and falling overall to the ocean.
- Static head for pressure pipelines of 5m.
- Colebrook White roughness coefficient, Ks = 0.6mm.
- Fittings loss coefficient per pipeline, K= 6.5.
- Land is available free supply where required and therefore land purchase costs have not been included.
- Surge mitigation is accommodated by allowance within the pressure class of pipeline and including of air valves in pipe rates.
- Sediment and slime control by velocity management and therefore no allowance has been made for pigging installations.
- Pumps operate at 70% efficiency.
- Power costs have been calculated based on the projected operating hours for the pump stations.
- Power supply capital costs for cabling and associated infrastructure $200,000/km = $200/m.
- Power supply is from Bunnythorpe, due north of Palmerston North, at an approximate distance of 10 km.

1.3.2.2 Treatment

A full list of assumption made in the option development can be found in WP15.2 Shortlist Treatment Assessment Report. The following is a list of key assumptions:

- The existing Totara Road site is suitable for construction of upgrades to the WWTP process. This requires that:
- For the activated sludge options (R2(b), L+R(b)) the Bardenpho bioreactor would need to be constructed where the current sludge lagoons are located. This requires the sludge lagoons be desludged and appropriate works carried out to allow construction – costs associated with this have not been included.
- It is assumed that the existing inlet works will be re-used and new inlet works are not required, some modifications will be required to pass flows up to 2,200 L/s.
- New fine screens for the MBR upgrade will be located at the MBR, not in the inlet works.
- Industrial inputs from NZP can be redirected back to the inlet works without impact or issues with hydrogen sulphide release.
- For the activated sludge processes an interstage pump station will be required following the PSTs.
- Further hydraulic analysis of flows through the process have not been considered at this assessment stage.
- No costs associated with seismic strengthening of any of the existing structures are included.
- Existing PSTs (with supplementation) and digesters can continue to be used throughout the project life.
- Site power supply is assumed to be a nominal cost on a comparative basis.
- Instrumentation and control costs based on process requirements have been included.
- New UV Unit will be required for all options.

1.3.2.3 Land Application

The following general assumptions have been made:

- Management of odour is not expected for biologically treated wastewater. Any objectionable odour can be managed by flushing irrigation lines after use with fresh water.
- Aerosol migration beyond the boundary can be managed with buffer zones. Management practices such as increased buffers downwind of the dominant wind direction or postponing irrigation of boundary paddocks during high winds could be used.
- Land irrigation of wastewaters elevated in sodium can result in dispersal of clay particles, which can reduce soil infiltration rates. This is typically managed with applications of gypsum or lime.
- Heavy metals and other pollutants can accumulate in topsoil, triggering guideline values for contaminated land. This is unlikely for biologically treated wastewater.
- Key Receiving environments for Floodplain Based Options: Primary = shallow groundwater system. Secondary = Manawatu River and nearby tributaries/drains. Potential water quality effects of are expected to be manageable for all options, but require further confirmation.
- Key Receiving environments for Coastal Forestry Options: Primary = shallow groundwater system. Secondary = foreshore seepage zone (seaward) and nearby tributaries/drains/lakes (landward). Potential water quality effects of are expected to be manageable for all options, but require further confirmation.
- Depending on placement, potential for some third-party water takes/users to be affected (beyond the assumed 30% buffer zones), but mitigation options available e.g. deepen borehole
- Land cost assumes purchase of full land area required (including buffer allowance).
- Inland locations L+R(a), L+R(d), and Dual R+L: land costed at $50,000 /ha. This is based on Feb 2019 land value estimates for Shannon-Opiki and Moutoa Floodplain. Estimates obtained from four local valuers/rural agents.
- Coastal Locations L+R(b), L+R(e), O+L (Loc 2): land costed at $10,000 /ha due to reduced level of forestry at this location (does not include an allowance for forestry value). Actual valuations of forestry are required to provide more accurate Forestry costs. Potential ETS liabilities are forest dependent and have not been included.
- Nitrogen leaching assessment for pastoral sites assumes a yield of 10,000 kg DM/ha/yr with no additional nitrogen fertiliser applications
- Nitrogen leaching assessments for forestry sites assume harvesting and replanting every 25 years (i.e. typical commercial forestry operation), 100 kg N/ha/yr uptake September to April, no uptake May to August.
- Nitrogen leaching assessments for forestry sites assume 20 kg N/ha/yr is an acceptable level of leach due to limited foreseen environmental effect.
- Assessment of phosphorus and heavy metal concentrations in treated wastewater suitable for rapid infiltration are excluded.
- Nitrogen concentrations and leaching assessments relate to the land application scheme only, and rapid infiltration is excluded (as not considered applicable to land application, rather is a direct discharge).

- Land purchase costs are not based on the purchase of full parcels. There is potential slightly larger area may need to be purchased to fit the required land area onto existing parcels.
- Main receiving environment for the Rapid Infiltration Basin Systems (RIBS) area is the shallow groundwater system and Manawatū River. Potential water quality effects are expected to be manageable.
- Unlikely to be many third-party groundwater users effected by RIBs, given the assumption that PNCC have purchased the land.
- Management of RIB groundwater mounding is a key component that requires further investigation and assessment to properly quantify.
- No present allowance for potential archaeological aspects
- Assumed works could be completed without reducing the existing flood mitigation ability.
- Return on forestry products as per PDP land usage report A031092070R001.
- Where relevant - Land cost assumes purchased land area for RIBS and storage facility, and includes identified buffer zone (in all directions).
- Where relevant - Land costed at $50,000 /ha. This is based on Feb 2019 land value estimates for Tiakiahuna - Longburn. Estimates obtained from 4 local valuers/rural agents.

The following is a list of options, key assumptions and comments applicable to each option:

Table 1-1 Land application key assumptions and comments

Option	Variant	Land Application Scheme & Key Infrastructure	Land Area	Key Assumptions / Option Comments / Notes
1: R2(b)	River discharge with enhanced treatment	-	-	-
	River discharge with enhanced treatment, and a small % to land	• Irrigation to land when the flow in the Manawatū River is below 37.5 m^3/s, 75% ADWF (22,500 m^3/d) to land. All other treated wastewater flows will be discharged to the River. • A significant proportion of the scheme is located in a flood area so the irrigation will all be via k-line irrigators (50%) and centre pivot (50%). • 40,000 m^3 active volume onsite storage facility (lined), lagoon area 1 ha, 4m operational depth + 1m freeboard.	Active Irrigation Area = 470 ha Total Area (Inclusive of 30% Buffer) = 670 ha	• Commercial cut and carry pastoral scheme, with average annual return on product of $2,000/ha/yr (as per PDP land usage report).

Option	Variant	Land Application Scheme & Key Infrastructure	Land Area	Key Assumptions / Option Comments / Notes
2: Dual R+L	Two river discharge points and a small % to land	• Irrigation to land when the flow in the Manawatū River is below 37.5 m3/s, 100% of AWDF (30,000 m^3/d). All other treated wastewater flows will be discharged to the River.	Active Irrigation Area = 680 ha Total Area (Inclusive of 30% Buffer) = 970 ha	• Irrigation to land when the flow in the Manawatū River is below 37.5 m^3/s, 100% of AWDF (30,000 m^3/d). All other treated wastewater flows will be discharged to the River.
3: L + R (a)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	• Irrigation to land on days when the River flow is below the 97th percentile or other exceptional circumstances, on all other days the treated wastewater will be discharged to the River. • Centre pivot irrigators (80% of area) with solid set irrigators in between (20% of area). • 160,000 m^3 active volume onsite storage facility (lined), lagoon area 4 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with a capacity of 60,000 m^3/day, with an average usage in the range of 10-20 days per year.	Active Irrigation Area = 2,250 ha Total Area (Inclusive of 30% Buffer) = 3,215 ha	• Commercial cut and carry pastoral scheme, with average annual return on product of $2,000/ha/yr (as per PDP land usage report).
3: L + R (b)	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	• Irrigation to land on days when the Manawatū River flow is below the 97th percentile or other exceptional circumstances, on all other days the treated wastewater will be discharged to the River. • Solid set irrigation. • 160,000 m^3 active volume onsite storage facility (lined), lagoon area 4 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with a capacity of 50,000 m^3/day with an average usage in the range of 10 days per year.	Active Irrigation Area = 1,550 ha Total Area (Inclusive of 30% Buffer) = 2,260 ha	• Commercial forestry scheme harvested in Y26-30. • Emissions trading scheme income would be returned at Y18 ($500/ha/yr), has been included in income for Y26-30.

Option	Variant	Land Application Scheme & Key Infrastructure	Land Area	Key Assumptions / Option Comments / Notes
4: L+R (d)	45 % applied to an inland land application site and a river discharge for the remainder of the time	• Irrigation to land on days when the flow in the Manawatū River is below 80 m^3/s, except when the wastewater flow is above the 97th percentile or other exceptional circumstances. On all other days the treated wastewater will be discharged to the River. • Centre pivot irrigators (80% of area) with solid set irrigators in between (20% of area). • 60,000 m^3 active volume onsite storage facility (lined), lagoon area 1.5 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with capacity of 15,000 m^3/day, with an average usage of 2 days per year.	Active Irrigation Area = 1,220 ha Total Area (Inclusive of 30% Buffer) = 1,740 ha	• Commercial cut and carry pastoral scheme, with average annual return on product of $2,000/ha/yr (as per PDP land usage report).
	55 % applied to an inland land application site and a river discharge for the remainder of the time	• Irrigation to land on days when the flow in the Manawatū River is below 62.2 m^3/s, except when the wastewater flow is above the 97th percentile or other exceptional circumstances. On all other days the treated wastewater will be discharged to the River. • Centre pivot irrigators (80% of area) with solid set irrigators in between (20% of area). • 45,000 m^3 active volume onsite storage facility (lined), lagoon area 1.5 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with capacity of 15,000 m^3/day, with an average usage of 2 days per year.	Active Irrigation Area = 1,000 ha Total Area (Inclusive of 30% Buffer) = 1,430 ha	• Commercial cut and carry pastoral scheme, with average annual return on product of $2,000/ha/yr (as per PDP land usage report).

Option	Variant	Land Application Scheme & Key Infrastructure	Land Area	Key Assumptions / Option Comments / Notes
4: L+R (e)	45 % applied to a coastal land application site and a river discharge for the remainder of the time	• Irrigation to land on days when the flow in the Manawatū River is below 80 m^3/s, except when the wastewater flow is above the 97th percentile or other exceptional circumstances. On all other days the treated wastewater will be discharged to the River. • Solid set irrigation. • 60,000 m^3 active volume onsite storage facility (lined), lagoon area 1.5 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with capacity of 15,000 m^3/day, with an average usage of 1 day per year.	Active Irrigation Area = 2,180 ha Total Area (Inclusive of 30% Buffer) = 3,110 ha	• Commercial forestry scheme harvested in Y26-30. • Emissions trading scheme income would be returned at Y18 ($500/ha/yr), has been included in income for Y26-30.
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	• Irrigation to land on days when the flow in the Manawatū River is below 62.2 m^3/s, except when the wastewater flow is above the 97th percentile or other exceptional circumstances. On all other days the treated wastewater will be discharged to the River. • Solid set irrigation. • 50,000 m^3 active volume onsite storage facility (lined), lagoon area 1.5 ha, 4m operational depth + 1m freeboard. • Rapid Infiltration with capacity of 15,000 m^3/day, with an average usage of 1 day per year.	Active Irrigation Area = 1,800 ha Total Area (Inclusive of 30% Buffer) = 2,570 ha	• Commercial forestry scheme harvested in Y26-30. • Emissions trading scheme income would be returned at Y18 ($500/ha/yr), has been included in income for Y26-30.
6: Ocean	Ocean discharge, with a small % to land	• Irrigation to land for an average of 50% of the year (nominally Nov to Apr), of 15,000 m^3/d (50% ADWF) except when the wastewater flow is above the 97th percentile or other exceptional circumstances. All other treated wastewater flows will be discharged to the River. • Solid set irrigation. • 10,000 m^3 active volume onsite storage facility (lined), lagoon area 0.5 ha, 3m operational depth + 0.5m freeboard.	Active Irrigation Area = 860 ha Total Area (Inclusive of 30% Buffer) = 1,230 ha	• Commercial forestry scheme harvested in Y26-30. • Emissions trading scheme income would be returned at Y18 ($500/ha/yr), has been included in income for Y26-30.
	Ocean discharge	-	-	-

1.3.3 Operations and Maintenance

1.3.3.1 General

- All costs are over a 35-year period as this is the duration of the consent expected to be sought.
- Population growth is based on and extrapolated from the “Hybrid population project for Palmerston North (September 2017)”.
- Population growth from 2048 onwards is assumed to be a 0.3% growth annually.
- Year 1 for O&M starts from 2026 and ends in 2060.

1.3.3.2 Conveyance

- Annual maintenance cost is 1.5% of capital cost.
- Operator labour cost is assumed to be minimal, remain the same throughout the 35-year period and is not treatment level specific.

1.3.3.3 Treatment

The following general assumptions have been made:

- Lift pumps, interstage pumps, a recycle, blowers, carbon dosing, alum dosing, UV power and sludge costs are affected by population growth.
- Annual maintenance cost is 1.5% of capital cost.
- Operator labour cost is assumed to be the same as the current operational cost of treatment plant.
- Power cost is assumed to be $0.13kWh.
- Power for lift pump operation is based on 100kW pumps running 50% of time based on current lift pump upgrade operation.
- Power for inlet screens is 1kW running 75% of the time based on Boneo operation costs.
- Power for primary tanks is 3kW running 40% of the time.
- Power for interstage pump station is based on 100kW pumps running 50% of the time based on current lift pump upgrade operation.
- Power for clarifier return activated sludge (RAS) pumps is 16kW running 100% of the time.
- Power for UV disinfection is 46kW running 100% of the time.
- Cost for bulbs and ballast are assumed to be $40,000 per annum.
- Cost for sludge disposal is assumed to be between $66,000 to $180,000 per annum depending on the option.

1.3.3.4 Land application

- Land application operations is assumed to not be affected by population growth
- Land application income for coastal forestry sites reflects when trees are harvested and is estimated per ha revenue with timber harvested after 25 years of growth and harvest revenue is spread across 5 years from Years 26 – 30 following the establishment of the scheme.
- Land application income for inland cut and carry sites is assumed to happen annually.

- Emissions trading scheme (ETS) income should be received at Year 18. However, for the cost estimates prepared for the WP15.7 BPO Option Summary Report_Oct 2020_Issue (October 2020), this income was included in the revenue from Years 26-30. As it made little difference to the Net Present Value, and no difference to the scoring, the numbers have been left as per prepared for the October 2020 Summary report

The following is a list of options, key assumptions and comments applicable to each option:

Table 1-2 WWTP Operations and Maintenance key assumptions and comments

Option	Variant	Key Assumptions
1: R2(b)	Without land application With land application	• Power for A Recycle is assumed to be 43kW pumps running 100% of the time. • Power for WAS pumps are 14kW running 13% of the time. • Membrane replacement is assumed to be $\$570,000$ per annum. • Membrane power is assumed to be 60kW running 58% of the time. • Membrane cleaning chemical is assumed to be $\$1,150,000$ per annum. • Carbon dosing chemical is assumed to be 200m^3/year at $\$319$ per m^3 • Alum dosing is assumed to be $\$1,747$ per m^3 of alum
2: Dual R+L		• Alum dosing is assumed to be $\$1,747$ per m^3 of alum • Power for A Recycle is assumed to be 29kW pumps running 100% of the time. • WAS Pumps are assumed to be 5kW running 13% of the time.
3: L + R (a)	Inland land application site	• Pond aeration power is 300kW running 100% of the time
3: L + R (b)	Coastal land application site	• Alum dosing is assumed to be $\$1,747$ per m^3 of alum • Power for A Recycle is assumed to be 29kW pumps running 100% of the time. • WAS Pumps are assumed to be 5kW running 13% of the time.
4: L+R (d)	Inland land application site, with less land application Inland land application site, with more land application	• Alum dosing is assumed to be $\$1,747$ per m^3 of alum • Pond aeration power is 300kW running 100% of the time

Option	Variant	Key Assumptions
4: L+R (e)	Coastal land application site, with less land application	• Alum dosing is assumed to be \$1,747 per m^3 of alum • Pond aeration power is 300kW running 100% of the time
	Coastal land application site, with more land application	
6: Ocean	With land application	• Pond aeration power is 300kW running 100% of the time
	Without land application	-

1.3.4 Renewals

Renewals have been included in the operations and maintenance costs. Renewals included are outlined below

1.3.4.1 General

- Renewal peaks have been spread out by averaging the significant renewal costs in Years 10, 15, 20, 25 and 30 by three (one year before and one year after expected renewal)
- For Dual R+L, renewal peaks for wetland bed replacement have been spread out by averaging the renewal costs every three years (one year before and one year after expected renewal)
- Renewals estimate excludes P&G, contingency and professional services
- Land application infrastructure renewals assumed at Year 15, 20 and 30

1.3.4.2 Conveyance

- Renewals every 20 years for electrical and conveyance pumps
- Renewal cost of pumps is assumed to be 50% of the total civil capital cost of the pump station
- Renewal for the electrical component assumes a like for like replacement
- Assume that with regular maintenance, no components of the dissipator and outfall will be required to be renewed

1.3.4.3 Treatment

- Yearly renewals for membranes and pond aeration
- Renewal every 7 years for diffusers
- Renewals every 20 years for a recycle and clarifiers

- Renewals every 25 years for lift pumps, screens, grit removal, primary tanks, interstage pumps and blowers
- Assumed that only the vertical flow wetland requires renewals with all other wetlands only requiring operation and maintenance

1.4 Capital, Operational and Maintenance and NPV Indicative Comparative Costs

Tables 1-3 to 1-4 set out the capital, O&M and NPV indicative comparative costs for each option. O&M costs in Table 4 are listed as Year 1 for clarity only, the O&M costs for each option will change annually due, e.g. due to growth, renewals required, wetland replanting required etc.

Table 1-3 Overall Indicative Comparative Costs

Option	Variant	Capital (Total, $M)	Operational & Maintenance (Y1, $M)[3]	NPV ($M)
1: R2(b)	River discharge with enhanced treatment	$193	$7	$292
	River discharge with enhanced treatment, and a small % to land	$290	$8	$399
2: Dual R+L	Two river discharge points and a small % to land	$272	$4	$364
3: L + R (a)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	$399	$3	$394
3: L + R (b)	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	$502	$7	$602
4: L+R (d)	45 % applied to an inland land application site and a river discharge for the remainder of the time	$230	$5	$289
	55 % applied to an inland land application site and a river discharge for the remainder of the time	$256	$5	$312
4: L+R (e)	45 % applied to a coastal land application site and a river discharge for the remainder of the time	$360	$3	$411
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	$388	$4	$454

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[3] This does not include income from land application schemes and is the estimate for Y1 of operation

Option	Variant	Capital (Total, $M)	Operational & Maintenance (Y1, $M)[3]	NPV ($M)
6: Ocean	Ocean discharge, with a small % to land	$408	$5	$487
	Ocean discharge	$343	$5	$415

Table 1-4 Indicative Comparative Operational and Maintenance Costs (including Renewals)

Option	Variant	Year 1 ($M)	Average per annum across 35 years ($M)	Total ($M)	NPV ($M)
1: R2(b)	River discharge with enhanced treatment	$7	$7	$239	$98
	River discharge with enhanced treatment, and a small % to land	$7	$8	$269	$110
2: Dual R+L	Two river discharge points and a small % to land	$5	$6	$225	$92
3: L + R (a)	97 % applied to an inland land application site, and a discharge to river in exceptional circumstances	-$1[4]	-$0.1[4]	-$4[4]	-$5[4]
3: L + R (b)	97 % applied to a coastal land application site, and a discharge to river in exceptional circumstances	$7	$6	$220	$100
4: L+R (d)	45 % applied to an inland land application site, and a river discharge for the remainder of the time	$4	$4	$147	$59
	55 % applied to an inland land application site, and a river discharge for the remainder of the time	$3	$4	$139	$56
4: L+R (e)	45 % applied to a coastal land application site, and a river discharge for the remainder of the time	$3	$3	$96	$51

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[4] Option 3: L+R (a) returns negative overall operational and maintenance costs as a result of the high land income.

Option	Variant	Year 1 ($M)	Average per annum across 35 years ($M)	Total ($M)	NPV ($M)
	55 % applied to a coastal land application site, and a river discharge for the remainder of the time	$4	$4	$124	$65
6: Ocean	Ocean discharge, with a small % to land	$5	$5	$180	$79
	Ocean discharge	$5	$5	$177	$72

Table 1-5 sets out the possible deferrals and associated cost savings for each option with the exception of the Ocean only option which does not have components that can be deferred. For the land application schemes this does not include deferment of land purchase costs, only the land application infrastructure. It should also be noted the land application schemes have been designed for a 50-year life, and there is deferment of some costs until Year 40 (past the life of the expected sought consent).

Table 1-5 Possible deferrals and associated savings

Option	Variant	Component	**Initial ($M)**	Year 10 ($M)	Year 20 ($M)	Year 30 ($M)	Year 40 ($M)	Deferred saving ($M)
1: R2(b)	River discharge with enhanced treatment	MBR AS Process (Bioreactor and membrane)	$52	-	-	$12	-	$4.5
	River discharge with enhanced treatment, and a small % to land	MBR AS Process (Bioreactor and membrane)	$52	-	-	$12	-	$4.5
		Land application infrastructure	$43	$1	$1	$1	$1	$2

Option	Variant	Component	**Initial ($M)**	Year 10 ($M)	Year 20 ($M)	Year 30 ($M)	Year 40 ($M)	Deferred saving ($M)
2: Dual R+L	Two river discharge points and a small % to land	Chemical clarifier	-	$2	-	-		$1.4
		Land application infrastructure	$48	$1	$1	$1	$1	$1
3: L + R (a)	97 % applied to an inland land application site, and a discharge to river in exceptional circumstances	Land application infrastructure	$208	$3.5	$3.5	$3.5	$3.5	$10
3: L + R (b)	97 % applied to a coastal land application site, and a discharge to river in exceptional circumstances	Conventional AS Process (Bioreactor and clarifier)	$38	-	-	$10	-	$6
		Land application infrastructure	$71	$3.5	$3.5	$3.5	$3.5	$2.5
4: L+R (d)	45 % applied to an inland land application site, and a river discharge for the remainder of the time	Chemical clarifier	-	$2	-	-	-	$1.3
		Land application infrastructure	$92	$1.5	$1.5	$1.5	$1.5	$1.5
	55 % applied to an inland land application site, and a river discharge for the remainder of the time	Chemical clarifier	-	$2	-	-	-	$1.4
		Land application infrastructure	$111	$2	$2	$2	$2	$2
4: L+R (e)	45 % applied to a coastal land application site, and a river discharge for the remainder of the time	Conventional AS Process (Bioreactor and clarifier)	$38	-	-	$10	-	$6
		Land application infrastructure	$74	$4	$4	$4	$4	$5
	55 % applied to a coastal land application site, and a river discharge for the remainder of the time	Conventional AS Process (Bioreactor and clarifier)	$38	-	-	$10	-	$6
		Land application infrastructure	$90	$4.8	$4.8	$4.8	$4.8	$4.6

Option	Variant	Component	**Initial ($M)**	Year 10 ($M)	Year 20 ($M)	Year 30 ($M)	Year 40 ($M)	Deferred saving ($M)
6: Ocean	Ocean discharge, with a small % to land	Conventional AS Process (Bioreactor and clarifier)	$38	-	-	$10	-	$6
		Land application infrastructure	$35	$1.8	$1.8	$1.8	$1.8	$1.6
	Ocean discharge	-	-	-	-	-	-	-

1.5 Assessment table

Table 1-6 sets out the preliminary assessment of the options by the authors using the approach detailed in Section 1.2, with weightings of 10, 8 and 9 given to Capital, O&M and NPV respectively.

Table 1-6 Draft Financial Criteria Scores

Option	Variant	Capital Score	Operational and Maintenance Score	NPV Score	Draft Total Score for MCA
1: R2(b)	River discharge with enhanced treatment	3.5	1.5	3.1	2.8
	River discharge with enhanced treatment, and a small % to land	2.7	1.0	2.3	2.1
2: Dual R + L	Two river discharge points and a small % to land	2.8	2.8	2.6	2.7
3: L+R (a)	97 % applied to an inland land application site, and a discharge to river in exceptional circumstances	1.8	3.2	2.4	2.4
3: L+R (b)	97 % applied to a coastal land application site, and a discharge to river in exceptional circumstances	1.0	1.5	1.0	1.1
4: L + R (d)	45 % applied to an inland land application site, and a river discharge for the remainder of the time	3.2	2.6	3.1	3.0

Option	Variant	Capital Score	Operational and Maintenance Score	NPV Score	Draft Total Score for MCA
	55 % applied to an inland land application site, and a river discharge for the remainder of the time	3.0	2.5	2.9	2.8
4: L + R (e)	45 % applied to a coastal land application site, and a river discharge for the remainder of the time	2.1	3.3	2.3	2.5
	55 % applied to a coastal land application site, and a river discharge for the remainder of the time	1.9	2.7	2.0	2.2
6: Ocean	Ocean discharge, with a small % to land	1.7	2.3	1.8	1.9
	Ocean discharge	2.3	2.6	2.2	2.4

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

Growth & Economic Development Comparative Assessment of Short-listed options

1.1 Introduction

This report sets out the ‘Growth and Economic Development’ comparative assessment of the short-listed options for the Palmerston North Wastewater BPO project (“Nature Calls”).

The report was prepared by:

- Melaina Voss, Wastewater BPO Project Manager for Palmerston North City Council. Melaina has a Bachelor of Planning from the University of Auckland, is a Full Member of the New Zealand Planning Institute and 18+ years’ experience in resource management planning and strategic planning for growth.
- Richard Peterson (Reviewer). Richard has a Master of Regional and Resource Planning degree from the University of Otago, is a Full Member of the New Zealand Planning Institute and has 25+ years planning experience.

1.2 Criterion and scoring approach

The overall scoring is as per the table below. The scores were generated from how well the option aligned with the sub-criteria. The final score has been reached by calculating an average across the two sub criteria (as outlined in the table below).

Criterion	Description	1	2	3	4	5
Growth and Economic Development	The degree to which the options will: • Support the population and economic growth anticipated for the City by Council? • Support / restrict further up-scaling to accommodate a sub-regional scheme?	Low degree	Low – Medium degree	Medium degree	Medium – High degree	High degree

1.3 Approach to the assessment

As set out in the MCA method report, the Growth and economic development description is the following:

- The degree to which the option supports the population and economic growth anticipated for the City by Palmerston North City Council; and
- The degree to which the option supports or restrict further up-scaling to accommodate regional growth?".

An option's draft score for growth and economic development has been developed by first scoring each of the two sub-categories separately. An overall score was then given by averaging these two scores, with equal weighting being given to the two categories.

1.3.1 Supporting population growth and economic development

- Ability to provide a solution that meets population growth targets for 35 years or greater
- Ability to secure sufficient land or capacity of receiving environment for the projected population growth targets (35 years) or greater
- Level to which the discharge impacts on a receiving environment that contributes to the region's economic development

1.3.2 Accommodating a sub-regional scheme

- Ability to accommodate additional flows and loads from neighbouring councils and industry
- Proximity of council infrastructure to connecting wastewater source
- Capacity within the receiving environment to accommodate additional flows and loads over the consent duration

1.4 Assumptions applied in the assessment

As the exact location of the proposed discharge is yet to be confirmed, broad assumptions have been made with respect to the potential adverse effects on growth and development for this Option.

It is assumed that the land suitable for land-based discharge is currently used for agricultural purposes ie within the fluvial soil areas or coastal sand country, and does not reduce the capacity of the regional to accommodation population growth.

The design and operation of any option will account for future population growth within the term of the consent (35 years) and until the life of the asset is designed to (50 years), as defined in the technical work completed by Stantec to date. This is including pipe, treatment plant and land application area sizing.

If Council is unable to secure the land via willing buyer process and/or leasing arrangements land will be pursued via the Public Works Act and the land is available for this process.

Growth and development within the areas of Palmerston North, Horowhenua and the Manawatu Regions, will likely occur on the boundary of existing urban limits/boundaries and not likely to occur within rural areas that immediately adjoin land application sites.

There are low, medium, and high forecasted population growth rates for Palmerston North, in which a medium growth rate has been adopted. The Council has determined that there will be both residential and light industry (commercial) growth and limited growth in wet industry is expected. This therefore will not increase wastewater contaminant loads significantly within the consent duration of 35 years.

On the basis that the exact location of the outfall to the Ocean is yet to be confirmed, however the assumption is the location is on the west coast approximately 30km from the existing WWTP.

Consideration of the impact of COVID on New Zealand and the Manawatu Region is not yet known on growth or the economy. Consideration is needed on the potential impacts of the proposal on the region’s economy and rates of growth in reflect of COVID. This may be assessed once the preferred option is identified and as part of the Assessment of Environmental Effects stage of the Project. This should focus on the potential impact of the BPO (if a land-based solution is adopted) on loss of agricultural land use and subsequent economy losses. A revision of the city’s growth rates may also be necessary due to the movement of people within New Zealand and a reduction in travel in and out of New Zealand.

1.5 Assessment table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below.

Option	Variant	Growth & Economic Development Assessment	Growth & Economic Score	Sub-Regional Scheme Assessment	Sub-Regional Scheme Score	Draft MCA score
1: R2(b)	River discharge with enhanced treatment	- The Manawatu River contributes to the region's tourism, traversing two territorial authorities to the north and south of Palmerston North, and all three currently discharging treated wastewater into the Manawatu River. There are clear policy drivers at National level to improve the quality of Rivers. - The Manawatu River is a feature for the region's tourism and environmentalists. Activities include passive and active recreation, camping, birdlife and planting preservations and recreational fishing. Organised sporting events ie canoeing and fly-fishing also occur regularly along the stretch of the River. Discharging of wastewater will continue to limit the ability for recreation and tourism activities to occur, constraining the ability for economic development and growth of sectors along/associated with the River. - Palmerston North City Council has clear growth targets for the city, including economic development strategy that targets sectors. The solution must meet these targets to achieve the strategic goals for economic development. - There is limited capacity within the treatment regimens to decrease contaminants as the increase in wastewater occurs from growth. Therefore, as the discharge reaches contaminate maximums in River catchment, the ability to accommodate future growth may be limited.	2	The river has limited capacity for the proposed wastewater discharge. A proposed regional scheme would limit the capacity for growth of the city, unless substantial increases in the treatment regime were achieved to manage nutrients entering the River. The option includes technology that is relatively advanced and therefore opportunities for further treatment advances are limited.	2	2
	River discharge with enhanced treatment, and a small % to land	As per Option1 R2(b); however reduced impacts on River from: - The land area may provide some relief to the effects on the River however will retain the same perceived issues. - Potentially allows for more growth, compared to Option 1 of all to River, as land can be expanded to accommodate this.	3	As per above, however with the introduction of land, this may allow for increased flows and loads associated with a regional scheme. The potential for a scheme is still limited due to the maximum limits of nutrients that need to be achieved in the River. However, with the addition of land, the potential for additional growth is supported.	2	2.5
2: Dual R + L	Two river discharge points and a small % to land	As per Option 1 R2(b) with land.	3	As per Option 1 R2(b) with land.	2	2.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	- As the exact location of the proposed discharge is yet to be confirmed and therefore, broad assumptions have been made with respect to the potential adverse effects on growth and economic development for this option. It is assumed that the majority of the land suitable for land-based discharge is currently used for the purpose of agriculture. This land would likely convert to a cut and carry operation and any form of dairy, intensive beef or sheep farming, would be unlikely to occur due to perceived issues with treated wastewater being discharged to land. This has the potential to impact on economic development within the region given the land area necessary. - - Land that could provide for the City's growth is used for the application of the City's wastewater and buffer areas therefore loss of developable land and land is the vicinity perceived as not desirable for residential living.	2	Large areas of land already required for PNCC alone which may be problematic (as per growth assessment). This is further constrained with increased flows and loads from neighbouring Councils, increasing the necessary land area.	2	2

Option	Variant	Growth & Economic Development Assessment	Growth & Economic Score	Sub-Regional Scheme Assessment	Sub-Regional Scheme Score	Draft MCA score
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	- As the exact location of the proposed discharge is yet to be confirmed and therefore, broad assumptions have been made with respect to the potential adverse effects on growth and economic development for this Option. It is assumed that most of the land suitable for land-based discharge is currently used for forestry or is vacant coastal land. This land would likely convert to a forestry operation. This has the potential to impact on economic development in a positive way in that there is a new/added source of economy brought to the region. - Land provides coastal amenity, which is no longer accessible, impacting on the region's tourism. This is however a limited area of land that will be required and unlikely to have a significant adverse effect on the region's overall economy. - Land that could provide for the City's growth is used for the application of the City's wastewater and buffer areas therefore loss of developable land and land is the vicinity perceived as not desirable for residential living.	3	As above (for fluvial soils)	3	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	Issues are as presented in Option 1 and 3, however are less in scale given the land area is reduced and the volume of wastewater to the river is less. Area of land may be easier to acquire due to the reduced sizes required.	3	In line with the assessment on growth, this option also provides an opportunity to increase flows and loads where the land area may be increased to accommodate the addition of neighbouring councils and/or industry wastewater. On the basis that the land required is less from the outset, there may be greater opportunity to increase land utilised in a staged way over time. There are still limitations on this availability however to acquire land and capacity within the River to take on nutrients. Enhanced treatment or additional land, would be necessary to achieve any significant increase in wastewater flows and loads from the planned growth.	3	3
	55 % applied to an inland land application site and a river discharge for the remainder of the time	As above for 45%	3	As above for 45%	3	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	As above L+R(b). However on the basis the land area is larger than the fluvial soils requirement and there is limited coastal land available, this option may be more constrained in accommodating growth.	2	As above for 4 L+R(b) However on the basis the land area is larger than the fluvial soils requirement and there is limited coastal land available, this option may be more constrained in accommodating growth.	2	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	As above for L+R(b).	2	As above for L+R(b)	2	2
6: Ocean	Ocean discharge, with a small % to land	As raised in the matters raised in Option R2(a), an outfall and discharge to the Ocean has the potential to impact on commercial activities occurring in the Region along the west). The activities that occur along coastline include: - Commercial fishing (and recreational)	4	Options provides the greatest assimilative capacity to accommodate wastewater discharges, including increased volumes from a sub-regional scheme on the basis the pipeline will provide an opportunity to connect in additional wastewater from neighbouring councils and/or industry. It is not yet confirmed if the wastewater is treated prior to connecting in or	4	4

Option	Variant	Growth & Economic Development Assessment	Growth & Economic Score	Sub-Regional Scheme Assessment	Sub-Regional Scheme Score	Draft MCA score
		- Water sports such as surfing, windsurfing and swimming that attracts tourists and community to the area - Passive recreation along the shoreline such as walking, motocross and 4WD along the shoreline and into the dunes - Bird watching (along the shoreline) - Visitors spend in the local shops As the discharge will occur away from the shoreline, there may be no immediate adverse effect on the ability to carry out activities along the shoreline due to pipeline/outfall structures. However, a discharge of treated wastewater into the ocean has the potential to impact on ecosystems that support fish and shell fish industry, however this is limited (refer to environmental comparative assessment). This in turn may have an adverse affect on marketing/sale of commercial fishing activities given there is a perceived degradation of water quality. This also has the potential to impact on tourism. With that said, the option also provides the greatest opportunity for growth in wastewater volume and loads in comparison to the other options. This is given the ability for the receiving environment to be less sensitive that the River and is less constrained than the land options. The total land area is smaller than the other options and there is potentially an opportunity t increase this land area over time to also accommodate growth.		if it is to be treated at Totara Road prior to being piped to the discharge location.		
	Ocean discharge	As above.	4	As above.	4	4

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

1.6 Assessment Summary

Option	Variant	Draft score
1: R2(b)	River discharge with enhanced treatment	2
	River discharge with enhanced treatment, and a small % to land	2.5
2: Dual R + L	Two river discharge points and a small % to land	2.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	2
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2
6: Ocean	Ocean discharge, with a small % to land	4
	Ocean discharge	4

1 Technology and Infrastructure Comparative Assessment of Short-listed Options

1.1 Introduction

This report sets out the Technology and Infrastructure comparative assessment of the short-listed options for the Palmerston North Wastewater BPO project (“Nature Calls”). This report is to be used to inform the Multi-Criteria Assessment (MCA) of the shortlisted options.

The report was prepared by:

- Overall Assessment of options
    - Rita Whitfield – Stantec Graduate Civil Engineer
    - Anna Bridgman – Stantec Group Manager/ Senior Civil Engineer
    - Jim Bradley – Stantec Technical Specialist
- Assessment of treatment element of options
    - Michael Tan – Stantec Process Engineer
    - Andrew Slaney – Stantec Senior Process Engineer
- Assessment of land treatment element of options
    - Luke Wilkinson – PDP Environmental Engineer
    - Aslan Perwick – PDP Groundwater Service Leader

1.2 Criterion and scoring approach

The overall scoring is as per the table below. Each of the six sub-criteria were scored with regards to how well the option aligned with that sub-criteria. The overall draft score is an average of these five scores, rounded to the nearest 0.5, with each sub-criteria given equal weighting. Average has been used rather than the lowest score as it is not believed that any one of these sub-criteria is the governing factor in the selection of the BPO.

Criterion	Description	1	2	3	4	5
Technology and Infrastructure	Degree to which the option: • can be staged • is able to be constructed and operational within 5 years of the commencement of the consent • allows for resource recovery / beneficial re-use	Low degree of alignment with sub-criteria and/or High Operational	Low – Medium degree of alignment with sub-criteria and/or Medium-High	Medium degree of alignment with sub-criteria and/or Medium	Medium – High degree of alignment with sub-criteria and/or Low-Medium	High degree of alignment with sub-criteria and/or Low Operational

Criterion	Description	1	2	3	4	5
	• infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme • involves Operational Complexity • involves Operational Risk	Complexity and Risk	Operational Complexity and Risk	Operational Complexity and Risk	Operational Complexity and Risk	Complexity and Risk

1.3 Technology & Infrastructure Categories

1. Can be Staged
   a) Can be sequentially upgraded/modified, as required, to accommodate increases in flows and loads, and/or for possible revised more stringent discharge parameters to meet legislative requirements

2. Is able to be constructed and operational within 5 years of the commencement of the consent
   a) Materials are available
   b) Contractors have the experience in the forms of installation and development required
   c) Suitable land is available

3. Allows for resource recovery / beneficial re-use
   a) Includes the land use ‘cut and carry’ or forestry resource recovery options, and waste stream resource recovery at a high level.
   b) The wastewater treatment plant (WWTP) can operate as a “Product Factory” in line with previously considered resource recovery information on the project.
   c) Includes potential carbon credits from forestry land application sites

4. Infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme

5. Involves Operational/Technical Complexity
   a) Scheme complexity leading to potential operational problems
   b) Scheme maintenance requirements which can cause additional operational problem

6. Involves Operational Risk
   a) Power supply reliability – effect of outages and rapid changes to electricity pricing

b) Unexpected air contamination effects (odour, aerosol, spry drift etc)
c) Third party damage to infrastructure, e.g. digger hitting cables, pipes etc
d) Crop failure/contamination
e) Loss of market for land application products e.g. cut and carry products, forestry production
f) Unexpected future requirements in terms of emerging contaminants of concern/endocrine disrupting compounds

1.4 Assumptions applied in the assessment

- All infrastructure assets to be constructed as part of the preferred option would be to the design standards and local specifications required at the time of detailed design.
- Cost is not a constraining component in the constructability sub-category
- Land is available for the construction of the options, including pipelines, pump stations, treatment facilities, outfalls and land application.
- Ocean Outfall options are 2km long from the foreshore. Dispersion modelling would be completed if an ocean option is selected as the BPO to validate this assumption and to assist site selection.
- Ground conditions are suitable for construction of pipelines, pump stations and treatment facilities, and that soft foundations can be addressed through minor ground improvements such as raft foundations
- All materials and equipment would be available in stock or with have short lead times so as to not greatly affect construction timeframes.
- A conventional project delivery method will be used (consent, design, tender and then construct). Alternative delivery models should ultimately be considered, including alternative procurement methods to expedite construction.
- Construction timeline of 5 years includes agreement of land purchase. It has been assumed that designation would also de-risk this timeframe.
- The distribution infrastructure within the land application scheme will not be designed with future expansion to a regional scheme in mind, therefore future expansion may require pump station upgrades and/or the replacement of some distribution mains.
- Access to the land application scheme will be restricted, thus providing reasonable protection from third party damage to infrastructure.
- Risk to loss of market for forestry considered greater than the risk to the cut and carry schemes as the cut and carry crop can be replaced over one season, whereas the forestry is intended to be a 25-year investment.
- Any Emerging Contaminants in the wastewater stream that require control will be managed as part of the incoming wastewater management (e.g. tradewaste controls) and the wastewater treatment process and will not change the operation of the land application system.
- In general, the larger schemes are considered more complex to operate and therefore have a higher associated risk from loss of irrigation blocks due to malfunctions and/or mismanagement of the scheme.
- Irrigation blocks will be rotated so not all will be in use each day, therefore the system has inbuilt resilience to when some irrigation blocks cannot be used during maintenance or breakdowns.
- For the assessment on whether the schemes could be upscaled (over and above Palmerston North City Council growth allowance) if required, the assumption has been made that untreated wastewater will be piped to the plant from other regions.

- The increase in capacity required for a sub-regional scheme is approximately 30%, taking in Marton, Bulls, Halcombe, Ohakea, Sanson and Feilding.
- The assessment of ability to increase capacity for a sub-regional scheme is based on infrastructure only, and not the environmental limits of the receiving environment. This is being covered in other Comparative Assessments.

1.5 Assessment table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below.

Where there are multiple variants of any option, factors which are common to all variants are listed in a row first.

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
1: R2(b)	Generic for both variants	- The membrane trains of the Membrane Reactor (MBR) units are designed to be installed in batches which indicates the installation could be staged. However, the bio reactor tanks would need to be installed up front. - Revised discharge parameters to meet legislative requirements may require additional treatment processes	- Expect Local contractors to have the experience to construct required infrastructure. - Land purchasing is achievable within this time frame - Design of the required infrastructure is achievable in this timeframe - There is an extent which the option influences time frame, but all are predicted to be achievable	- Treatment level produces high quality treated wastewater which could be re-used for non-potable uses - Potential to recover struvite which would reduce but not eliminate alum dosing requirement. This requires a 5-stage process so additional infrastructure. - Retaining digestors would allow for energy recovery through biogas with carbon additions	- Additional membrane bioreactor components can be added to the treatment plant increasing capacity, with minimal space requirements, but will need significant additional upgrades for hydraulic capacity through the plant including inlet works replacement. - Additional flow will reduce capacity of wet weather storage in converted lagoons - Additional flow may require a lower SIN concentration be targeted, the ability to achieve this target will need to be considered.	- Significantly more complex due to cleaning and maintaining of membranes required, however this is automated. - Chemicals are required for cleaning - Fine screens also require cleaning and maintenance - Changing requirements for emerging contaminants of concern/endocrine disrupting compounds may affect treatment required, but this is the best suited plant type for removal of emerging contaminants.	- At risk of power failure but within WWTP site for operational repair - Additional chemicals required for cleaning. - Less risk of fluctuating treated wastewater quality, with physical barrier - More power required due to membranes therefore greater risk of fluctuations of operation costs, with an overall higher operation cost - Lesser risk of requiring treatment process upgrades due to environmental concerns due to high quality treated wastewater	
	River discharge with enhanced treatment				- Can only send treated wastewater to river, no options to send elsewhere	- Relatively simple system, pipeline within WWTP boundary - Only need to control discharge to one location, no need to consider alternatives. - Largest wetland scheme	- Reduced risk due to the minimal amount of infrastructure required, only one discharge point, but largest wetland scheme. - Discharge linked to upstream river quality and loading, this may result in environmental issues if upstream discharge increases or river flow decreases. This cannot be offset by discharge to land.	4.0
		4	5	3	4	3	4	
	River discharge with enhanced treatment, and a small % to land	- Irrigation infrastructure can be staged - Conveyance infrastructure staging would require dual mains (an additional cost) and staggered pump installation		- Option intent is to support commercial cut and carry crops complementary with discharge - Will be at a much smaller scale than Option 3 & 4 variants, therefore lesser potential for resource recovery/beneficial re-use, but cut & carry is a beneficial re-use - Nutrient resources within the wastewater stream are being actively recovered in agricultural product.	- Additional flow will reduce capacity of wet weather storage in converted lagoons - Acquiring additional land area considered to be (comparatively) easier than the larger options. - Irrigation system can be expanded. There may be 're-work' required during scaling up the distribution infrastructure if this has not accounted for in the initial design.	- Scheme is relatively simple, however does require flow split - Odour/drift etc needs to be managed by buffer zones, application methods and management of storage systems -This option is the smallest irrigation scheme within the BPO, so (comparatively) is considered the simplest to operate. - Crop harvesting will require contractor involvement as this	- Irrigation infrastructure and pipeline is potentially at risk from third party damage - Crop failure is a risk, can be managed with effective operations - Permanent loss of market for crops is considered unlikely - Irrigation blocks can be rotated which provides inherent resilience to partial breakdowns across the irrigation scheme - Power outages would affect pumping to scheme and	4.0

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
				- To achieve equivalent production on the same land, the re-use of the wastewater stream inherently means that freshwater resources are being spared e.g. promotes freshwater allocation to be used elsewhere within the region.		will not be in the day to day operator’s skill set.	irrigation system, but backup systems could control this	
		4	5	4	4	2	4	
2: Dual R+L	Two river discharge points and a small % to land	- Conveyance infrastructure staging would require dual mains (an additional cost) and staggered pump installation - Irrigation infrastructure can be staged - Revised discharge parameters to meet legislative requirements may require additional treatment processes	- Expect Local contractors to have the experience to construct required infrastructure. - Land purchasing is achievable within this time frame - Design of the required infrastructure is achievable in this timeframe - There is an extent which the option influences timeframe but all are predicted to be achievable	- Option intent is to support a commercial cut and carry crops complementary with discharge - Will be at a much smaller scale than Option 3 & 4 variants, therefore lesser potential for resource recovery/beneficial re-use. This will depend on the size and uptake of the market for biomass material. - Retaining digestors could allow for energy recovery through biogas with carbon additions - Nutrient resources within the wastewater stream are being actively recovered in agricultural product for proportion going to land. - To achieve equivalent production on the same land, the re-use of the wastewater stream inherently means that freshwater resources are being spared e.g. promotes freshwater allocation to be used elsewhere within the region.	- Will need significant additional upgrades for hydraulic capacity through the plant - Acquiring additional land area considered to be (comparatively) easier than the larger options. - Irrigation system can be expanded. There may be ‘re-work’ required during scaling up the distribution infrastructure if this has not accounted for in the initial design. -Inlet works will need to be upsized and potentially replaced to accommodate additional flows. - Aerated lagoons have a limited organic loading capacity and this will limit the total capacity of the process.	- Scheme is relatively simple with shorter pipelines than options 3, 4 & 6 - Odour/drift etc to be managed by buffer zones, application methods and management of storage systems - This option is the second smallest irrigation scheme within the BPO, so (comparatively) is considered simpler to operate. - Crop harvesting will require contractor involvement as this will not be in the day to day operator’s skill set. - Control system will need to split flows appropriately between different discharge locations, quantities of wastewater sent to different locations will also need to be considered.	- Power outages would affect pumping to scheme and irrigation system, but backup systems could control this - Irrigation infrastructure and pipeline is potentially at risk from third party damage - Crop failure is a risk, can be managed with effective operations - Permanent loss of market for crops is considered unlikely - Emerging/unknown contaminants present a potential risk to all disposal schemes, but are likely to be manageable with changes to treatment practices (if required) - Irrigation blocks can be rotated which provides inherent resilience to partial breakdowns across the irrigation scheme - Greater redundancy in the system with two river discharge locations and land disposal scheme - Some treatment would be possible without power due to the large area of the ponds but, if this condition occurs over a long period overloading will cause foul odours to be generated	3.0
		2	5	3	3	2	4	

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
3: L+R (a) & (b)	Generic for both sub-options	- Conveyance infrastructure staging would require dual mains (an additional cost) and staggered pump installation - Revised discharge parameters to meet legislative requirements may require additional treatment processes - Irrigation infrastructure can be staged	- Expect Local contractors to have the experience to construct required infrastructure. - Land purchasing is achievable within this time frame - Design of the required infrastructure is achievable in this timeframe - There is an extent which the option influences time frame but all are predicted to be achievable	- Retaining digestors could allow for energy recovery through biogas with carbon additions - Nutrient resources within the wastewater stream are being actively recovered in agricultural product. - To achieve equivalent production on the same land, the re-use of the wastewater stream inherently means that freshwater resources are being spared e.g. promotes freshwater allocation to be used elsewhere within the region.	- Will need significant additional upgrades for hydraulic capacity through the plant - Inlet works may be a hydraulic constraint - This option is already a large land area however, so there may be limitations on acquiring suitable land. - Irrigation system can be expanded. There may be 're-work' required during scaling up the distribution infrastructure if this has not accounted for in the initial design.	- Scheme is relatively simple, although on a large scale - Odour/drift etc to be managed by buffer zones, application methods and management of storage systems - Irrigation schemes are generally considered high complexity to operate however, this would be the largest in New Zealand by wide margin, which is likely to increase operational complexity. - Crop/ forestry harvesting will require contractor involvement as this will not be in the day to day operators skill set. -Increased complexity with flow split - Greater redundancy in the system with dual scheme - No alum dosing required - Flow discharge to river based on high river flow rate	- Crop failure is a risk, can be managed with effective operations - Permanent loss of market for crops is considered unlikely - Emerging/unknown contaminants present a potential risk to all disposal schemes, but are likely to be manageable with changes to treatment practices (if required) - Irrigation infrastructure and pipeline is potentially at risk from third party damage - Land area basis will allow full discharge year-round - Power outages would affect pumping to scheme and irrigation system, but backup systems could control this	
	97 % applied to an inland land application site and a discharge to river in exceptional circumstance	- Treatment components cannot be staged		- Option intent is to support a commercial cut and carry crops complementary with discharge	- Aerated lagoons have a limited organic loading capacity and this will limit the total capacity of the process.	-Lagoon process will allow some treatment without power	- Some treatment would be possible without power due to the large area of the ponds but, but if this condition occurs over a long period overloading will cause foul odours to be generated - Organic overloading could cause odour issues	3.0
		3	5	4	2	3	2	

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	- Installation of the second clarifier has the potential to be staged, this will be dependent on attributes of the influent and growth patterns. It also adds additional risk with reduced redundancy of the system		- Option intent is to grow a commercial forestry block complementary with discharge - With additional tertiary treatment a portion of the treated wastewater could be reused as a non-potable water supply - Potential to recover struvite which would reduce but not eliminate alum dosing requirement. This requires a 5-stage process so additional infrastructure. - Could be part of ETS / a carbon sink, so a positive from a sustainability / carbon offset perspective	- Additional treatment train capacity (PST, bioreactor and clarifier) could be installed to augment process	- Power required to supply aeration	- Full aeration to be supplied via mechanical aeration. - Risk of operational shutdowns due to forestry maintenance needs, but impacts can be limited by strategic design and management of forestry and infrastructure.	3.0
		3	5	5	2	2	2	
4: L + R (d) & (e)	Generic for both sub-options	- Conveyance infrastructure staging would require dual mains (an additional cost) and staggered pump installation - Revised discharge parameters to meet legislative requirements may require additional treatment processes - Irrigation infrastructure can be staged	- Expect Local contractors to have the experience to construct required infrastructure. - Land purchasing is achievable within this time frame - Design of the required infrastructure is achievable in this timeframe - There is an extent which the option influences timeframe but all are predicted to be achievable	- Retaining digestors could allow for energy recovery through biogas with carbon additions - Nutrient resources within the wastewater stream are being actively recovered in agricultural product. - To achieve equivalent production on the same land, the re-use of the wastewater stream inherently means that freshwater resources are being spared e.g. promotes freshwater allocation to be used elsewhere within the region.	- Will need significant additional upgrades for hydraulic capacity through the plant - Additional flow will reduce capacity of wet weather storage in converted lagoons - This option is already a large land area however, so there may be limitations on acquiring suitable land. - Irrigation system can be expanded. There may be ‘re-work’ required during scaling up the distribution infrastructure if this has not accounted for in the initial design.	- Scheme is relatively simple, although on a large scale - Odour/drift etc to be managed by buffer zones, application methods and management of storage systems - Irrigation schemes are generally considered high complexity to operate however, this would be the largest in New Zealand by wide margin, which is likely to increase operational complexity. - Crop/forestry harvesting will require contractor involvement as this will not be in the day to day operators skill set -Increased complexity with flow split - Greater redundancy in the system with dual scheme - River flow triggers and recording of flow and load to river and to land required	- Irrigation infrastructure and pipeline is potentially at risk from third party damage - Crop failure/contamination are only a risk if scheme is inappropriately managed - Permanent loss of market for crops is considered unlikely - Emerging/unknown contaminants present a potential risk to all disposal schemes, but are likely to be manageable with changes to treatment practices (if required) - Prolonged low river flows could see infrequent flow to river. - Power outages would affect pumping to scheme and irrigation system, but backup systems could control this	3.0
	45 % applied to an inland land application site and			- Option intent is to support a commercial cut and carry crops complementary with discharge	- Aerated lagoons have a limited organic loading	- Lagoon process will allow some treatment without power		3.0

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
	a river discharge for the remainder of the time				capacity and this will limit the total capacity of the process.			
		2	5	4	2	3	3	
	55 % applied to an inland land application site and a river discharge for the remainder of the time			- Option intent is to support a commercial cut and carry crops complementary with discharge	- Aerated lagoons have a limited organic loading capacity and this will limit the total capacity of the process.	- Lagoon process will allow some treatment without power		3.0
		2	5	4	2	3	3	
	Coastal land application site, with more land application 55% applied to a coastal land application site and a river discharge for the remainder of the time			- Option intent is to grow a commercial forestry block complementary with discharge - Would be part of ETS / a carbon sink, so a positive from a sustainability / carbon offset perspective. - With additional tertiary treatment a portion of the treated wastewater could be reused as a non-potable water supply	-additional treatment train capacity (PST, bioreactor and clarifier) could be installed to augment process	- Power required to supply aeration	- Risk of operational shutdowns due to forestry maintenance needs, but impacts can be limited by strategic design and management of forestry and infrastructure - Higher quality of treatment process	3.0
		2	5	5	2	2	2	
	55% applied to coastal land application site and a river discharge for the remainder of the time.			- Option intent is to grow a commercial forestry block complementary with discharge - Would be part of ETS / a carbon sink, so a positive from a sustainability / carbon offset perspective. - With additional tertiary treatment a portion of the treated wastewater could be reused as a non-potable water supply	-additional treatment train capacity (PST, bioreactor and clarifier) could be installed to augment process	- Power required to supply aeration	- Risk of operational shutdowns due to forestry maintenance needs, but impacts can be limited by strategic design and management of forestry and infrastructure - Higher quality of treatment process	3.0
		2	5	5	2	2	2	
6: Ocean	Generic for both sub-options	- Conveyance infrastructure staging would require dual mains (an additional cost) and staggered pump installation - Outfall could not be staged - Revised discharge parameters to meet legislative requirements may	- Expect Local contractors to have the experience to construct required infrastructure. - Land purchasing is achievable within this time frame	- Retaining digestors could allow for energy recovery through biogas with carbon additions	- Additional treatment train capacity (PST, bioreactor and clarifier) could be installed to augment process - Will need significant additional upgrades for hydraulic capacity through the plant	- Outfall will need periodic inspections and some maintenance of the diffuser over the long term - Reliant on pumping to scheme - Scheme is relatively simple, although on a large scale	- At risk of power failure but within WWTP site for operational repair - Pipeline is potentially at risk from third party damage - Power outages would affect pumping to scheme, but backup systems could control this	

Option	Variant	Can be staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
		require additional treatment processes	- Design of the required infrastructure is achievable in this timeframe - There is an extent which the option influences timeframe but all are predicted to be achievable		- Pipelines may have to be duplicated/upsized with additional pumping		- Emerging/unknown contaminants present a potential risk to all disposal schemes, but are likely to be manageable with changes to treatment practices (if required)	
	Ocean discharge, with a small % to land	- Irrigation infrastructure can be staged		- Nutrient resources within the wastewater stream are being actively recovered in agricultural product. - To achieve equivalent production on the same land, the re-use of the wastewater stream inherently means that freshwater resources are being spared e.g. promotes freshwater allocation to be used elsewhere within the region. - Option intent is to grow a commercial forestry block complementary with discharge - Would be part of ETS / a carbon sink, so a positive from a sustainability / carbon offset perspective. - Will be at a much smaller scale than Option 3 & 4 variants, therefore lesser potential for resource recovery/beneficial re-use	- Acquiring additional land area considered to be (comparatively) easier than the larger options. - Irrigation system can be expanded. There may be 're-work' required during scaling up the distribution infrastructure if this has not accounted for in the initial design.	- Increased complexity with flow split - Greater redundancy in the system with dual scheme - Odour/drift etc to be managed by buffer zones, application methods and management of storage systems - This option is the second smallest irrigation scheme within the BPO, so (comparatively) is considered the simpler to operate. - Forestry harvesting will require contractor involvement as this will not be in the day to day operators skill set.	- Risk of operational shutdowns due to forestry maintenance needs, but impacts can be limited by strategic design and management of forestry and infrastructure - Lesser risk due to the smaller area - Irrigation infrastructure is potentially at risk from third party damage - Crop failure/contamination are only a risk if scheme is inappropriately managed - Permanent loss of market for crops is considered unlikely	2.5
		1	5	3	1	3	2	
	Ocean discharge			- No land resource recovery available	- Ocean outfall may have to be duplicated, or bigger pumps added, depending on additional capacity built in when constructed			2.5
		1	5	2	1	3	2	

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

1.6 Summary Assessment

The table below summarises the assessment scores for the technology and infrastructure comparative assessment.

Option	Variant	Can Be Staged	Constructable & Operational within 5yrs	Allows for Resource recovery	Can be Up-scaled	Operational / Technical Complexity	Operational Risk	Draft score
1: R2(b)	River discharge with enhanced treatment	4	5	3	4	3	4	4.0
	River discharge with enhanced treatment, and a small % to land	4	5	4	4	2	4	4.0
2: Dual R + L	Two river discharge points and a small % to land	2	5	3	3	2	4	3.0
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	5	4	2	3	2	3.0
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	3	5	5	2	2	2	3.0
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	2	5	4	2	3	3	3.0
	55 % applied to an inland land application site and a river discharge for the remainder of the time	2	5	4	2	3	3	3.0
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	5	5	2	2	2	3.0
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	5	5	2	2	2	3.0
6: Ocean	Ocean discharge, with a small % to land	1	5	3	1	3	2	2.5
	Ocean discharge	1	5	2	1	3	2	2.5

1 Natural Environment Comparative Assessment of Short-listed options

1.1 Introduction

This report sets out the Natural Environment comparative assessment of the short-listed options for the Palmerston North Wastewater BPO project ("Nature Calls").

The report was prepared by:

- Keith Hamill assessed effects on freshwater environments. Keith is a director and Principal Environmental Scientist with River Lake Ltd. Keith has 24 years' experience in environmental management and ecological assessments on freshwater environments. He has been involved in assessing the effects of the Tōtara Road WWTP on the Manawatū River since 2011.
- Dr Olivier Ausseil assessed effect on freshwater environments. Oliver is a director and Principal Scientist with Aquanet Consulting Ltd with over 18 years professional experience in New Zealand. Olivier has been involved as a technical advisor on behalf of consenting authorities, applicants and submitters on over 35 resource consent applications for discharges of treated domestic wastewater to land and/or water, from both medium-sized towns and small communities. He developed the initial versions of Aquanet's PointSim model for the Feilding WWTP re-consenting process. Olivier has been involved in involved in assessing the effects of the Tōtara Road WWTP on the Manawatū River since 2017, with a particular focus on monitoring and modelling the effects of the discharge on the Manawatū River's water quality and ecology.
- Aslan Perwick assessed effects on soils and groundwater. Aslan is a lead Groundwater Scientist with Pattle Delamore Partners Ltd with over 13 years' experience. Aslan specialises in assessing groundwater effects from discharges to land, and has been involved in several municipal discharge to land consent applications/studies, acting for applicants and as an expert reviewer. Some notable previous municipal projects Aslan has been involved in are: Watercare WWTP discharge applications (Omaha-Matakana WWTP, Wellsford WWTP, Warkwork-Snells WWTP, Army Bay WWTP, Waiuku-SW WWTP), Featherstone WWTP, Cooks Beach WWTP, Te Anau WWTP, and Waipu WWTP.
- David Cameron assessed effect on the Coastal Environment. David is a Principle Environmental Scientist with Stantec Ltd with over 30 years' experience in water quality and aquatic ecology assessment. He was involved in the preparation Tōtara Road WWTP consent application in 2001 and has assessed the effects of coastal outfall discharges at Pencarrow, Moa Point, Karori, Porirua, Hastings, Tauranga and Ruakaka.

1.2 Criterion and scoring approach

The comparative assessment for effects on the Natural Environment assessed the potential adverse environmental effects of each option on the receiving environments, particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, and aquatic ecology. It was assumed that all options would be implemented and managed so as to have little effect on terrestrial ecology.

The different options were assessed for effects on the Natural Environment using a scale of 1 to 5 with a low score of 1 reflecting a poor outcome and a high score of 5 reflecting a good outcome. Criteria used to determine each score are described in **Table 1**.

Separate assessments were made for potential effects on “Freshwater Systems” (including the Manawatū River and small local streams and lakes potentially affected by the land irrigation), Groundwater and Soils, and the Coastal Environment (including the estuary, beaches and ocean floor). The lowest score for any sub-group was used to determine the overall score for the group. For example, separate scores were given to potential effects on the Manawatū River and small streams or lakes near the irrigation area, and the lowest score determined the combined score for ‘Rivers’. Similarly, separate scores were assigned to Groundwater and Soils, and the lowest score determined the combined score for ‘Groundwater and Soils’.

The Overall Score for the Natural Environment was the lowest score (i.e. worst score) assigned for “Rivers”, “Groundwater and Soil”, and the “Coast”. However, to help with differentiating between different options we have also shown the average score from each of these categories.

Table 1: Criteria used to score Natural Environment components of “Rivers”, “Groundwater and Soil”, and the “Coast”.

Score	traffic light	Description	Freshwater (rivers and lakes)	Coastal
1	Red: Very High adverse effects	Major loss or alteration of baseline conditions (in absence of current discharge)	a) Effects on water quality and/or aquatic ecology of the Manawatu River (including the estuary) are overall similar than currently; b) The option causes 'high' or 'very high' adverse effects on other freshwater environments; c) The One Plan targets for periphyton cover or biomass are likely to be regularly exceeded (i.e. more than 8% of samples); d) The One Plan target relative to QMCI change (20% reduction) is likely to be regularly exceeded; e) Ammonia poses a risk of chronic or acute toxic effect to a range of species (specifically in excess of the 95% species protection level, i.e. the protection level set in the One Plan).	a)The effects on water quality and/or aquatic ecology in the Seawater Management Zone after reasonable mixing represent a major loss or alteration from baseline condition; b) The effects on marine benthic ecology outside of a zone of reasonable mixing are significant; c) The One Plan target for algal biomass is likely to be regulary exceeded; d) Ammonia poses a risk of chronic or acute toxic effect to sensitive species (specifically in excess of the 99% protection level for ammoniacal nitrogen, i.e., the protection level set in the One Plan).
2	Orange: High adverse effects	Major alteration of baseline conditions (in absence of current discharge)		
3	Yellow: Moderate adverse effects	Alteration to existing baseline conditions. Generally effects are moderate but acceptable in the context of magnitude, spatial scale, duration and frequency.	a) The effects on the Manawatu River represent a substantial improvement compared with the current situation; b) The effects on water quality and ecology are measurable but generally meet One Plan targets; c) There is a moderate risk of (i.e. of short duration and/or infrequent) exceedance of the One Plan targets.	a)The effects on water quality and/or aquatic ecology in the Seawater Management Zone after reasonable mixing represent a slight to moderate deterioration compared with the baseline conditions; b)The effects on marine benthic ecology outside of a zone of reasonable mixing zone are measurable but not significantly adverse; c)There is a moderate risk of exceedance of the One Plan targets.
4	Green: Low adverse effects	Minor shift from baseline conditions or ecological populations (in absence of current discharge).		
5	Blue: Very Low adverse effects	Very slight change in baseline conditions.	a) The effects on the Manawatu River represent a substantial reduction/improvement compared with the current situation; b) The effects on water quality and ecology are likely to be small and of short duration/infrequent so as to have negligible overall ecological effect. c) The risk of exceedances of the One Plan targets is very low.	a)The effects on water quality and ecology in the Seawater Management Zone are unlikely to be measurable; b)The risk of exceedances of the One Plan targets is very low.

Score	traffic light	Description	Groundwater	Soils
1	Red: Very High adverse effects	Major loss or alteration of baseline conditions (in absence of current discharge)	a) Likely to cause greater than minor adverse effects on groundwater quality within the regional GW resource e.g. significantly degraded from current status; b) The option is likely to cause 'high' or 'very high' adverse effects on other receiving/connected freshwater environments (water quality and/or water quantity/flow) ; c) Likley to cause adverse effects/consume >1% of the presently available groundwater quantity (regional aquifer) d) Likely to cause adverse groundwater mounding effects (off site) e) Overall greater than minor adverse effects expeced. Nill positive effects expected.	a) Likely to cause adverse effects on soil chemical properties, e.g. acidicifation b) Likely to cause irreparable change or detrimental damage to the soil physical properties, e.g. erosion, compaction, loss of cohesion c) Very high risk of accumulation of heavy metals and soil contaminants including micronutrients, d) Likely to result in a detrimental effect on the soil biological properties and soil fertility as such that the soil becomes desolated. e.g. crop growth rate reductions
2	Orange: High adverse effects	Major alteration of baseline conditions (in absence of current discharge)		
3	Yellow: Moderate adverse effects	Alteration to existing baseline conditions. Generally effects are moderate but acceptable in the context of magnitude, spatial scale, duration and frequency.	a) Unlikely to cause more than minor adverse effects on groundwater quality within the regional GW resource e.g. less than minor degradation from current status; b) The option is likely to cause less than minor adverse effects on other receiving/connected freshwater environments (water quality and/or water quantity/flow) ; c) Likely to have a neutral or less than minor effect on the presently available groundwater quantity (regional aquifer) d) Unlikely to cause more than minor adverse groundwater mounding effects (off site) e) Overall minimal-minor adverse effects on groundwater expected. Minimal positive effects expected.	a) Unlikely to cause more than minor adverse effects on the soil physical, chemical or biological properties e.g. relative to other anthropogenic activities in the region, including urban and agricultural land use. b) Low risk of heavy metals/micronutrients issues in the soil insofar that standard soil management practices are not considered able to keep these to less than minor effects.
4	Green: Low adverse effects	Minor shift from baseline conditions or ecological populations (in absence of current discharge).		
5	Blue: Very Low adverse effects	Very slight change in baseline conditions.	a) Likely to result in groundwater quality benefits within the regional GW resource e.g. significantly improvment from current status; b) The option is likely to significantly improve either the water quality and/or water quantity (flow) of receiving/connected freshwater environments; c) Likely to cause positive effects/increase the presently available groundwater quantity (regional aquifer) d) Unlikely to cause any discernable groundwater mounding effects (off site) e) Overall negliible/minimal adverse effects on groundwater expected. Some positive effects expected.	a) Likely to lead to beneficial changes in physico-chemical and biological properties of the soil b) Increase in soil microorganisms metabolic activities c) Unlikely to cause any net long term adverse effect on the soil physical, chemical or biological properties d) Imporves soil stability / reduces soil erosion

1.3 Approach to the assessment

The effects assessment considered the magnitude, spatial scale, duration, frequency of effects and certainty in predictions. Comparisons were in the context of expected background conditions in the absence of the current discharge. By way of reference, the effects of the current discharge on the Manawatū River were considered to be unacceptable due to the excessive periphyton growth and corresponding effects of aquatic macroinvertebrate communities during periods of low flow.

Some options had higher levels of uncertainty about whether they would consistently be within acceptable levels (e.g. Option R2b). In these situations, lower scores were given to options that allowed little opportunity for practicing adaptive management by expanding the treatment system in some way; this is particularly relevant to option R2b. Similarly, for some land treatment options there was some uncertainty about the degree of effects on small streams or lakes near the irrigation areas, so better scores were given to options that had more opportunity to avoid catchments of sensitive waterbodies due to smaller land area requirements.

1.4 Assumptions applied in the assessment

1.4.1 Freshwater

Discharges to the Manawatū River increase the concentration of nutrients in the river which can stimulate excessive periphyton growth. This in turn reduces the health of aquatic macroinvertebrate communities in the river, effects the dissolved oxygen regime and has potential effects on fish. Key considerations in assessing potential effects on the Manawatū River were the effects on achieve One Plan targets for periphyton (biomass/cover) and nutrient concentrations. Restricting discharges to higher flows (greater than about median flow) dramatically reduces the potential for periphyton to grow. Similarly shifting the discharge location to downstream of Opiki reduces ecological effects because habitat starts to constrain periphyton growth downstream of this location. Restricting discharges to higher flows is generally not as effective at reducing annual nutrient loads discharged to the coast as options with N and P treatment for a wide range of flows.

The focus of the assessment on the Manawatū River was on minimising the effects of eutrophication currently observed in the River. Thus, a strong emphasis was given to the effects of nitrogen (N) and phosphorus (P) in the discharge. A Water Quality and Periphyton Model has been developed to better understand effects on the river and how different options would impact on the river achieving targets set in the One Plan. The assessment relied on the results of this model (called the Point Source Impact Model (PointSIM) is described in Greer and Ausseil (2019, 2020a, 2020b), in addition to monitoring data and investigations assessing the effects of the current discharge.

The spraying of effluent has potential effects on small waterways and lakes close to the irrigation area from the leaching of nitrate into the groundwater. The extent of this risk was assessed by considering the N leaching rate the irrigation compared to likely rates from current landuse, likely proximity of waterbodies, buffer zones, the potential to avoid streams in the irrigation area, seasonality in application and the potential benefits from increase flow volumes. This relied on information in the groundwater assessment and location of potential irrigation sites (PDP 2020b, Appendix B).

The scenario with the worse score for waterways near irrigation area were Options L+R(e) (score 3). This score was given because the irrigation area, assumed for this option for the purposes of this assessment, is anticipated to include substantial areas of some small lake catchments and there is uncertainty on the effect of N on the lake. This score would improve to 4 if the effluent was first treated for and so allow a smaller irrigation area that avoided the lake catchments. The scenario with land treatment that has the best score for small waterbodies is O-1 (scored 5). Negligible effects were expected for this scenario because the land discharge area was small so easy to avoid sensitive areas, the discharge is limited to summer when N uptake is highest, and the N leaching rate was small (10 kg N/ha/ya).

The risk of direct effects of the irrigation on local streams is very low because a 200m buffer zone will be used. The risk of P leaching is very low because the soils in the irrigation areas are P deficient and have a large P sorption capacity.

The potential effects of emerging contaminants on the environment was considered to be equal for all treatment options for the purpose of this process. The weighting of effects will largely depend on the values placed different receiving environments (i.e. land, river or coast). In general land treatment will provide better options for removal of emerging contaminants but may bring with it the risk of land contamination. Overall, there too many unknowns to use the potential risks posed by emerging contaminants in the assessment.

1.4.2 Coastal

In assessing the effects of the different options on coastal sites attention was given to the extent to which they would contribute to nitrogen loads in sensitive coastal areas (e.g. in estuaries and near-shore), effect on One Plan targets for coastal areas, and direct effects of the discharge on benthic habitat associated with the outfall.

Information on the treatment of nitrogen loads was from PDP (2020b, Table 3) and from estimated nitrogen removal from N treatment options using the PointSIM model.

1.4.3 Groundwater and Soils

The description of land treatment options including assumed leaching rates and removal rates and key assumptions is described in PDP (2020a, 2020b)

Groundwater is potentially influenced by nitrogen leaching from land application of effluent. The risk reduces when managing application to have low nitrogen leaching rates and low leaching rates relative to current landuse. The risk is also reduced when the land application is seasonal during dryer periods. The risks can increase when land application is in sensitive catchments (e.g. coastal lakes) or if the availability of suitable land threatens to limit ability to apply required buffer zones.

Key Risks relating to soils considered in the assessment were:

- Potential for areas of compacted soil structure from mechanical harvest of the cut & carry crop, particularly when soils are at or above field capacity. Risk is reduced by the reduced period of wastewater application, relative to the year round discharge options
- Potential mining of soil nutrients from insufficient nutrient loads relative to the export of nutrients in crops, depleting the soil nutrient pool reserves and reducing soil fertility, if wastewater is the only nutrient supply - risk reduced by addition of soil fertiliser/applications.
- Potential for acidification of the soil profile, resulting in release of cations and a reduction in soil microbial activity
- Some heavy metal accumulation likely to occur slowly over long periods of time e.g. but can be managed by phytoremediation and other soil treatment measures

1.5 Assessment table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below.

Table 2: Summary of overall assessment for Rivers, Coast and Groundwater and Soils.

Option	Variant	Assessment	FW	Coast	GW / soils	Overall score
1: R2(b)	River discharge with enhanced treatment	Manawatū River close to targets and limited options for adaptive management.	3	5	5	3
	River discharge with enhanced treatment + 75% DWF to land	Manawatū River likely to achieve targets but risk in dry years and uncertainty in modelling. Opportunity for adaptive management.	3.5	5	5	3.5
2: Dual R + L (b)	Two river discharge points (Tōtara Rd and Opiki) 75% ADWF to land during low flows.	Manawatū River has small ecological effects but load reduction less than other options.	4	4.5	4.5	4
3: L+R (a) & (b)	97% to land at <u>inland</u> sites *	Groundwater risk from large land area with year round irrigation.	4	5	3.5	3.5
	97% to land at <u>coastal</u> sites *	Small waterways near irrigation and groundwater risk.	4	4.5	4	4
4: L + R (d) & (e)	Land application to <u>inland</u> sites when river <80 m^3/s	Manawatū River discharge occurs at river flows above median.	4	4.5	4.5	4
	Land application to <u>inland</u> sites when river <62 m^3/s	Manawatū River discharge occurs at river flows below median	4	4.5	4.5	4
	Land application to <u>coastal</u> sites when river <80 m^3/s	Risk to small waterbodies near irrigation area due to the large land area extending into lake catchments.	3	4	4	3
	Land application to <u>coastal</u> sites when river <62 m^3/s	Risk to small waterbodies near irrigation area due to the large land area extending into lake catchments.	3	4	4	3
6: Ocean	Ocean * with 50% ADWF applied to land during summer	Coastal zone	5	4.5	5	4.5
	Ocean *	Coastal zone	5	4	5	4

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

* = Highest 3% of wastewater flows will still discharge to the Manawatū River at Tōtara Road.

Table 3: Scores and reasons for Freshwater Manawatu River and waterways near irrigation area.

No.	Option	Rivers	Manawatū	Waterways near irrigation		
		Score	Score	Score	Summary	Reason
1	R2b	3	3	5	Much better than current. Generally meets OP periphyton targets but possible occasional exceedance of OP periphyton targets. Little opportunity for adaptive management if exceedances occur.	Excessive periphyton growth (as in exceeding the nominal OP target for biomass and/or cover) will be substantially reduced in terms of their frequency, severity and spatial extent. However, risk that One Plan target may not be met (at 8% exceedance tolerance), especially at current monitoring site due to limited mixing. Key risk period remains long periods of low river flows especially in summer/early autumn. SIN and DRP concentrations at river flows< 20th FEP reduced by 92% and 50% respectively. Key uncertainties/risks: (1) periphyton modelling has high uncertainty. Cannot confirm if the OP periphyton target will be fully met and this would need carefully monitoring. Conversely the model likely over-estimates periphyton biomass as N and P get closer to upstream concentrations. (2) Wastewater treatment as proposed is understood to be at or near technological limit, with limited options to improve treatment further if in-river periphyton targets are not fully met. Adaptive management options are limited to: (1) improve mixing and/or increase length of the zone of reasonable mixing, (2) discharge all or part of the wastewater to land during low river flows (see option R2b(2)). Score would be lower if assuming no N removal in wetland.

No.	Option	Rivers	Manawatū	Waterways near irrigation		
1	R2b 2	3.5	3.5	5	A material improvement over R2b 1a with a higher certainty of meeting OP targets due to partial removal of the discharge during low river flows. But some occasional exceedances of OP periphyton target may still occur, e.g. during dry years. Ability for adaptive management by future expansion of land application if monitoring shows this is needed. Not as good for Manawatu as L+R (d) or (e). Very low risk of effects on local streams within irrigation area, as irrigation will only occur during dry season.	98% reduction in SIN and 40% reduction in DRP compared to current discharge. Full removal from river at low flows will avoid vast majority of periphyton issues. P managed at intermediate flow to control shoulder season periphyton. But some occasional exceedances of OP periphyton target may still occur and remaining uncertainty re. overall compliance with OP target (at 8% tolerance) during dry years. More resilient than R2b1 with ability for adaptive management to increase the % discharge to land if needed. This gives more comfort that periphyton effects can be managed within limits. Low risk of effects on local streams within irrigation area, as irrigation will only occur during dry season (high nutrient retention/low losses are expected). Also large buffers and N loading rates less than moderately intensive dairy so a possible in improvement in N in local streams concentrations.
2	Dual R + L (b)	4	4	5	Negligible effect at Tōtara Road. Negligible to small effects in Manawatu d/s Oroua. Adaptive management possible with land treatment component. Moderate improvement in N load. Low risk to local streams. N loading of 20kg N/ha/yr likely similar to current landuse. Discharge during summer low flow reduces risk of irrigation to any local waterways. Soils are P deficient so very little P loss.	Little impact at Totara Road as high periphyton biomass very rare at >62 m3/s. Little periphyton effect at d/s Opiki site due to habitat constraints. ca. 50% less SIN compared to current. Future resilience with ability to extend either treatment or land.

No.	Option	Rivers	Manawatū	Waterways near irrigation		
3	L+R (a)	4	5	4	Negligible effect on Manawatu River. Low risk to local waterways but irrigation is year round so high risk compared to option with a summer only discharge.	Negligible river effect on Manawatū River. Small risk to nearby waterways managed by buffers, leaching rate (21kg N/ha/yr) similar or better than current landuse and options to mitigate effects on local waterways with riparian planting/shading. Negligible P leaching. Potential benefits by increasing baseflow.
3	L+R (b)	4	5	4	Negligible effect on Manawatu River. Low risk to coastal streams and lakes due to buffers zones, mostly avoiding lake catchments and low leaching rate of 15 kg/ha/yr. Risk of limited land availability to apply the buffers.	Small risk to nearby waterways managed by buffers, mostly avoiding lake catchments, and low leaching rate (15 kg N/ha/yr) . Negligible P leaching. Irrigation mostly avoids lake catchments, avoids upgradient of all lakes and applies a min. 200m buffer. Score assumes local stream mitigation and N within NPS-FM. Potential to mitigate effects on local waterways with riparian planting/shading. Potential benefits by increasing baseflow.
4	L + R (d) 1	4	4	4.5	Only small effect on Manawatū River. A little more risk to the river than L+R(d)2 but room for adaptive management. Risk to local streams is low (little winter irrigation and low leaching rate).	Low risk of effects on periphyton in Manawatu at Totara Rd with discharges >62m3/s. Significant reduction in PNCC's contribution to in-river loads/concentrations. Very little more risk to Manawatu than L+R (d)2. Periphyton risk slightly higher than L+R(d)2 but not enough to justify different grading.
4	L + R (d) 2	4	4	4.5	Only small effect on Manawatū River with high flow discharges. Risk to local streams is low (little winter irrigation and low leaching rate).	Manawatū River periphyton risk slightly lower than Option L+R(d)1, but not enough to justify different grading. Risk to local streams is similar to L+R (a) but less winter irrigation and lower leaching rate (15 kg N/ha/yr) so reduced risk.

No.	Option	Rivers	Manawatū	Waterways near irrigation		
4	L + R (e) 1	3	4	3	Only small effect on Manawatū River. Moderate risk and uncertainty of effects on coastal streams and lakes due to large land area extending into lake catchments.	Low risk to Manawatū River periphyton as described in L&R(d)1. Land treatment area extends into the catchment of some coastal lakes. See discussion for L+R(e)2.
4	L + R (e) 2	3	4	3	Only small effect on Manawatū River with high flow discharges. Moderate risk and uncertainty of effects on coastal streams and lakes due to large land area extending into lake catchments.	Low risk to Manawatu River periphyton as described in L+R(d)2. Land treatment area is very large because no treatment for N, and extends over some lake catchments. Higher N leaching rate (20 kg N/ha/yr) than likely current landuse. Effect on local streams will depend on current state. Score will improve to 4 if treating N at source to 25 mg N/L.
	Ocean					
6	O -1	5	5	5	Negligible effect on Manawatu River. Negligible effect on local streams due to small land discharge, during summer and low N leaching rates.	No discharge to Manawatū River except at flood flows. Negligible effect on local streams due to small land discharge during summer (when high nutrient retention). Small N leaching rate of 10 kg/ha/yr. The small land area for irrigation allows options to avoid sensitive areas.
6	O -2	5	5	5	Negligible effect on freshwater systems or estuary.	No discharge to Manawatū River except at flood flows.

Table 4: Scores and reasons for the coastal environment.

No.	Option	Coastal	
		Score	**Reason**
1	R2b	5	Negligible increases in N and P concentrations in coastal water in the vicinity of the Manawatu River mouth. Note a 95% reduction in N load to coast compared to current discharge.
1	R2b 2	5	Negligible increases in N and P concentrations in coastal water in the vicinity of the Manawatu River mouth. Slightly improved over R2b but enough to change score.
2	Dual R + L (b)	4.5	Slight local increases in N and P concentrations in coastal water in the vicinity of the Manawatu River mouth. N load to coast a little less (about 15%) than current.
3	L+R (a)	5	Negligible effect on coastal waters
3	L+R (b)	4.5	Slight local increases in N concentrations in nearshore coastal water adjacent to land application sites (estimated 23,000 kg nitrogen leached per year) is possible. Negligible P.
4	L + R (d) 1	4.5	Slight local increases in N and P concentrations in coastal water in the vicinity of the Manawatū River mouth.
4	L + R (d) 2	4.5	Slight local increases in N and P concentrations in coastal water in the vicinity of the Manawatū River mouth.
4	L + R (e) 1	4	Slight local increases in N and P concentrations in coastal water in the vicinity of the Manawatū River mouth and in nearshore waters adjacent to land application sites (estimated 12,000 kg nitrogen leached per year).
4	L + R (e) 2	4	Slight local increases in N and P concentrations in coastal water in the vicinity of the Manawatū River mouth, and in nearshore waters adjacent to land application sites (estimated 16,000 kg nitrogen leached per year).
	Ocean		
6	O -1	4.5	Slight local increases in N, P and POM in discharge plume close to outfall diffuser, and some potential for POM deposition on seabed. Local increase in nitrogen in nearshore coastal waters because of an estimated 12,000 kg N leached from land application area per year. Discharge 2km offshore has high dilution and is well separated from sensitive near-shore coastal environments.
6	O -2	4	Slight to moderate local increases in N, P and POM in discharge plume close to outfall diffuser, and likely some POM deposition on seabed. Discharge 2km offshore has high dilution and is well separated from sensitive near-shore coastal environments.

Table 5: Scores and reasoning for Groundwater and Soil

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
		Score	Summary	Score	Reason	Score	Reason
1	R2b	5	No effects on GW or soil.	5	No significant discharge to groundwater	5	No significant soil impacts
1	R2b 2	5	Negligible effects on GW. Very low leaching rate of 7.5 kg M/ha/yr, likely less than current. Small land area, seasonal irrigation. Negligible effects on soil.	5	Very low leaching rates of 7.5 kg N/ha/yr estimated, lower than other permissible landuses on this soil. Comparatively the smallest land area of all Land-based options. Seasonal irrigation only. Existing land-use is intensive agricultural (High Production Exotic Grassland), so likely to have higher N application and leaching rates 'Downstream' position within catchment, primary groundwater discharge into the Manawatu River. Land area includes possible wetland sites which are likely to be groundwater supported Likely to have negligible groundwater effects, and some water quality and quantity/flow benefits expected.	5	Overall negligible/minimal soil effects expected. Key Risks outlined below - but all considered manageable under standard practices: - Potential for areas of compacted soil structure from mechanical harvest of the cut & carry crop, particularly when soils are at or above field capacity. Risk is reduced by the reduced period of wastewater application, relative to the year round discharge options - Potential mining of soil nutrients from insufficient nutrient loads relative to the export of nutrients in crops, depleting the soil nutrient pool reserves and reducing soil fertility, if wastewater is the only nutrient supply - risk reduced by addition of soil fertiliser/applications. - Potential for acidification of the soil profile, resulting in release of cations and a reduction in soil microbial activity - some heavy metal accumulation likely to occur slowly over long periods of time e.g, but can be managed by photoremediation and other soil treatment measures

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
2	Dual R + L (b)	4.5	Small effects on GW. Leaching rate of 20 kg M/ha/yr similar to current landuse. Negligible effects on soil.	4.5	Leaching rates of 20 kg N/ha/yr estimated, and is comparable or lower than other permissible landuses on these soils Comparatively the small land area of all Land-based options. Seasonal irrigation only. Existing land-use is intensive agricultural (High Production Exotic Grassland), so likely to have higher N application and leaching rates 'Downstream' position within catchment, primary groundwater discharge into the Manawatu River. Land area includes possible wetland sites which are likely to be groundwater supported Likely to have negligible groundwater effects, and some water quality and quantity/flow benefits expected.	5	as above

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
3	L+R (a)	3.5	Small to moderate effect on GW. Large land area for irrigation but leaching rates (20-27 kg N/ha/yr) likely similar or less than existing landuse. Year round application increases the risks. Small effect on soils but large land area being irrigated which increases risk.	3.5	Leaching rates of ~20-27 kg N/ha/yr estimated, and is comparable or lower than other permissible landuses on these soils Comparatively large land area of all Land-based options. Year-round irrigation requirement (less desirable). Existing land-use is intensive agricultural (High Production Exotic Grassland), so likely to have similar or potentially higher N application and leaching rates 'Downstream' position within catchment, primary groundwater discharge into the Manawatu River, but a number of stream/drains within the nominated area Land area includes possible wetland sites which are likely to be groundwater supported Likely to have less than minor adverse groundwater effects. Some water quantity/flow benefits expected (more so than the smaller LA options)	4	as above - but largest option and requires effectively year-round harvesting, so the overall risk is considered higher/more complex to manage

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
3	L+R (b)	4	Small effect on GW. Low leaching rate (15 kg N/ha/yr) but likely more than current landuse. Large land area but less than for L+R(a). Yearround application. Negligible to small effect on soils. Likely to stabilise soils but potential for small areas of compaction. Uptake of nutrients is less than cut and carry.	4	Generally low leaching rates of 15 kg N/ha/yr estimated, but generally greater than existing. Large land area required so total loading is high but less than for L+R(a) - due to addition N treatment at WWTP Year-round irrigation requirement (less desirable) Existing low-intensity or non-economic land-use. Mixture of mobile, dune systems, small proportion of exotic forestry, small proportion of agricultural. Vast majority of groundwater is likely to discharge into the marine environment. Set back will be required from dune lakes & freshwater bodies. Land area includes/borders wetland sites which are likely to be groundwater supported - but nature of these feature requires specific assessment e.g. perched or window? HRC suggests that existing groundwater quality may be nitrogen impacted. Requires confirmation. The option may provide groundwater quality improvements. Likely to have less than minor adverse groundwater effects. Some water quantity/flow benefits expected (more so than the smaller LA options).	4.5	Overall less than minimal soil effects, plus expected erosion reduction benefits (e.g. establish of forestry on presently easily erodible/movable soils) - Likely to stabilise soil structure on in areas on sandy dunes where erosion occurs - Potential for confined areas of compaction of soils occurring from tree maintenance and at harvest - but risks deemed manageable. - Uptake of nutrients per year is likely to be lower than cut and carry land uses, less ability to accumulate and remove heavy metals

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
4	L + R (d) 1	4.5	Small effect on GW. Low leaching rate (15 kg N/ha/yr) similar to current landuse. Seasonal application reduces risks. Negligible to small effect on soils. Uptake of nutrients is less than cut and carry.	4.5	Leaching rates of 15 kg N/ha/yr estimated, and is comparable or lower than other permissible landuses on these soils Comparatively the moderate land area of all Land-based options. Seasonal irrigation (but more shoulder season requirement than R2b and Dual R+L). Existing land-use is intensive agricultural (High Production Exotic Grassland), so existing landuse is likely to have higher N application and leaching rates 'Downstream' position within catchment, primary groundwater discharge into the Manawatu River, but a number of stream/drains within the nominated area Land area includes possible wetland sites which are likely to be groundwater supported Likely to have less than minor adverse groundwater effects. Some water quality and quantity/flow benefits expected. Low leaching rates of 15 kg N/ha/yr estimated. Lower than current Horizons requirements Current land-use is agricultural so maybe higher application and leaching rates	4.5	as above for L+R(a) - but lesser area

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
4	L + R (d) 2	4.5	Small effect on GW. Low leaching rate (15 kg N/ha/yr) similar to current landuse. Seasonal application reduces risks. Negligible to small effect on soils. Uptake of nutrients is less than cut and carry.	4.5	Groundwater is likely to discharge into the Manawatu River Land area includes 2 possible wetland sites which are likely to be groundwater supported Current shallow groundwater quality is relatively good. At least two shallow bores immediately downstream that may be affected Effects are manageable Leaching rates of 15 kg N/ha/yr estimated, and is comparable or lower than other permissible landuses on these soils Comparatively the moderate land area of all Land-based options. Seasonal irrigation (but more shoulder season requirement than R2b and Dual R+L). Existing land-use is intensive agricultural (High Production Exotic Grassland), so existing landuse is likely to have higher N application and leaching rates 'Downstream' position within catchment, primary groundwater discharge into the Manawatu River, but a number of stream/drains within the nominated area Land area includes possible wetland sites which are likely to be groundwater supported Likely to have less than minor adverse groundwater effects. Some water	4.5	as above for L+R(a) - but lesser area

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
		🟦		🟦	quality and quantity/flow benefits expected. Low leaching rates of 15 kg N/ha/yr estimated Lower than current Horizons requirements Current land-use is agricultural so maybe higher application and leaching rates Groundwater is likely to discharge into the Manawatu River Land area includes 2 possible wetland sites which are likely to be groundwater supported Current shallow groundwater quality is relatively good. At least two shallow bores immediately downstream that may be affected. Effects are manageable	🟦	

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
4	L + R (e) 1	4	Large land area reaquired. Low leaching rates (20 kg N/ha/yr) but greater than current landuse. Seasonal irrigation reduces risks. Needs setback from dune lakes. Small effect on soils. Likely to stabilise soils but potential for small areas of compaction. Large land area.	4	Generally low leaching rates of 20 kg N/ha/yr estimated, but generally greater than existing. Under TN- 35 mg/L effluent - second largest coastal site land area. Seasonal irrigation (but more so than O+L). Existing low-intensity or non-economic land-use. Mixture of mobile, dune systems, small proportion of exotic forestry, small proportion of agricultural. Vast majority of groundwater is likely to discharge into the marine environment. Set back will be required from dune lakes & freshwater bodies. Careful management required. Land area includes/borders wetland sites which are likely to be groundwater supported - but nature of these feature requires specific assessment e.g. perched or window? HRC suggests that existing groundwater quality may be nitrogen impacted. Requires confirmation. The option may provide groundwater quality improvements. Likely to have less than minor adverse groundwater effects. Some water quantity/flow benefits expected (more so than the smaller LA options).	4.5	as above for L+R(b) - but greater area

No.	Option	GW & Soil	GW & Soil		Groundwater		Soil
4	L + R (e) 2	4	Large land area reaquired. Low leaching rates (20 kg N/ha/yr) but greater than current landuse. Seasonal irrigation reduces risks. Needs setback from dune lakes. Small effect on soils. Likely to stabilise soils but potential for small areas of compaction. Large land area.	4	Generally low leaching rates of 20 kg N/ha/yr estimated, but generally greater than existing. Under TN- 35 mg/L effluent - largest coastal site land area. Seasonal irrigation (but more so than O+L, and the 60 m3/s option). Existing low-intensity or non-economic land-use. Mixture of mobile, dune systems, small proportion of exotic forestry, small proportion of agricultural. Vast majority of groundwater is likely to discharge into the marine environment. Set back will be required from dune lakes & freshwater bodies. Careful management required. Land area includes/borders wetland sites which are likely to be groundwater supported - but nature of these feature requires specific assessment e.g. perched or window? HRC suggests that existing groundwater quality may be nitrogen impacted. Requires confirmation. The option may provide groundwater quality improvements. Likely to have less than minor adverse groundwater effects. Some water quantity/flow benefits expected (more so than the smaller LA options).	4.5	as above for L+R(b) - but greater area
	Ocean						

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
6	O -1	5	Negligible effect on GW due to small scale application, and low leaching rates (10 kg N/ha/yr). Negligible effect on soils due to small scale application.	5	Low leaching rates of 10 kg N/ha/yr estimated, but generally greater than existing. Under TN- 35 mg/L effluent - smallest coastal site land area. Seasonal irrigation (lowest land proportion of the coastal options). Existing low-intensity or non-economic land-use. Mixture of mobile, dune systems, small proportion of exotic forestry, small proportion of agricultural. Vast majority of groundwater is likely to discharge into the marine environment. Set back will be required from dune lakes & freshwater bodies. Careful management required. Land area includes/borders wetland sites which are likely to be groundwater supported - but nature of these feature requires specific assessment e.g. perched or window? HRC suggests that existing groundwater quality may be nitrogen impacted. Requires confirmation. The option may provide groundwater quality improvements. Likely to have less than negligible/minimal adverse groundwater effects. Likely to have minimal negative effects.	5	as above for L+R(b) - but smallest scale

No.	Option	GW & Soil	GW & Soil	Groundwater		Soil	
6	O -2	5	No discharge to GW or soils.	5	No discharge to groundwater	5	No soil impacts

Appendix 1: Additional information used in the assessments

Wastewater quality used in assessing the option O-2 (all to ocean).

O-2 All to ocean, no P treatment

	wastewater quality	Assumed background	Dilution @ 100m (x-fold)	Concentration @100m	One Plan Target for seawater
TSS	40	10	100	10.3	none
TP	4.5	0.005	100	0.05	0.01
TN	35	0.03	100	0.38	0.06
ammonia-N	22	0.01	100	0.23	0.5

Table 3 from PDP (2020b) used to assess N uptake from land treatment systems

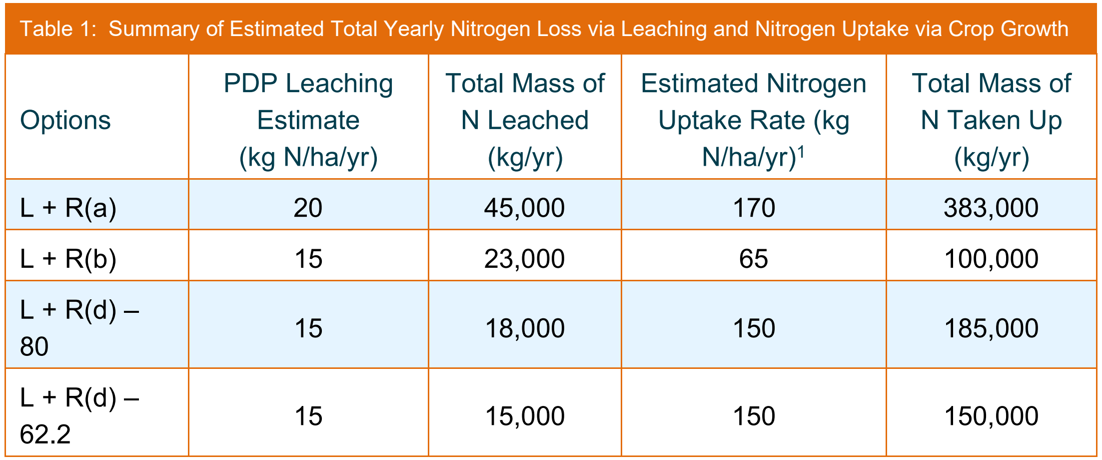

Table 1: Summary of Estimated Total Yearly Nitrogen Loss via Leaching and Nitrogen Uptake via Crop Growth

Options	PDP Leaching Estimate (kg N/ha/yr)	Total Mass of N Leached (kg/yr)	Estimated Nitrogen Uptake Rate (kg N/ha/yr)[1]	Total Mass of N Taken Up (kg/yr)
L + R(a)	20	45,000	170	383,000
L + R(b)	15	23,000	65	100,000
L + R(d) – 80	15	18,000	150	185,000
L + R(d) – 62.2	15	15,000	150	150,000

Table 1: Summary of Estimated Total Yearly Nitrogen Loss via Leaching and Nitrogen Uptake via Crop Growth

L + R(e) – 80 (TN = 10 mg/L)	20	16,000	65	52,000
L + R(e) – 62.2 (TN = 10 mg/L)	17.5	12,000	60	43,000
Dual R+L (c)	20	10,000	135	71,000
Dual R+L (b)	20	14,000	135	92,000
O + L (TN = 10 mg/L)	10	4,500	55	23,000
R2(b) – 50%	7.5	2,500	5	1,000
R2(b) – 75%	7.5	3,500	5	1,000

Notes

1. *Nitrogen uptake estimate excludes any fertiliser that may be applied to increase crop yield.*

1 Public Health Risk Comparative Qualitative Assessment of Short-listed Options

1.1 Introduction

This report sets out the Public Health Risk comparative qualitative assessment of the short-listed options for the Palmerston North Wastewater BPO project ("Nature Calls"). The output of this paper will be used in Multicriteria Assessment (MCA) of the shortlisted options.

The draft report was prepared by:

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The following personnel have been involved with the development of the paper prior to the MCA workshop:

- Aslan Perwick, Groundwater Services Leader, PDP (Land application options)
- David Cameron, Principal Environmental Scientist, Stantec (Ocean outfall options)
- Olivier Ausseil, River Scientist, Aquanet (River discharge options)

The following representatives from public health have provided input and advice into the methodology and assessment of exposure pathways, which has been invaluable. Their contribution is gratefully recognised especially given the constraints on their time at the current time. They have not undertaken a detailed review of the assessment and do not provide an endorsement of the results of the assessment:

- Dr Stephen Palmer, Medical Officer of Health, MidCentral Public Health Services
- Brett Munro, Health Protection Officer, MidCentral Public Health Services

1.2 Criterion and Scoring Approach

To the authors knowledge, there is no published, standard method for undertaking a qualitative assessment of public health risk associated with the discharge of treated wastewater. The methodology used in this assessment has been developed based on the standard risk assessment matrix approach coupled with the exposure pathway methodology previously adopted by some members of this project team for the Ruakaka wastewater project undertaken for Whangarei District Council. This project involved the comparison of a number of options in a qualitative way based on an exposure pathway assessment and an assessment of the degree of difficulty in controlling public health risks.

The authors note that there is an established methodology for the Quantitative Public Health Risk Assessment or Quantitative Microbial Risk Assessment (QPHRA or QMRA) and we understand that this will be undertaken for the preferred Best Practicable Option (BPO) to support consent applications. The authors have developed three potential criteria that could be used to assess the risk to public health from the shortlisted options.

The first criterion is based on a qualitative assessment of the degree to which the option has the potential to result in health risks to the public as a result of exposure to treated wastewater. As elaborated on below this is based on the critical (lowest) MCA score of all pathways assessed. This follows a precautionary principle.

The second and third criteria are based on the number of exposure pathways that have been conceptualised for each option. This relates to the extent to which the treated wastewater can interact with the public and hence the degree of difficulty in controlling the public health risks and extent of the control measures that will need to be implemented in order to mitigate the identified risks. These criteria can be developed based on either on the total number of all conceptualised exposure pathways (criterion 2) or on the number of identified critical exposure pathways (criterion 3).

The scoring approach for all three criteria is given in Table 1 and half scores in the 1 to 5 range will be used as necessary when the risk falls between a whole a number. The options have been scored against all three criteria and are provided for consideration to the MCA workshop.

Table 1: MCA scoring

Criterion	Description	MCA score:	1	2	3	4	5
Public Health 1	Potential for health risk to the public as a result of exposure to treated wastewater (including through land application) based on qualitative assessment of public health risk	Narrative description of MCA score:	extreme	high	medium	low	none[1]
2	Potential for health risk to the public as a result of exposure to treated wastewater (including through land application) based on potential degree of difficulty in controlling public health risk	Number of all conceptualised exposure pathways	Option with most exposure pathways	Rated according to number of pathways			Option with least exposure pathways
3	Potential for health risk to the public as a result of exposure to treated wastewater (including through land application) based on potential degree of difficulty in controlling public health risk	Number of critical exposure pathways	Option with most exposure pathways	Rated according to number of pathways			Option with least exposure pathways

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[1] None: indicates that there were no exposure pathways for the option where treated wastewater could reach the public.

1.3 Approach to the assessment

1.3.1 Qualitative Risk Matrix

The health risk to the public is assessed through the qualitative assessment of individual exposure pathways from the discharge of the treated wastewater to the member(s) of the public who is/are placed at risk. All complete conceivable exposure pathways are considered for each option with each pathway being scored. A complete exposure pathway is one where the treated wastewater will reach the member of the public. Any conceived incomplete exposure pathways will be documented for completeness.

Given that this is a public health assessment and hence we have adopted the precautionary principle, the overall score used for the option will be the critical (lowest) score of all the pathways assessed.

The approach to the public health risk assessment is a qualitative assessment based on the expertise and judgements of the specialist authors.

The scale of the public health effect that could result from the exposure scenario is considered as well as the frequency with which it may occur over the course of a 35 year consent term (the maximum allowed under the RMA). These factors are assessed and combined using the framework in Table 2.

Given that Table **2** forms the basis for the allocation of the risk rating, it is important, that the authors review and accept the form of the table and the allocation of the ratings to the various scales and frequencies of event. This should be reviewed as part of the assessment workshop.

Table 2: Qualitative Risk Matrix

		Scale of Public Health Effect				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Frequency of Exposure	Almost Certain	*High*	*High*	*Extreme*	*Extreme*	*Extreme*
	Likely	*Medium*	*High*	*High*	*Extreme*	*Extreme*
	Possible	*Low*	*Medium*	*High*	*Extreme*	*Extreme*
	Unlikely	*Low*	*Low*	*Medium*	*High*	*Extreme*
	Rare	*Low*	*Low*	*Low*	*Medium*	*High*
	None	*None*	*None*	*None*	*None*	*None*

For each exposure pathway, the “scale of the public health effect” from the exposure to the pathogens or contaminants in the treated wastewater resulting from the exposure pathway will be rated according to the classes in the columns (i.e. insignificant, minor, moderate, major, catastrophic). The general definitions of the scale of the public health effects that has been followed in the assessment are:

- Insignificant: illness resulting from the treated wastewater discharge is indiscernible above the normal background level of illness in the community.
- Minor: health effects are limited to a single person, single household or single group of people who can be readily identified and contacted by the public health authorities and the consent holder for appropriate advice who experience a minor illness
- Moderate: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a minor illness
- Major: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a moderate illness, which may be dangerous to sensitive members of the community
- Catastrophic: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a major illness, which is likely to be dangerous to sensitive members of the community

Then, the “frequency of exposure” with which the exposure pathway could occur is also rated with the classes in the rows (i.e. almost certain, likely, possible, unlikely, rare, none). These frequencies are defined by considering the number of potential incidences of the public health effect occurring over the potential 35 year period of the consent term.

The body of Table **2** (coloured section, red, orange, yellow, green, blue) is used to combine the two ratings of the scale and frequency of the exposure pathway into a qualitative risk rating (i.e. low, medium, high, extreme).

If no conceivable exposure pathway can be developed that can connect the treated wastewater to the public, then the public health risk will be rated as none and the MCA will be 5 as given in Table 1.

1.3.2 Definition of Exposure Pathway

The components of the exposure pathways that will be developed are:

- the discharge points from which the treated wastewater could be released from the infrastructure (outfall, spray irrigation through land application system, wetland, land passage, pipeline)
- the environment between the point of release and the potential exposure sites to the public
- the exposure route through which the public comes into contact with the treated wastewater.

The normal operation and the conceivable other discharge scenarios will be considered separately and will include:

- primary discharge site, being the outfall or land application site. This will include discharge:
  - to fresh and marine waters

    - to land
    - to air through aerosol/spray
- conceivable other discharge scenarios between the wastewater treatment plant (WWTP) and the primary discharge site, such as pipeline breakage, spillage, or overflow.

The interactions between the treated wastewater and the environment will significantly alter the nature of the risk being posed particularly in terms of dilution and frequency of exposure. A conceptual model of the transfer of the treated wastewater from the discharge point to the exposure site will be developed for each pathway. This will be developed for the conceptual exposure site that in the judgement of the authors would result in the highest potential for risk (i.e. the site which combines the most number of people exposed, the lowest level of dilution prior to exposure, etc).

The potential exposure routes that will be considered are:

- Recreation
    - Primary contact[2]
    - Secondary contact[3]
    - Public recreation within the land application land holding area[4]
- Food gathering and consumption (shellfish, fish, watercress etc.)[5]
    - Recreational
    - Commercial / aquaculture
    - Customary
- Drinking water
    - Surface water
    - Groundwater
    - Tank water[6]
- Inhalation[6]

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[2] recreational activities such as swimming, paddling, boating, or watersports, and particularly for activities where there is a high likelihood of water or water vapour being ingested or inhaled (based on NPS-FM 2020)

[3] People’s contact with fresh water that involves only occasional immersion and includes wading or boating (except boating where there is high likelihood of immersion).

[4] Assumed that adequate controls would be included to ensure separation from active treated wastewater application areas.

[5] Risk from gathering in surface water affected by treated wastewater and also potentially crops and animals affected by spray drift and impacted stock water

[6] Risk associated with spray drift from land application

1.4 Assumptions applied in the Assessment

In undertaking the assessment, the following assumptions have been made:

- Assumes that the wastewater is treated to sufficient standard that public health risk associated with the primary discharge site are considered acceptable and would be consentable. The wastewater for each route will be treated using different treatment methods and hence be of different qualities as required to achieve the required protection of environmental effects. The different treatment methods and resultant pathogen and contaminant loads are noted in the following assessment tables. We note that given this assumption, all options should be rated with a risk of low. However, each option is not yet fully developed. Each option has been assessed in accordance with our current understanding of the controls that have been included in the design and costing at this stage in the project. This has meant that some options have been given a risk rating of medium. It is expected that if these options are carried forward as the preferred BPO option then the exposure pathways will be rigorously assessed as part of the further development of the option such that the risk of all exposure pathways for the option are reduced to low.
- The assessment does not consider “out of specification” wastewater, or wastewater with pathogens or contaminants which are significant greater than anticipated by the design and operation of the WWTP and included in the consent conditions.[7]
- The assessment is undertaken assuming that there is no significant outbreak of illness in the community which would cause elevated concentrated of pathogens in the wastewater. The impact of this effect will be assessed at the stage of the quantitative public health risk assessment for the selected option.
- The public health risk considered for the exposure pathways includes that from pathogens for all exposure pathways, and nitrogen for the water supply pathway. The assessment of water supply is on the basis of the maximum acceptable value for nitrate concentrations of 50 mg nitrate /L (equivalent to 11.8 mg-N/L) in NZDWS 2018[8]
- Risk from emerging contaminants and heavy metals to human health is not considered in this assessment. Whilst these are important for the assessment of the impact of the discharges on aquatic and soil ecosystems, they are not considered relevant to human health at this level
- The following matters have not been included in this assessment
  - Worker contact (outside WWTP) as a result of management of land application areas and operations in conjunction with farming. This would be covered by appropriate work safe practices with appropriate training and PPE and hence is excluded
  - Worker contact as a result of pipe breakages, as above
  - Worker contact within the WWTP and wetlands / land passage, as above
  - Odour generation – this is considered to be a nuisance effect
  - Mental health / perception – this is addressed under the Social and Community considerations criterion
  - Māori health and wellbeing following the Mason Durie Model or other acceptable model or approaches
- Wastewater beneficial reuse options that could be part of any option e.g. irrigation of reserves and golf courses, industrial reuse and others have not been included in this assessment. (Refer to other work packages for beneficial reuse/resource recovery options)

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[7] Incidents involving discharge of “out of specification” wastewater will be managed to reduce public exposure and hence risks appropriately.

[8] Note that concern about potential risk of bowel cancer associated with nitrate in drinking water at lower concentrations is not assessed.

- For those options where there can be a 3% discharge to the Manawatu River (to cover exceptional circumstances), this discharge has not been included in the assessment as it is expected to occur at times of exceptionally high river flows.

1.5 Assessment

1.5.1 Option naming

The following are the Short-listed Options and naming as is being used for all criteria. The areas of the land schemes are shown in the maps as indicated. These areas are the nominal areas of the schemes and include buffer zones and set backs as appropriate. Irrigation will not be undertaken to the entire area.

Table 3: Shortlisted Options

Option[9]	Variant
1: R2(b)	River discharge with enhanced treatment
	River discharge with enhanced treatment, and a small % to land on fluvial plane
2: Dual R + L	Two river discharge points and a small % to land
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time
	55 % applied to an inland land application site and a river discharge for the remainder of the time
	45 % applied to a coastal land application site and a river discharge for the remainder of the time
	55 % applied to a coastal land application site and a river discharge for the remainder of the time
6: Ocean	Ocean discharge, with a small % to land
	Ocean discharge

The sub-options for treated wastewater applied to an land application site and a river discharge for the remainder of the time (L + R (d) & (e)) for 45% and the 55% are considered the same for this assessment will not be separately scored.

1.5.2 Option Assessment

Table 4 is a summary of the MCA qualitative public health risk score determined as set out above.

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[9] Option 5 has been deleted from the shortlist

Table 5 is a summary of the difficulty in controlling public health risk. Criterion 2 includes all exposure pathways. Criterion 3 includes the number of critical exposure pathways. Draft MCA scores are given for both cases.

Appendix 1 (tables 6-14) contains the detailed assessment exposure pathways that has been completed for each option to document all the exposure pathways considered. All assumptions and definitions made in the table are documented in footnotes to the tables.

Where options include multiple discharge options, i.e. discharge to land and ocean or river, all exposure pathways for all routes will be assessed for the options. Where options have different relative proportions of the same elements (i.e. 55% land and 45% river versus 97% land and 3% river), the assessment of the scale of risk will be the same for the exposure pathways. However, there could be an assessed difference in the frequency of exposure. This has resulted in differences between options.

The critical exposure pathways have been identified in bold in the Appendix 1 tables for each of the options.

1.6 Assessment Summary

Table 4 and Table 5 sets out the preliminary assessment of the options by the authors according to the three criteria proposed in this assessment. This will be used as a starting point for discussion at the MCA workshop. Any change to the public health scoring will be performed while the public health experts are available for discussion. The final MCA assessment and score may therefore differ from what is set out below. We recommend that the MCA workshop adopt the rating developed from the degree of difficulty in controlling potential for public health risk based on the number of critical exposure pathways as highlighted in bold in Table 5. Figure 1 shows the range of scores as a bar chart.

Table 4: MCA Score Summary based on Qualitative Public Health Risk (Criterion 1)

Options[10]	Option Description	Critical Qualitative Risk Rating	Draft MCA Score
1: R2(b)	River discharge with enhanced treatment	High	2
	River discharge with enhanced treatment, and a small % to land	High	2
2: Dual R + L	Two river discharge points and a small % to land	High	2
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	High	2
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	High	2
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	High	2
	55 % applied to an inland land application site and a river discharge for the remainder of the time	High	2
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	High	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	High	2
6: Ocean	Ocean discharge, with a small % to land	High	2
	Ocean discharge	High	2

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[10] Option 5 has been deleted from the short list.

Table 5: MCA Score Summary based on degree of difficulty in controlling public health risk (Criteria 2 and 3)

Options[11]	Option Description	Number of all exposure pathways (Criterion 2)	Draft MCA score	Number of critical exposure pathways (Criterion 3)	Draft MCA Score
1: R2(b)	River discharge with enhanced treatment	9	3	4	**4**
	River discharge with enhanced treatment, and a small % to land	28	1	6	**2.5**
2: Dual R + L	Two river discharge points and a small % to land	28	1	4	**4**
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	19	1.5	5	**3**
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	20	1.5	4	**4**
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	28	1	5	**3**
	55 % applied to an inland land application site and a river discharge for the remainder of the time	28	1	5	**3**
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	29	1	8	**2**
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	29	1	8	**2**
6: Ocean	Ocean discharge, with a small % to land	20	1.5	6	**2.5**
	Ocean discharge	6	5	3	**5**

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[11] Option 5 has been deleted from the short list.

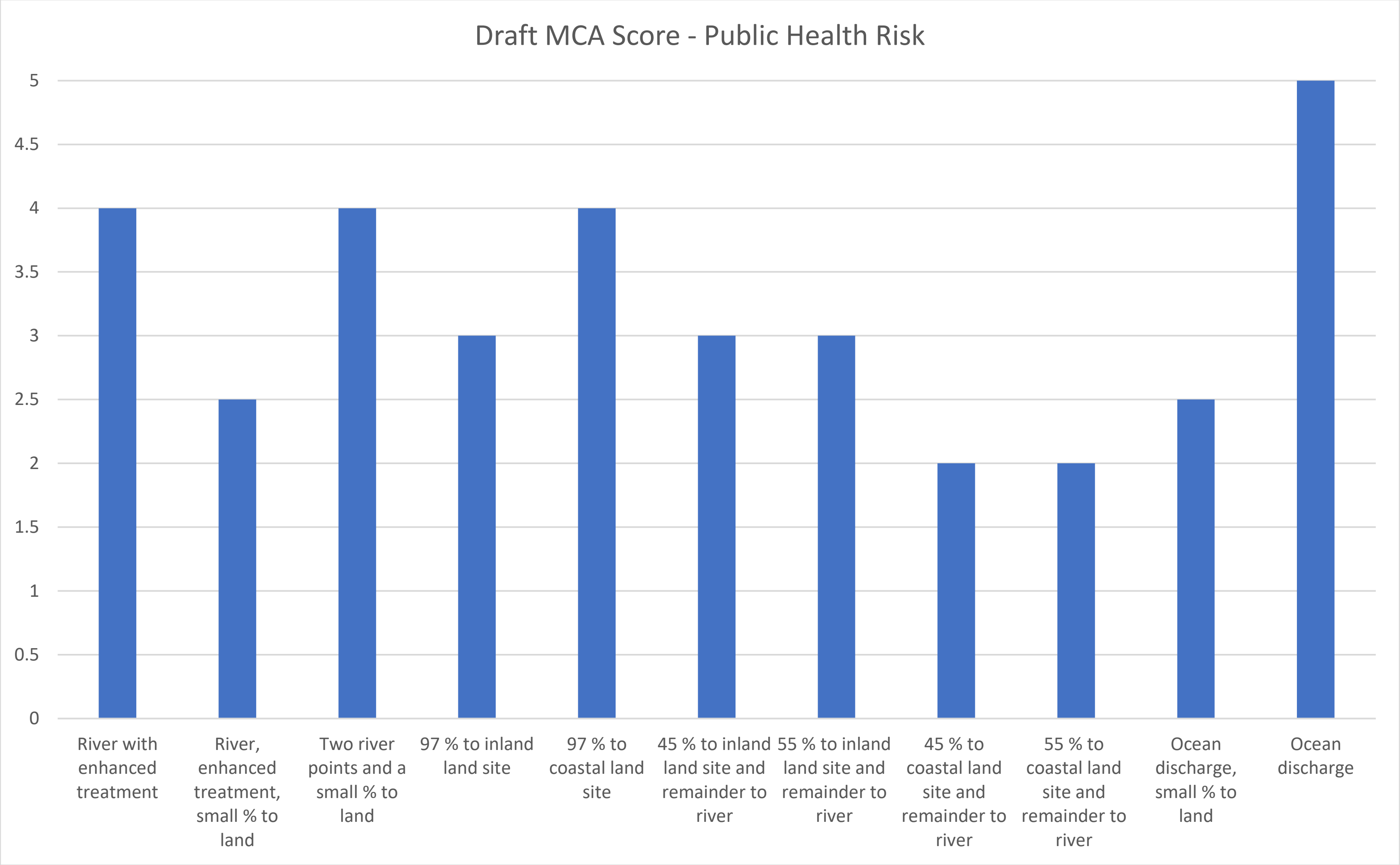

Figure 1: Recommended Draft MCA Scores based on degree of difficulty in controlling potential for public health risk based on the number of critical exposure pathways

Appendix 1: Public Health Risk Tables: Detailed Assessment of Exposure Pathways

Option 1 R2(b) River Discharge with Enhanced Treatment

#	Exposure Pathways - Option 1 R2(b)	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	**main discharge[12] direct to Manawatu River at WWTP with contact recreation in river downstream above Opiki**	**Moderate[13]**	**Likely**	**High**
2	**main discharge direct to Manawatu River at WWTP with contact recreation in river downstream below Opiki**	**Minor**	**Almost Certain**	**High**
3	main discharge direct to Manawatu River at WWTP with water take for current untreated domestic drinking water from river downstream	Moderate	Rare/None[14]	Low/None
4	main discharge direct to Manawatu River at WWTP with water take for potential future untreated domestic drinking water from river downstream	Moderate	Rare/Unlikely	Low/medium
5	main discharge direct to Manawatu River at WWTP with recreational food gathering of water cress from river downstream	Moderate	Unlikely	Medium
6	**main discharge direct to Manawatu River at WWTP with recreational food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
7	**main discharge direct to Manawatu River at WWTP with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Minor**	**Likely**	**High**

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[12] Enhanced treatment with membrane and UV, therefore very low levels of pathogens.

[13] Due to very high level of treatment with multiple barriers. With distance downstream, dilution increases and hence risk of illness reduces. The risk of illness from the treated wastewater will need to be assessed in more detail in later stages of the project.

[14] There are no current consented water takes from the Manawatu River. However, there may be takes under the permitted activity rules.

#	Exposure Pathways - Option 1 R2(b)	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
8	main discharge to wetland before discharge to Manawatu River - recreational gathering of water cress from wetland	Insignificant/minor[15]	Rare/None[16]	Low/None
9	main discharge to wetland before discharge to Manawatu River - recreational gathering of shellfish, fish or eels from wetland	Insignificant/minor	Rare/None	Low/None
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[15] If birds gather on the wetland then some potential for pathogens carried by birds to be deposited in the wetlands. However current design is for fully vegetated wetlands which are less attractive to birds which reduces this risk.

[16] Public access to the wetland will be restricted as it is part of the WWTP.

Option 1 R2(b) River discharge with enhanced treatment, and a small % to land at enhance treatment (50% of the dry weather flows when river flows are low)

#	Exposure Pathways - Option 1 R2(b) with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	**main discharge[17] direct to Manawatu River at WWTP with contact recreation in river downstream above Opiki**	**Moderate[18]**	**Likely**	**High**
2	**main discharge direct to Manawatu River at WWTP with contact recreation in river downstream below Opiki**	**Minor**	**Almost certain**	**High**
3	main discharge direct to Manawatu River at WWTP with water take for drinking water from river downstream	Moderate	Rare/None	Low/None
4	main discharge direct to Manawatu River at WWTP with water take for potential future untreated domestic drinking water from river downstream	Moderate	Rare/unlikely	Low/medium
5	main discharge direct to Manawatu River at WWTP with recreational food gathering of water cress from river downstream	Moderate	Unlikely	Medium
6	**main discharge direct to Manawatu River at WWTP with recreational food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
7	**main discharge direct to Manawatu River at WWTP with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
8	main discharge to wetland before discharge to Manawatu River - recreational gathering of water cress from wetland	Insignificant/minor[19]	Rare/None[20]	Low/None

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[17] Enhanced treatment with membrane and UV, therefore very low levels of pathogens.

[18] Due to very high level of treatment with multiple barriers. With distance downstream, dilution increases and hence risk of illness reduces. The risk of illness from the treated wastewater will need to be assessed in more detail in later stages of the project.

[19] If birds gather on the wetland then some potential for pathogens carried by birds to be deposited in the wetlands. However current design is for fully vegetated wetlands which are less attractive to birds which reduces this risk.

[20] Public access to the wetland will be restricted as it is part of the WWTP.

#	Exposure Pathways - Option 1 R2(b) with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
9	main discharge to wetland before discharge to Manawatu River - recreational gathering of shellfish, fish or eels from wetland	Insignificant/minor	Rare/None	Low/None
10	**main discharge to land then shallow groundwater to bore used as domestic water supply[21]**	**Insignificant[22]**	**Almost certain**	**High**
11	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[23]	Insignificant[24]	Rare[25]	Low
12	main discharge to air then spray drift[26] to neighbours within application area and inhaled	Insignificant	Rare[27]	Low
13	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Insignificant	None[28]	None
14	main discharge to air then spray drift to public recreating on land within land application area[29]	Insignificant	Rare	Low
15	main discharge to land then shallow groundwater to Manawatu River with contact recreation in river above Opiki	Insignificant	Possible	Low

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[21] All bores within scheme are replaced or appropriately managed with public water supply so only bores outside of scheme are potentially affected and assessed here. Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is insignificant.

[22] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[23] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[24] Given level of treatment through WWTP and land and at least 100m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[25] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[26] Centre pivot with wind control with buffer zones and wind planting included around the schemes.

[27] Mitigation measures render spray drift of aerosol to neighbours rare

[28] Assume that all potentially affected houses will be provided with alternative domestic water supply

[29] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

#	Exposure Pathways - Option 1 R2(b) with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
16	**main discharge to land then shallow groundwater to Manawatu River with contact recreation in river downstream below Opiki**	**Insignificant**	**Almost Certain**	**High**
17	main discharge to land then shallow groundwater to Manawatu River with water take for current or potential future untreated domestic drinking water from river downstream	Insignificant	Rare	Low
18	main discharge to land then shallow groundwater to Manawatu River with recreational and customary gathering of water cress from river downstream	Insignificant	Unlikely	Low
19	main discharge to land then shallow groundwater to Manawatu River with recreational and customary food gathering of shellfish, fish (incl eels) from river downstream	Insignificant	Likely	Medium
20	main discharge to land then shallow groundwater to Manawatu River with current or potential commercial food gathering of shellfish, fish (incl eels) from river downstream	Insignificant	Likely	Medium
21	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams[30]	Insignificant	Possible[31]	Low
22	main discharge to land then shallow groundwater then streams and drains with recreational gathering of water cress, shellfish or fish (incl eels) from streams and drains	Minor	Possible	Medium
23	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish or fish (incl eels) from streams and drains	Minor	Unlikely[32]	Low

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[30] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[31] Access to the >3000ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

[32] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

#	Exposure Pathways - Option 1 R2(b) with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
24	main discharge to land then shallow groundwater then streams and drains with current or potential commercial gathering of shellfish or fish (incl eels) from streams and drains	Minor	Unlikely	Low
25	main discharge to land then direct[33] as surface runoff to streams and drains with secondary contact recreation in streams within the application area	Insignificant	Rare	Low
26	transfer pipe breakage[34] discharge of treated WW to surface water[35] where contact recreation occurs	Minor	Rare	Low
27	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[36]	Minor	Rare	Low
28	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[37]	Minor	Rare	Low
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[33] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[34] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[35] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[36] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[37] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

Option 2: Dual R+L Two river discharge points and a small % to land (all of treated wastewater to land at low river flow)

#	Exposure Pathways - Option 2: Dual R+L	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	main discharge[38] direct to Manawatu River at WWTP or Opiki with contact recreation in river downstream above Opiki	Moderate	Unlikely[39]	Medium
2	main discharge direct to Manawatu River at WWTP or Opiki with contact recreation in river downstream below Opiki	Minor	Possible	medium
3	main discharge direct to Manawatu River at WWTP or Opiki with water take for untreated domestic drinking water from river downstream	Moderate[40]	Rare/None	Low/None
4	main discharge direct to Manawatu River at WWTP or Opiki with water take for potential future untreated domestic drinking water from river downstream	Moderate	Rare/None	Low/None
5	main discharge direct to Manawatu River at WWTP or Opiki with recreational gathering of water cress from river downstream	Minor	Unlikely	Low
6	**main discharge direct to Manawatu River at WWTP or Opiki with recreational gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
7	**main discharge direct to Manawatu River at WWTP with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Minor**	**Likely**	**High**
8	main discharge to wetland before discharge to Manawatu River - recreational gathering of water cress from wetland	Insignificant/minor[41]	Rare/None[42]	Low/None

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[38] Biological treatment with clarification and UV, residual level of pathogens remain

[39] During low flow discharge will be removed from the river to land, during slightly higher flow discharge will be at Opiki below which the river is not conducive to significant contact recreation due to its form. Discharge direct to the river just below the WWTP is only during higher river flows when dilution is higher and contact recreation is less prevalent.

[40] There will significant dilution in the river by the point of any take given the discharge scenario which would reduce the risk, however, there is not as high a level of treatment as the river only option.

[41] If birds gather on the wetland then some potential for pathogens carried by birds to be deposited in the wetlands. However current design is for fully vegetated wetlands which are less attractive to birds which reduces this risk.

[42] Public access to the wetland will be restricted as it is part of the WWTP.

#	Exposure Pathways - Option 2: Dual R+L	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
9	main discharge to wetland before discharge to Manawatu River - recreational gathering of shellfish, fish or eels from wetland	Insignificant/minor	Rare/None	Low/None
10	**main discharge to land then shallow groundwater to bore used as domestic water supply**[43]	**Insignificant**[44]	**Almost certain**	**High**
11	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[45]	Moderate[46]	Rare[47]	Low
12	main discharge to air then spray drift[48] to neighbours within application area and inhaled	Moderate	Rare[49]	Low
13	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[50]	None
14	main discharge to air then spray drift to public recreating on land within land application area[51]	Moderate	Rare	Low
15	main discharge to land then shallow groundwater to Manawatu River with contact recreation in river above Opiki	Moderate	Unlikely[52]	Medium

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[43] All bores within scheme are replaced or appropriately managed with public water supply so only bores outside of scheme are potentially affected and assessed here. Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is insignificant.

[44] Given level of treatment through WWTP and ground and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[45] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[46] Given level of treatment through WWTP and ground and at least 100m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[47] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[48] Centre pivot with wind control with buffer zones and wind planting included around the schemes.

[49] Mitigation measures render spray drift of aerosol to neighbours rare

[50] Assume that all potentially affected houses will be provided with alternative domestic water supply

[51] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

[52] Treated wastewater discharge is not directed to river when most recreation activity would occur

#	Exposure Pathways - Option 2: Dual R+L	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
16	**main discharge to land then shallow groundwater to Manawatu River with contact recreation in river downstream below Opiki**	**Moderate**	**Possible**	**High**
17	main discharge to land then shallow groundwater to Manawatu River with water take for current or potential future untreated domestic drinking water from river downstream	Insignificant/minor	Rare	Low
18	main discharge to land then shallow groundwater to Manawatu River with recreational gathering of water cress from river downstream	Insignificant/minor	Unlikely	Low
19	main discharge to land then shallow groundwater to Manawatu River with recreational food gathering of shellfish, fish (incl eels) from river downstream	Insignificant/minor[53]	Likely	Medium/high
20	main discharge to land then shallow groundwater to Manawatu River with current or potential commercial food gathering of shellfish, fish (incl eels) from river downstream	Insignificant/minor	Likely	Medium/high
21	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams[54]	Minor	Possible[55]	Medium
22	main discharge to land then shallow groundwater then streams and drains with recreational gathering of water cress, shellfish or fish (incl eels) from streams and drains	Minor	Possible	Medium
23	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish or fish (incl eels) from streams and drains	Minor	Unlikely[56]	Low

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[53] Scheme is not being operated to optimise land treatment, therefore cannot reduce scale of public health effect to reflect probable increased treatment through land resulting from application during low river flow.

[54] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[55] Access to the 970ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

[56] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

#	Exposure Pathways - Option 2: Dual R+L	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
24	main discharge to land then shallow groundwater then streams and drains with current or potential commercial gathering of shellfish or fish (incl eels) from streams and drains	Minor	Unlikely	Low
25	main discharge to land then direct[57] as surface runoff to streams and drains with contact recreation in streams within the application area	Minor	Rare	Low
26	transfer pipe breakage[58] discharge of treated WW to surface water[59] where contact recreation occurs	Moderate	Rare	Low
27	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[60]	Moderate	Rare	Low
28	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[61]	Moderate	Rare	Low
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[57] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[58] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[59] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[60] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[61] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

Option 3: L+R (a) 97 % applied to an inland land application site and a discharge to river in exceptional circumstances

#	Exposure Pathways - Option 3: L+R (a) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	main discharge[62] to land then shallow groundwater to bore used as domestic water supply[63]	Insignificant[64]	Possible[65]	Low
2	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[66]	Moderate[67]	Rare[68]	Low
3	main discharge to air then spray drift[69] to neighbours within application area and inhaled	Moderate	Rare[70]	Low
4	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[71]	None
5	main discharge to air then spray drift to public recreating on land within land application area[72]	Moderate	Rare	Low
6	**main discharge to land then shallow groundwater to Manawatu River with contact recreation in river above Opiki**	**Moderate**	**Possible**	**High**

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[62] Biological treatment with clarification and UV, residual level of pathogens remain

[63] All bores within scheme are replaced or appropriately managed with public water supply so only bores outside of scheme are potentially affected and assessed here. Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is insignificant.

[64] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[65] Low density of population results in low potential for drinking bores

[66] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[67] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[68] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[69] Centre pivot with wind control with buffer zones and wind planting included around the schemes.

[70] Mitigation measures render spray drift of aerosol to neighbours rare

[71] Assume that all potentially affected houses will be provided with alternative domestic water supply

[72] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

#	Exposure Pathways - Option 3: L+R (a) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
7	**main discharge to land then shallow groundwater to Manawatu River with contact recreation in river downstream below Opiki**	**Minor**	**Almost certain**	**High**
8	main discharge to land then shallow groundwater to Manawatu River with water take for current or potential future untreated domestic drinking water from river downstream	Insignificant/minor	Rare	Low
9	main discharge to land then shallow groundwater to Manawatu River with recreational gathering of water cress from river downstream	Insignificant/minor	Unlikely	Low
10	**main discharge to land then shallow groundwater to Manawatu River with recreational food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
11	**main discharge to land then shallow groundwater to Manawatu River with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
12	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams[73]	Insignificant	Possible[74]	Low
13	**main discharge to land then shallow groundwater then streams and drains with recreational gathering of water cress, shellfish or fish (incl eels) from streams and drains**	**Moderate**	**Possible**	**High**
14	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish or fish (incl eels) from streams and drains	Moderate	Unlikely[75]	Medium

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[73] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[74] Access to the >3000ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

[75] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

#	Exposure Pathways - Option 3: L+R (a) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
15	main discharge to land then shallow groundwater then streams and drains with current or potential commercial gathering of shellfish or fish (incl eels) from streams and drains	Moderate	Unlikely	Medium
16	main discharge to land then direct[76] as surface runoff to streams and drains with secondary contact recreation in streams within the application area	Minor	Rare	Low
17	transfer pipe breakage[77] discharge of treated WW to surface water[78] where contact recreation occurs	Moderate	Rare	Low
18	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[79]	Moderate	Rare	Low
19	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[80]	Moderate	Rare	Low
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[76] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[77] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[78] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[79] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[80] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

Option 3: L+R (b) 97 % applied to a coastal land application site and a discharge to river in exceptional circumstances

#	Exposure Pathways - Option 3: L+R (b) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	main discharge[81] to land then shallow groundwater to bore used as domestic water supply[82]	Minor/moderate[83]	Rare[84]	Low
2	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[85]	Moderate[86]	Rare[87]	Low
3	main discharge to air then spray drift[88] to neighbours[89] and inhaled	Moderate	Rare[90]	Low
4	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[91]	None
5	main discharge to air then spray drift to public recreating on land within land application area[92]	Moderate	Rare	Low
6	main discharge to land[93] then shallow groundwater to Coastal Lakes with contact recreation[94] in lakes	Insignificant/minor	Likely	Medium/high

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[81] Biological treatment with clarification and UV, residual level of pathogens remain

[82] All bores within scheme are replaced with public water supply so only bores outside of scheme are potentially affected.

[83] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[84] Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is low.

[85] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[86] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[87] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[88] Solid State spray into trees with wind control with buffer zones included around the schemes.

[89] Distance to neighbour is unknown but minimal neighbours around this site.

[90] Mitigation measures render spray drift of aerosol to neighbours unlikely. Minimal houses around the coastal land application area

[91] Assume that all potentially affected houses will be provided with alternative domestic water supply

[92] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

[93] Most of the treated wastewater will be applied downgradient of the Coastal Lakes and only a minor fraction will be applied upgradient.

[94] Lakes are not suitable for primary recreation as shallow, muddy and macrophyte dominated, but are used for duck shooting and could be used for kayaking and other secondary contact recreation

#	Exposure Pathways - Option 3: L+R (b) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
7	main discharge to land then shallow groundwater to Coastal lakes with recreational gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/Medium
8	main discharge to land then shallow groundwater to Coastal lakes with customary gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/medium
9	main discharge to land then shallow groundwater to Coastal lakes with commercial gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/medium
10	**main discharge to land then shallow groundwater to coast with contact recreation[95] on beach**	**Insignificant[96]**	**Almost certain**	**High**
11	**main discharge to land then shallow groundwater to coast with recreational gathering of shellfish[97] on beach**	**Minor**	**Almost certain**	**High**
12	**main discharge to land then shallow groundwater to coast with commercial gathering of shellfish on beach**	**Minor**	**Almost certain**	**High**
13	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams[98]	Minor	Possible[99]	Medium
14	**main discharge to land then shallow groundwater then streams and drains with recreational gathering of watercress, shellfish, fish (incl eels) from streams and drains**	**Moderate**	**Possible**	**High**

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[95] Beaches near Himatangi Beach and Foxton Beach are well used public beaches. The shallow groundwater potentially containing treated wastewater will enter the beach and children could interact directly with this affected groundwater, albeit following significant treatment through the land and at significant dilutions.

[96] Travel time between the application area and the beach is a minimum of 1 year and probably more likely to be 5-10 years. This will allow considerable reduction in pathogens and reduction in risk of illness.

[97] There are shellfish beds on the beach adjacent to the potential land application site from which the public can gather shellfish

[98] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[99] Access to the >3000ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

#	Exposure Pathways - Option 3: L+R (b) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
15	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish, fish (incl eels) from streams and drains	Moderate	Unlikely[100]	Medium
16	main discharge to land then shallow groundwater then streams and drains with current or potential future commercial food gathering of watercress, shellfish, fish (incl eels) from streams and drains	Moderate	Unlikely	Medium
17	main discharge to land then direct[101] to streams and drains with secondary contact recreation in streams	Insignificant	Rare	Low
18	transfer pipe breakage[102] discharge of treated WW to surface water[103] where contact recreation occurs	Moderate	Rare	Low
19	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[104]	Moderate	Rare	Low
20	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[105]	Moderate	Rare	Low

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[100] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

[101] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[102] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[103] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[104] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[105] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

#	Exposure Pathways - Option 3: L+R (b) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
	Resultant Risk level for Option: (critical of all pathways)			**High**

Option 4: L + R (d) 45% or 55%[106] applied to an inland land application site and a river discharge for the remainder of the time

#	Exposure Pathways - Option 4: L + R (d) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	main discharge[107] to land then shallow groundwater to bore used as domestic water supply[108]	Insignificant[109]	Possible	Low
2	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[110]	Moderate[111]	Rare[112]	Low
3	main discharge to air then spray drift[113] to neighbours within application area and inhaled	Moderate	Rare[114]	Low
4	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[115]	None
5	main discharge to air then spray drift to public recreating on land within land application area[116]	Moderate	Rare	Low
6	main discharge to land then shallow groundwater to Manawatu River with contact recreation in river above Opiki	Minor	Possible	Medium

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[106] For this assessment the 45% and 55% options are considered to be equivalent and have the same scoring

[107] Biological treatment with clarification and UV, residual level of pathogens remain

[108] All bores within scheme are replaced or appropriately managed with public water supply so only bores outside of scheme are potentially affected and assessed here. Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is insignificant.

[109] Given level of treatment and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[110] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[111] Given level of treatment and at least 100m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[112] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[113] Centre pivot with wind control with buffer zones and wind planting included around the schemes.

[114] Mitigation measures render spray drift of aerosol to neighbours rare

[115] Assume that all potentially affected houses will be provided with alternative domestic water supply

[116] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

#	Exposure Pathways - Option 4: L + R (d) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
7	**main discharge to land then shallow groundwater to Manawatu River with contact recreation in river downstream below Opiki**	**Moderate**	**Likely**[117]	**High**
8	main discharge to land then shallow groundwater to Manawatu River with water take for current or potential future untreated domestic drinking water from river downstream	Insignificant/minor	Rare	Low
9	main discharge to land then shallow groundwater to Manawatu River with recreational gathering of water cress from river downstream	Insignificant/minor	Unlikely	Low
10	main discharge to land then shallow groundwater to Manawatu River with recreational food gathering of shellfish, fish (incl eels) from river downstream	Insignificant/minor[118]	Likely	Medium/high
11	main discharge to land then shallow groundwater to Manawatu River with current or potential commercial food gathering of shellfish, fish (incl eels) from river downstream	Insignificant/minor	Likely	Medium/high
12	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams[119]	Insignificant	Possible[120]	Low
13	**main discharge to land then shallow groundwater then streams and drains with recreational gathering of water cress, shellfish or fish (incl eels) from streams and drains**	**Moderate**	**Possible**	**High**

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[117] The treated wastewater is removed from the river during low flow and hence by the time the discharge reaches the river below Opiki it is either highly dilute which will reduce the public health risk or is not present when recreational activities take place which would be in lower flow conditions.

[118] Scheme is not being operated to optimise land treatment, therefore cannot reduce scale of public health effect to reflect probable increased treatment through land resulting from application during low river flow.

[119] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[120] Access to the 1700ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

#	Exposure Pathways - Option 4: L + R (d) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
14	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish or fish (incl eels) from streams and drains	Minor	Unlikely[121]	Low
15	main discharge to land then shallow groundwater then streams and drains with current or potential commercial gathering of shellfish or fish (incl eels) from streams and drains	Minor	Unlikely	Low
16	main discharge to land then direct[122] as surface runoff to streams and drains with secondary contact recreation in streams within the application area	Minor	Rare	Low
17	transfer pipe breakage[123] discharge of treated WW to surface water[124] where contact recreation occurs	Moderate	Rare	Low
18	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[125]	Moderate	Rare	Low
19	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[126]	Moderate	Rare	Low

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[121] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

[122] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[123] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[124] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[125] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[126] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

#	Exposure Pathways - Option 4: L + R (d) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
20	main discharge[127] direct to Manawatu River at WWTP with contact recreation in river downstream above Opiki	Moderate	Unlikely[128]	Medium
21	**main discharge direct to Manawatu River at WWTP with contact recreation in river downstream below Opiki**	**Moderate**	**Possible**	**High**
22	main discharge direct to Manawatu River at WWTP with water take for untreated domestic drinking water from river downstream	Moderate[129]	Rare/None	Low/None
23	main discharge direct to Manawatu River at WWTP with water take for potential future untreated domestic drinking water from river downstream	Moderate	Rare/None[130]	Low/None
24	main discharge direct to Manawatu River at WWTP with recreational gathering of water cress from river downstream	Moderate	Unlikely	Medium
25	**main discharge direct to Manawatu River at WWTP with recreational gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
26	**main discharge direct to Manawatu River at WWTP with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
27	main discharge to wetland before discharge to Manawatu River - recreational gathering of water cress from wetland	Insignificant/minor[131]	Rare/None[132]	Low/None

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[127] Biological treatment with clarification and UV, residual level of pathogens remain

[128] During lower flow discharge will be removed from the river to land. Discharge direct to the river just below the WWTP is only during higher river flows, when dilution is higher and contact recreation is less prevalent.

[129] There will significant dilution in the river by the point of any take given the discharge scenario which would reduce the risk, however, there is not as high a level of treatment as the river only option. Risk of illness from the treated wastewater will need to be assessed in more detail. With distance downstream, dilution increases and hence risk of illness reduces.

[130] There are no current consented water takes from the Manawatu River. However, there may be takes under the permitted activity rules.

[131] If birds gather on the wetland then some potential for pathogens carried by birds to be deposited in the wetlands. However current design is for fully vegetated wetlands which are less attractive to birds which reduces this risk.

[132] Public access to the wetland will be restricted as it is part of the WWTP.

#	Exposure Pathways - Option 4: L + R (d) inland	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
28	main discharge to wetland before discharge to Manawatu River - recreational gathering of shellfish, fish or eels from wetland	Insignificant/minor	Rare/None	Low/None
	Resultant Risk level for Option: (critical of all pathways)			**High**

Option 4: L + R (e) 45% or 55%[133] applied to a coastal land application site and a river discharge for the remainder of the time

#	Exposure Pathways - Option 4: L + R (e) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	main discharge[134] to land then shallow groundwater to bore used as domestic water supply[135]	Minor/moderate[136]	Rare[137]	Low
2	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[138]	Moderate[139]	Rare[140]	Low
3	main discharge to air then spray drift[141] to neighbours[142] and inhaled	Moderate	Rare[143]	Low
4	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[144]	None
5	main discharge to air then spray drift to public recreating on land within land application area[145]	Moderate	Rare	Low

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[133] For this assessment the 45% and 55% options are considered to be equivalent and have the same scoring

[134] Biological treatment with clarification and UV, residual level of pathogens remain

[135] All bores within scheme are replaced with public water supply so only bores outside of scheme are potentially affected.

[136] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[137] Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is low.

[138] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[139] Given level of treatment and at least 600m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[140] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[141] Solid State spray into trees with wind control with buffer zones included around the schemes.

[142] Distance to neighbour is unknown but minimal neighbours around this site.

[143] Mitigation measures render spray drift of aerosol to neighbours unlikely. Minimal houses around the coastal land application area

[144] Assume that all potentially affected houses will be provided with alternative domestic water supply

[145] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

#	Exposure Pathways - Option 4: L + R (e) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
6	main discharge to land[146] then shallow groundwater to Coastal Lakes with contact recreation[147] in lakes	Insignificant/minor	Likely	Medium/high
7	main discharge to land then shallow groundwater to Coastal lakes with recreational gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/Medium
8	main discharge to land then shallow groundwater to Coastal lakes with customary gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/medium
9	main discharge to land then shallow groundwater to Coastal lakes with commercial gathering of watercress, shellfish, fish (incl eels) from lakes	Insignificant/minor	Possible	Low/medium
10	**main discharge to land then shallow groundwater to coast with contact recreation[148] on beach**	**Minor[149]**	**Almost certain**	**High**
11	**main discharge to land then shallow groundwater to coast with recreational gathering of shellfish[150] on beach**	**Minor**	**Almost certain**	**High**
12	**main discharge to land then shallow groundwater to coast with commercial gathering of shellfish on beach**	**Minor**	**Almost certain**	**High**
13	main discharge to land then shallow groundwater then streams and drains with contact recreation in streams	Minor	Unlikely[151]	Low

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[146] Most of the treated wastewater will be applied downgradient of the Coastal Lakes and only a minor fraction will be applied upgradient.

[147] Lakes are not suitable for primary recreation as shallow, muddy and macrophyte dominated, but are used for duck shooting and could be used for kayaking and other secondary contact recreation

[148] Beaches near Himatangi Beach and Foxton Beach are well used public beaches. The shallow groundwater potentially containing treated wastewater will enter the beach and children could interact directly with this affected groundwater, albeit following significant treatment through the land and at significant dilutions.

[149] Travel time between the application area and the beach is a minimum of 1 year and probably more likely to be 5-10 years. This will allow considerable reduction in pathogens and reduction in risk of illness.

[150] There are shellfish beds on the beach adjacent to the potential land application site from which the public can gather shellfish

[151] Due to depth and nature of streams, contact recreation is unlikely

#	Exposure Pathways - Option 4: L + R (e) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
14	**main discharge to land then shallow groundwater then streams and drains with recreational gathering of watercress, shellfish, fish (incl eels) from streams and drains**	**Moderate**	**Possible**[152]	**High**
15	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish, fish (incl eels) from streams and drains	Moderate	Unlikely[153]	Medium
16	main discharge to land then shallow groundwater then streams and drains with current or potential future commercial food gathering of watercress, shellfish, fish (incl eels) from streams and drains	Moderate	Unlikely	Medium
17	main discharge to land then direct[154] to streams and drains with secondary contact recreation in streams	Insignificant	Rare	Low
18	transfer pipe breakage[155] discharge of treated WW to surface water[156] where contact recreation occurs	Moderate	Rare	Low
19	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[157]	Moderate	Rare	Low

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[152] Access to the 1700ha application area will be controlled and hence incidence of collection from streams and drains will be reduced. All streams downstream of the application (to the west) could be impacted by the treated wastewater and is included in this pathway.

[153] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified.

[154] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[155] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[156] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[157] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

#	Exposure Pathways - Option 4: L + R (e) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
20	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[158]	Moderate	Rare	Low
21	**main discharge[159] direct to Manawatu River at WWTP with contact recreation in river downstream above Opiki**	**Moderate**	**Possible[160]**	**High**
22	**main discharge direct to Manawatu River at WWTP with contact recreation in river downstream below Opiki**	**Moderate**	**Likely**	**High**
23	main discharge direct to Manawatu River at WWTP with water take for untreated domestic drinking water from river downstream	Moderate[161]	Rare/None	Low/None
24	main discharge direct to Manawatu River at WWTP with water take for potential future untreated domestic drinking water from river downstream	Moderate	Rare/unlikely	Low/medium
25	main discharge direct to Manawatu River at WWTP with recreational gathering of water cress from river downstream	Moderate	Unlikely	Medium
26	**main discharge direct to Manawatu River at WWTP with recreational gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**

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[158] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

[159] Biological treatment with clarification and UV, residual level of pathogens remain

[160] During lower flow discharge will be removed from the river to land. Discharge direct to the river just below the WWTP is only during higher river flows, when dilution is higher and contact recreation is less prevalent.

[161] There will significant dilution in the river by the point of any take given the discharge scenario which would reduce the risk, however, there is not as high a level of treatment as the river only option.

#	Exposure Pathways - Option 4: L + R (e) coastal	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
27	**main discharge direct to Manawatu River at WWTP with current or potential customary or commercial food gathering of shellfish, fish (incl eels) from river downstream**	**Moderate**	**Likely**	**High**
28	main discharge to wetland before discharge to Manawatu River - recreational gathering of water cress from wetland	Insignificant/minor[162]	Rare/None[163]	Low/None
29	main discharge to wetland before discharge to Manawatu River - recreational gathering of shellfish, fish or eels from wetland	Insignificant/minor	Rare/None	Low/None
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[162] If birds gather on the wetland then some potential for pathogens carried by birds to be deposited in the wetlands. However current design is for fully vegetated wetlands which are less attractive to birds which reduces this risk.

[163] Public access to the wetland will be restricted as it is part of the WWTP.

Option 6 Ocean: Ocean discharge, with a small % to land (half of the average dry flow in November to April)

#	Exposure Pathways - Option 6 Ocean with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	**main discharge[164] through outfall[165] to beach contact rec**	**Moderate**	**Possible**	**High**
2	**main discharge through outfall to recreational fishing/shellfish gathering**	**Moderate**	**Possible**	**High**
3	**main discharge through outfall to potential future commercial aquaculture**	**Moderate**	**Possible**	**High**
4	main discharge to land then shallow groundwater to bore used as domestic water supply[166]	Minor/moderate[167]	Rare[168]	Low
5	main discharge to land then shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as commercial water supply for horticulture or irrigation[169]	Moderate[170]	Rare[171]	Low
6	main discharge to air then spray drift[172] to neighbours[173] and inhaled	Moderate	Rare[174]	Low
7	main discharge to air then spray drift to neighbour's roof used to supply tank water for untreated domestic water supply	Moderate	None[175]	None

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[164] Biological treatment with clarification and UV, residual level of pathogens remain

O[165] outfall is 2km from coast. This results in significant dilutions at beach, and plume will generally not go to beach but will travel offshore

[166] All bores within scheme are replaced with public water supply so only bores outside of scheme are potentially affected.

[167] Given level of treatment through WWTP and land and at least 600m of distance through aquifer, large removal of pathogens expected. Increase in nitrate concentrations as a result of the treated wastewater application is expected to be less than NZDWS 2018 MAV. Note that groundwater concentration may already be elevated.

[168] Domestic water supply bores have small drawdown zone of 10m and hence risk of incorporating groundwater affected by treated wastewater plume is low.

[169] A commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route.

[170] Given level of treatment and at least 600m of distance through aquifer, large removal of pathogens expected. Given the larger volume of use and the wider number of people potentially exposed to the pathogens, the scale of the effect is considered larger than the domestic water supply bore.

[171] As part of the scheme all bores in the application area will be sealed to prevent this pathway, however some bores may be missed and hence there is a risk that this route may remain open.

[172] Solid State spray into trees with wind control with buffer zones included around the schemes.

[173] Distance to neighbour is unknown but minimal neighbours around this site.

[174] Mitigation measures render spray drift of aerosol to neighbours unlikely. Minimal houses around the coastal land application area

[175] Assume that all potentially affected houses will be provided with alternative domestic water supply

#	Exposure Pathways - Option 6 Ocean with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
8	main discharge to air then spray drift to public recreating on land within land application area[176]	Moderate	Rare	Low
9	main discharge to land[177] then shallow groundwater to Coastal Lakes[178] with secondary contact recreation[179] in lakes	Insignificant/minor	Rare/None	None/Low
10	**main discharge to land then shallow groundwater to coast with primary contact recreation[180] on beach**	**Moderate[181]**	**Likely**	**High**
11	**main discharge to land then shallow groundwater to coast with recreational gathering of shellfish[182] on beach**	**Moderate**	**Likely**	**High**
12	**main discharge to land then shallow groundwater to coast with customary or commercial gathering of shellfish on beach**	**Moderate**	**Likely**	**High**
13	main discharge to land then shallow groundwater then streams and drains[183] with contact recreation in streams[184]	Minor	Unlikely[185]	Low

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[176] Assume that public will be kept from the active spray areas and hence any exposure to spray drift will be subsequent to adequate mitigation measures

[177] Most of the treated wastewater will be applied downgradient of the Coastal Lakes and only a minor fraction will be applied upgradient.

[178] Application area is downgradient of lakes and hence the plume is unlikely to travel towards them especially as application is restricted to summer months and restricted to half of average dry weather.

[179] Lakes are not suitable for primary recreation as shallow, muddy and macrophyte dominated, but are used for duck shooting and could be used for kayaking and other secondary contact recreation

[180] Beaches near Himatangi Beach and Foxton Beach are well used public beaches. The shallow groundwater potentially containing treated wastewater will enter the beach and children could interact directly with this affected groundwater, albeit following significant treatment through the land and at significant dilutions.

[181] Travel time between the application area and the beach is a minimum of 1 year and probably more likely to be 5-10 years. This will allow considerable reduction in pathogens and reduction in risk of illness.

[182] There are shellfish beds on the beach adjacent to the potential land application site from which the public can gather shellfish

[183] Application area restricted to sandy dunes and is not in the coastal hinterland behind the sand dunes where most of the streams and drains are located. There is still a stream that runs along the northern edge of the application area. Given that application restricted to summer months, and reduced flows, potential for discharge to streams is reduced from year round operation.

[184] Assume that primary contact not feasible in streams and drains due to depth and nature of streams

[185] Application area is relatively small and access to potentially affected streams and drains can be controlled such that exposure is unlikely.

#	Exposure Pathways - Option 6 Ocean with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
14	main discharge to land then shallow groundwater then streams and drains with recreational gathering of watercress, shellfish, fish (incl eels) from streams and drains	Minor	Unlikely	Low
15	main discharge to land then shallow groundwater then streams and drains with customary gathering of watercress, shellfish, fish (incl eels) from streams and drains	Minor	Unlikely[186]	Low
16	main discharge to land then shallow groundwater then streams and drains with current or potential future commercial food gathering of watercress, shellfish, fish (incl eels) from streams and drains	Minor	Unlikely	Low
17	main discharge to land then direct[187] to streams and drains with secondary contact recreation in streams	Insignificant	Rare	Low
18	transfer pipe breakage[188] discharge of treated WW to surface water[189] where contact recreation occurs	Moderate	Rare	Low
19	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[190]	Moderate	Rare	Low
20	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to	Moderate	Rare	Low

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[186] To reduce the public health risk, any stream or drain potentially impacted by the treated wastewater plume would be excluded from a customary or commercial gathering operation. The mechanism for this would need to be codified. The area potentially affected is smaller than other options.

[187] The land application areas will be designed, operated and maintained to ensure that surface runoff is minimised and that applied treated wastewater is discharge via land to the shallow groundwater. Therefore this pathway is considered to be rare for all the exposure pathways associated with this discharge route.

[188] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[189] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[190] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

#	Exposure Pathways - Option 6 Ocean with land	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
	bore used as municipal or commercial water supply for horticulture or irrigation[191]			
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[191] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

Option 6 Ocean: Ocean discharge

#	Exposure Pathways - Option 6 Ocean	Scale of Public Health Risk	Frequency of Exposure	Qualitative Risk Rating
1	**main discharge[192] through outfall[193] to beach contact rec**	**Moderate**	**Possible**	**High**
2	**main discharge through outfall to recreational fishing/shellfish gathering**	**Moderate**	**Possible**	**High**
3	**main discharge through outfall to potential future commercial aquaculture**	**Moderate**	**Possible**	**High**
4	transfer pipe breakage[194] discharge of treated WW to surface water[195] where contact recreation occurs	Moderate	Rare	Low
5	transfer pipe breakage discharge of treated WW to shallow groundwater to bore used as domestic water supply[196]	Moderate	Rare	Low
6	transfer pipe breakage discharge of treated WW to land then surface water or shallow groundwater then intermediate groundwater via inadequately sealed bore in application area to bore used as municipal or commercial water supply for horticulture or irrigation[197]	Moderate	Rare	Low
	Resultant Risk level for Option: (critical of all pathways)			**High**

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[192] Biological treatment with clarification and UV, residual level of pathogens remain

[193] outfall is 2km from coast. This results in significant dilutions at beach, and plume will generally not go to beach but will travel offshore

[194] Pipe normally below ground, but pressure from pumping will result in high pressure release at the surface of the treated wastewater. Stream crossing will be below or as pipe bridges but will be above ground.

[195] The pipeline between the WWTP and the outfall crosses a number of minor tributaries with low flow and no major recreational areas. No swimming areas, so would be suitable for wading / playing and not swimming.

[196] It is assumed that any pipe break can be identified within 24 hour timeframe, and any impacted private bores would be identified and its use would be stopped. During the design phase, all water supply bores in the vicinity of the route will be identified and a log of the contact details of the water supplies by the scheme operator will be maintained during the life of the scheme to facilitate the public health response.

[197] A municipal or commercial water supply bore will be for a large water take with a larger drawdown area and hence will potentially be impacted by a wider area of impact. This will increase the risk that the bore could be impacted by a plume from this route. We assume that the municipal supply will include treatment which will reduce risk and any commercial operation can control subsequent supply of product to the public to minimise exposure.

1 Cultural Comparative Assessment of Short-listed options

1.1 Introduction

This report sets out the Rangitāne o Manawatū cultural comparative assessment of the short-listed options for the Palmerston North Wastewater BPO Project (“Nature Calls”).

The report was prepared by:

- Rangitāne o Manawatū representatives over a number of hui and wananga.

1.2 Criterion and Scoring Approach

Criterion	Description	1	2	3	4	5
Rangitāne Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Rangitāne o Manawatū, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga	Destruction of Rangitāne culture, connections and kaitiakitanga. Critical effect on Rangitāne o Manawatū	Significant effect or impact on all aspects of Rangitāne Mana, Toanga, Atua and natural resources	Major impact on all aspects of Rangitāne significant sites and natural resources	Minimal impact on Rangitāne significant sites and natural resources	Minimal to no effect on Rangitāne o Manawatū

1.3 Approach to the Assessment

The assessment was undertaken by the Rangitāne representatives. Rangitāne o Manawatū also invited neighbouring Iwi to a hui to go through the options as well. This hui was attended by representatives from Ngati Apa, Muaupoko and Ngati Kauwhata. Throughout the hui impacts on key cultural parameters were identified and discussed. However to be clear this paper does not seek to speak on their behalf or is their official response. They have their own mana and speak for themselves. The key parameters identified were;

Rangitāne O Manawatū Values
Mana Whenua
1. Will the activity uphold ROM mana?
Taonga
2. Does the activity impact our taonga and significant cultural sites in a negative way?
Mauri
3. Does the activity negatively impact mauri in our rohe?
Wairua
4. If there are effects from an activity will they negatively impact whanau ora, health and well-being?

Rangitāne O Manawatū Whenua Landscapes
Manawatū River
5. Is the activity impacting or impeding our kaitiakitanga over our taonga the River and its role to nourish our rohe and people?
Wetlands
6. Is there a negative impact on our wetlands?
Coast
7. Is the activity negatively impacting on the (Hauora) cultural health of our coastlines?
Dunes
8. Will the sand dune landforms be disrupted?
Mountains
9. Will the activity impact on our sacred peaks?

Rangitāne O Manawatu atua

Ranganui
10. Is Ranganui being respected?
Papatuanuku
11. Is Papatuanuku being cared for?
Tangaroa
12. Is Tangaroa still connected and in balance?

Haumia-tiketike
13. Is *Haumia-tiketike* still productive?
Rongomatane
14. Is *Rongomatane still cared for?*

Nga Uri o Rangitāne o Manawatu
15. Is this acceptable to our people.

1.4 Assumptions Applied in the Assessment

- We undertook our assessment with a focus on Rangitāne o Manawatū values only.
- Rangitāne o Manawatū maintains an initial position that any wastewater treatment process or system needs to start with ensuring investment is made on constantly improving the treatment methods to ensure that the wastewater eventually is at a "drinking water" standard. This is the preferred long-term "number 1" option. However, beyond this our scores are focussed on those options as currently presented to us.
- There is an assumption in the scores presented that the landuse of any future development will not result in a landuse which is more damaging to the current environment that the current landuse. Simply we are assuming that in the land application options that there is no intensification on landuse beyond the current landuse. We would also expect to be involved in landuse options as well.
- There is an assumption from Rangitāne o Manawatū that in those areas selected where significant cultural and historic sites exist that there will be no further negative impacts on those sites and that significant mitigation is envisaged to protect them further in partnership with us.

1.5 Assessment Table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below.

Option	Variant	Assessment	Draft score
1: R2(b)	River discharge with enhanced treatment	The impacts on Rangitāne mana and one of the most significant taonga (river) is not acceptable. That option and activity has a negative flow on effect through all aspects of Rangitāne culture (fatally flawed).	1
	River discharge with enhanced treatment, and a small % to land	The impacts on Rangitāne mana and one of the most significant taonga (river) is not acceptable. That option and activity has a negative flow on effect through all aspects of Rangitāne culture (fatally flawed).	1
2: Dual R + L	Two river discharge points and a small % to land	The impacts on Rangitāne mana and one of the most significant taonga (river) is not acceptable. That option and activity has a negative flow on effect through all aspects of Rangitāne culture (fatally flawed).	1
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	Minimal effect or impact on Rangitāne o Manawatū. However there are still impacts on Rangitāne significant cultural and historic sites. Rangitāne mana less impacted if the site is maintained in the Manawatu.	4
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	Minor issues however there are still impacts on Rangitāne significant cultural and historic sites. Rangitāne are only open to one possible site which is near Tangimoana yet the impacts to coastal resources (wetlands and shellfish beds) are of significant concern.	3

Option	Variant	Assessment	Draft score
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	There are major effects or impacts on all aspects of Rangitāne mana, taonga, atua and natural resources compounding the effects on Nga Uri o Rangitāne.	2
	55 % applied to an inland land application site and a river discharge for the remainder of the time	The impacts on Rangitāne taonga and culture could be considered major. Concerns remain on the impact to significant cultural and historic sites requiring investigation. Rangitāne mana less impacted if site is maintained in the Manawatu.	3
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	There are significant impacts on all aspects of Rangitāne mana, taonga, atua and natural resources resulting in compounding effects to Nga Uri o Rangitāne.	2
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	Impact on all aspects of Rangitāne mana, taonga, atua and natural resources compounding to effect Nga uri o Rangitāne.	2
6: Ocean	Ocean discharge, with a small % to land	Significant to critical impacts on Rangitāne mana and culture as well as direct impacts to Nga Uri o Rangitāne who perceive this area as the last relatively untouched culturally important natural resource. (fatally flawed).	1
	Ocean discharge	Significant to critical impacts on Rangitāne mana and culture as well as direct impacts to Nga Uri o Rangitāne who perceive this area as the last relatively untouched culturally important natural resource. (fatally flawed).	1

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

1 Resilience Comparative Assessment of Short-listed Options

1.1 Introduction

This report sets out the Resilience comparative assessment, as part of the Multi-Criteria Assessment (MCA) process of the short-listed options for the Palmerston North Wastewater BPO project ("Nature Calls").

Resilience can be described as the ability of a system or organisation to respond to, or recover readily from, a crisis, disruptive process etc.

The report was prepared by:

- Overall Assessment of options
    - Rita Whitfield – Stantec Graduate Civil Engineer
    - Anna Bridgman – Stantec Group Manager/ Senior Civil Engineer
    - Peter Brown – Stantec Senior Civil Engineer
    - Jim Bradley – Stantec Technical Specialist
- Assessment of treatment element of options
    - Michael Tan – Stantec Process Engineer
    - Andrew Slaney – Stantec Senior Process Engineer
- Assessment of land treatment element of options
    - Luke Wilkinson – PDP Environmental Engineer
    - Aslan Perwick – PDP Groundwater Service Leader

1.2 Criterion and scoring approach

The overall scoring is as per the table below. Each of the two sub-criteria were scored with regards to how well the option aligned with that sub-criteria. The overall score is an average of these scores, with each sub-criteria given equal weighting. Average has been used rather than the lowest score as it is not believed that any one of these sub-criteria is the governing factor in the selection of the BPO.

Criterion	Description	1	2	3	4	5
Resilience	Degree to which the option is resilient to • natural hazards • climate change	Low degree of resilience	Low – Medium degree of resilience	Medium degree of resilience	Medium – High degree of resilience	High degree of resilience

1.3 Approach to the assessment

An option's draft score for resilience has been developed by first scoring each of the two resilience categories separately. An overall score was then given by averaging these two scores, with equal weighting being given to the two categories.

As land application sites, and pipeline route options, have only been identified at a high level the assessment of hazards for the options is at a more general level than particular identified for each location and option.

1.4 Resilience Categories

As set out in the MCA method report, the Resilience description is "Degree to which the option is resilient to natural hazards and climate change". Two categories have been identified for this criterion, namely natural hazards and climate change and adaptation. Operational resilience is covered in the Technology and Infrastructure Comparative Assessment of short listed options.

1.4.1 Natural Hazards

a) Risks of earthquakes damaging the infrastructure
b) Land movement and erosion affecting infrastructure
c) Flooding affecting infrastructure
d) Storm surge/tsunami affecting infrastructure

1.4.2 Climate Change and Adaptation

a) High intensity rainfall peaks affecting the infrastructure
b) Prolonged wet weather periods affecting the infrastructure
c) Prolonged dry periods affecting the infrastructure
d) Prolonged dry periods resulting in an increase of low flows in the Manawatū River flows, thereby requiring increased levels of treatment (phosphorous and nitrogen removal for greater periods of time)
e) Sea level rise possibly raising groundwater levels in the coastal sand country. Also, considerations associated with an ocean outfall scheme.

1.5 Assumptions applied in the assessment

- The design and operation of any option would take in to account a predetermined and prudent level of resilience for each of the resilience categories. This would be based on known matters at the time of design and installation.
- Options with at least dual, if not multiple, infrastructure components undertaking the same function would be viewed as more resilient than options relying on a single infrastructure component forming part of the scheme.
- All aspects at treatment plant score the same for natural hazards and climate change.
- There are varying degrees of seismic resilience within the existing treatment plant components. Any new infrastructure will be designed to Importance Level 4 (in accordance with the Building Code) for seismic resilience.
- It is recognised that all options have a vulnerability to flooding hazards as the treatment plant inlet works are recessed.
- Soil moisture modelling that has been completed to estimate the size of the scheme has taken the effects of climate change into account on the rainfall and Potential Evapotranspiration (PET).
- Flood risk to the schemes is assumed to be managed by using infrastructure designed to be removed from flood areas prior to a flood event, or by mobile irrigation systems (such as k-line) that can be completely removed from the flood risk area (in advance of a major flood). Assumed good management procedures will be in place.
- Climate change is not considered likely to affect crop growth conditions enough to cause the crop to be unable grow in the future. In the worst case, a different more suitable crop could be used.
- Consent conditions would be developed to ensure that during dry years, when more irrigation is required than usual, maximum loading limits for the land scheme will not be exceeded.
- A greater earthquake consequence is assumed for schemes with larger storage dams (that is the larger land application options).

- The risk of forest fire is present for the coastal forestry options. For this region, forest fire risk is rated as ‘average’ on a national scale – so it is not considered to be an area particularly prone to forest fires. Other fire risk management measures are assumed to be in place e.g. fire breaks, Emergency Response Plans.
- No perceived risk of climate change affecting crop growth/productivity.

1.6 Assessment table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below. The natural hazards and climate change and adaptation categories as set out in Section 1.4 above have been assessed as a comparison of all these as they apply to each option.

Where there are assessment notes that are common to the variants of an option, these have been noted above the option variants.

Option	Variant	Natural Hazards	Natural Hazards Score	Climate Change & Adaptation	Climate Change Score	Draft Resilience MCA Score
1: R2(b)	Generic for both variants	- Scouring & realignment of river may affect outlet - Risk of lateral spreading with seismic activity - Improved resilience to flooding from current as the activated sludge is contained within tanks, which would be constructed to the building code regulations for flood levels, and therefore lesser impacted than current lagoons - Any new elements of treatment plant would be constructed to high level of seismic resilience		- Climate change physical effects on Manawatū River flow, resulting in longer low River flows, higher peaks, can be designed for - Potential extended dry periods may require additional phosphorus treatment and therefore higher operation costs - Prolonged wet weather results in bypass of more flow around membranes as it is constrained by membrane capacity		
	River discharge with enhanced treatment	-	4	-	4	4
	River discharge with enhanced treatment, and a small % to land	- Pipeline connections, pump stations at risk from seismic activity. No storage facility incorporated for this option. Events can be designed for, some remaining risk. - Pipeline route at limited risk of land movement and erosion. Route design will assist in minimising risk but cannot be removed - Scour risk at waterbody crossings - Flooding possible, some of the area is located within the floodplain. Some moveable k-line irrigators may be used in the floodplain. Good practice procedures required to be in place to ensure irrigation gear is not lost during large floods. Residual risk of a 'major' flood causing loss of irrigation land e.g. Manawatu River changes course. - Potential disease risk to crops. This could have both financial (reduced return), and environmental (reduced nutrient uptake / increased leaching) impacts. - Smaller land area needed than other land application options, could choose lower risk land	3	- Limited effects from high intensity rainfall peaks - Prolonged wet weather will have a limited effect as wastewater will go to river - Prolonged dry periods are likely to improve the efficiency of land application - Prolonged dry periods on Manawatu River will require more land discharge which may cause the system loading limits to be exceeded. Risk to be managed via appropriate development of consent conditions - Smaller land area needed than other land application options, could choose lower risk land	3	3
2: Dual R + L	Two river discharge points and a small % to land	- Potential earthquake damage to storage facility and/or distribution infrastructure (land scheme). This option has only a small storage facility (comparatively). Events can be designed for, some remaining risk. - Pipeline route at limited risk of land movement and erosion. Route design will assist in minimising risk but cannot be removed - Scour risk at waterbody crossings - Flooding possible, some of the area is located within the floodplain. Some moveable k-line irrigators may be used in the floodplain. Good practice procedures required to be in place to ensure irrigation gear is not lost during large floods. Residual risk of a 'major' flood causing loss of irrigation land e.g. Manawatu River changes course. - Potential disease risk to crops. This could have both financial (reduced return), and environmental (reduced nutrient uptake / increased leaching) impacts. - Smaller land area needed than other land application options, could choose lower risk land	4	- Climate change physical effects on Manawatū River flow, resulting in longer low River flows, higher peaks, can be designed for - Potential extended dry periods may require additional treatment or storage for river discharges - Limited effects from high intensity rainfall peaks - Prolonged wet weather will reduce the efficiency of the system and may cause increased leaching into groundwater - Prolonged dry periods are likely to improve the efficiency of land application - Smaller land area needed than other land application options, could choose lower risk land	3	3.5

Option	Variant	Natural Hazards	Natural Hazards Score	Climate Change & Adaptation	Climate Change Score	Draft Resilience MCA Score
3: L+R (a) & (b)	Generic for both variants	- Pipeline connections, pump stations, storage facility at risk from seismic. Events can be designed for, some remaining risk. - Pipeline route at risk of land movement and erosion. Route design will assist in minimising risk but cannot be removed - Scour risk at waterbody crossings - Potential earthquake damage to storage facility and/or distribution infrastructure (land scheme). This option has only a small storage facility (comparatively). Events can be designed for, some remaining risk. - Scouring & realignment of river may affect outlet - Risk of lateral spreading with seismic activity - Potential disease risk to crops. This could have both financial (reduced return), and environmental (reduced nutrient uptake / increased leaching) impacts.		- Limited effects from high intensity rainfall peaks, wastewater will go to the river for highest 97% of flows - Prolonged wet weather will reduce the efficiency of the system and may cause increased leaching into groundwater. Prolonged wet weather may increase the risk of overflows from the storage lagoon, risk is managed with RI/contingency discharge - Prolonged dry periods are likely to improve the efficiency of land application - Climate change physical effects on Manawatū River flow, resulting in longer low River flows, higher peaks, can be designed for		
	97 % applied to an inland land application site and a discharge to river in exceptional circumstances (a)	- Flooding possible, some of the area is located within the floodplain. Some moveable k-line irrigators may be used in the floodplain. Good practice procedures required to be in place to ensure irrigation gear is not lost during large floods. Residual risk of a 'major' flood causing loss of irrigation land e.g. Manawatu River changes course.	3		3	3
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances (b)	- Limited tsunami risk. - Flooding possible but considered localised. Site is generally away from major watercourses. - Potential large storm/winds risk e.g. fallen trees, areas of damage to forestry and/or irrigation gear. - Potential Forest Fire Risk (note – the region is deemed 'Average' on a National Scale). If occurred: potential financial impact (e.g. loss of forest + irrigation gear – however assume that there would be insurance. Also potential environmental impacts associated with increased used of the River discharge until the land discharge system was restored. - Pest control related risks	3	- Due to coastal location, some sea-level rise related risks, which effectively present as exacerbations of; storm-surge and/or flooding damage risk, erosion risk, groundwater table rise risks (potentially limiting useable area for forestry + reducing infiltration capacity of RI facility), although only expected to have a limited effect (over 35-year time period) - Long term increase in forest fire risk possible (if climate tends drier/hotter). - Though an increase o risk on the above it is not deemed significant enough to warrant a lower score under this scoring system.	3	3
4: L + R (d) & (e)	Generic for all variants	- Pipeline connections, pump stations, storage facility at risk from seismic. Events can be designed for, some remaining risk. - Pipeline route at risk of land movement and erosion. Route design will assist in minimising risk but cannot be removed - Scour risk at waterbody crossings - Potential earthquake damage to storage facility and/or distribution infrastructure (land scheme). This option has only a small storage facility (comparatively). Events can be designed for, some remaining risk. - Scouring & realignment of river may affect outlet - Risk of lateral spreading with seismic activity		- Limited effects from high intensity rainfall peaks - Prolonged wet weather will reduce the efficiency of the system and may cause increased leaching into groundwater. Prolonged wet weather may increase the risk of overflows from the storage lagoon, risk is managed with RI/contingency discharge. - Prolonged dry periods are likely to improve the efficiency of land application - Climate change physical effects on Manawatū River flow, resulting in longer low River flows, higher peaks, can be designed for		

Option	Variant	Natural Hazards	Natural Hazards Score	Climate Change & Adaptation	Climate Change Score	Draft Resilience MCA Score
		- Potential disease risk to crops. This could have both financial (reduced return), and environmental (reduced nutrient uptake / increased leaching) impacts.				
	55 % applied to an inland land application site and a river discharge for the remainder of the time (d)	- Decreased risk from (L+R a) scores due to the smaller land application area	4	- Similar resilience to (L+R a) above	3	3.5
	45 % applied to an inland land application site and a river discharge for the remainder of the time (d)	- Decreased risk from (L+R a) scores due to the smaller land application area	4	- Similar resilience to (L+R a) above	3	3.5
	55 % applied to a coastal land application site and a river discharge for the remainder of the time (e)	- Increased risk from (L+R b) scores due to the larger land application area (lower level of treatment, larger land)	2	- Similar resilience to (L+R b) above	3	2.5
	45 % applied to a coastal land application site and a river discharge for the remainder of the time (e)	- Increased risk from (L+R b) scores due to the larger land application area (lower level of treatment, larger land)	2	- Similar resilience to (L+R b) above	3	2.5
6: Ocean	Generic for both variants	- Pipeline connections, pump stations, storage facility at risk from seismic. Events can be designed for, some remaining risk. - Pipeline route at risk of land movement and erosion. Route design will assist in minimising risk but cannot be removed - Scour risk at waterbody crossings - Potential earthquake damage to storage facility and/or distribution infrastructure (land scheme). This option has only a small storage facility (comparatively). Events can be designed for, some remaining risk. - Scouring & realignment of river may affect outlet - Risk of lateral spreading with seismic activity		- Limited effects from high intensity rainfall peaks, wastewater will go to ocean - Effects of prolonged dry periods on Manawatu River are largely not applicable as not direct discharge to river - Due to coastal location, some sea-level rise related risks, which effectively present as exacerbations of; storm-surge and/or flooding damage risk, erosion risk		
	Ocean discharge, with a small % to land	- Similar risk from (L+R b) score due to the smaller land application area, but includes ocean outfall	3	- Prolonged wet weather will reduce the efficiency of the system and may cause increased leaching into groundwater. Could be managed by going to ocean and irrigating over the other period of the year to retain 6-month average	3	3

Option	Variant	Natural Hazards	Natural Hazards Score	Climate Change & Adaptation	Climate Change Score	Draft Resilience MCA Score
				- Due to coastal location, some sea-level rise related risks, which effectively present as exacerbations of; storm-surge and/or flooding damage risk, erosion risk, groundwater table rise risks (potentially limiting useable area for forestry + reducing infiltration capacity of RI facility). - Long term increase in forest fire risk possible (if climate tends drier/hotter) - Sea level rise is expected to have only a limited effect (over 35-year time period) - Similar risk from (L+R b) score due to the smaller land application area, but includes ocean outfall		
	Ocean discharge	- Less risk than Ocean with land as no land element, but majority of risk from natural hazards in pipeline and outfall	3	- Less risk than Ocean with land as no land element	4	3.5

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

1.7 Assessment Summary

Option	Variant	Draft score
1: R2(b)	River discharge with enhanced treatment	4
	River discharge with enhanced treatment, and a small % to land	3
2: Dual R + L	Two river discharge points and a small % to land	3.5
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	3
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	3.5
	55 % applied to an inland land application site and a river discharge for the remainder of the time	3.5
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	2.5
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	2.5
6: Ocean	Ocean discharge, with a small % to land	3
	Ocean discharge	3.5

1 Social Comparative Assessment of Short-listed options

1.1 Introduction

This is the social comparative assessment of the short-listed options for the Palmerston North Wastewater BPO project (“Nature Calls”). The assessment does not include an assessment of the social effects of increased rates.

This template has been provided by Stantec for use in the scoring. It is recommended a full social impact assessment be undertaken for the preferred option once confirmed.

This assessment has been undertaken by:

- Rachel Maas – author. 20+ years experience conducting SIAs in New Zealand and Australia. Bachelor of Science, Post Graduate Diploma (Social Impact Assessment), Masters of Evaluation, Certified Environmental Practitioner, Impact Assessment Specialist (CEnvp IA), member of Environment Institute of Australia and New Zealand (EIANZ) and International Association for Impact Assessment (IAIA).
- Julie Boucher – QA review. Post Graduate Diploma, Resources and Environmental Planning, Masters of Social Science (Geography), PMP, MNZPI, Licensed IAP2 Australasia Trainer, IAP2 Certificate of Public Participation.

1.2 Criterion and scoring approach

The social criterion description has changed since the Traffic Light Assessment. The previous description was the *potential adverse effects on social and community values relating to amenity, recreation and food gathering*. This description is dependent on the option and associated geographical locations for infrastructure and application (if required) being known. At this point of the Nature Calls project, we do not have this information so a different description was developed. The description takes into account the information that is known and described in the:

- Wastewater BPO Shortlist Options (as presented by Richard Peterson on Monday 21 September 2020) and
- Work Package 15.6/7 Shortlisted Options Summary Report, September 2020.

Criterion	Description	1	2	3	4	5
Social	Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option	Severe	Major	Moderate	Minor	Insignificant

1.3 Approach to the assessment

The significance of potential social effects is based on a peer reviewed and published significance rating methodology developed by Esteves et al 2017[1]. The rating methodology has been adapted to the BPO project. The methodology is based on identifying significance from the perspective of the people likely to experience social effects.

Each option has been assessed against the following sub-criteria:

Social Criterion	Description	Level
Gravity	Option will cause death or adverse health effects that could lead to significant reduction in quality of life and/or longevity and/or continued exposure is generally likely to lead to long term limiting illness or disease	G1
	Infringement in access to: • Basic life necessities (including education, livelihood etc) and/or • Cultural, economic, natural or social infrastructure/assets that have been identified as highly valued by identified groups or subject matter experts • Ecosystem services identified as priority to livelihoods[2], health, safety or culture by identified groups or subject matter experts	G2
	All other impacts	G3
Distributive equity	Waste water treated in PNCC and part of the water discharged into the river and/or part of the water conveyed out of PNCC area so treated water can be applied to land outside the PNCC area	E1
	Waste water treated in PNCC area and all discharge into the river within PNCC or piped to the ocean for discharge	E2

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[1] Esteves, AM., Factor, G., Vanclay, F., Götzmann, N., Moreira, S. (2017) Adapting social impact assessment to address a project's human rights impacts and risks *Environmental Impact Assessment Review* 67 73 - 87

[2] Livelihoods refers to the way of life a person or household and how they make a living, in particular, how they secure the basic necessities of life, e.g. their food, their water, shelter and clothing and live in the community (IAIA SIA Guidance 2015:87)

Social Criterion	Description	Level
	Waste water treated in PNCC area and treated water applied to land wholly within PNCC area	E3
Need for land acquisition and degree of permanence of land use change	Yes with permanent land/water use changes	PC1
	Yes with temporary land/water use changes (able to be reversed) or no need for acquisition	PC2
Public support for the option[3]	Little or no support based on feedback from the public (<25% of feedback identified as most preferred)	S1
	Feedback doesn't provide a clear indication of support (25 – 50% feedback identified as most preferred)	S2
	High level of support based on feedback from the public (>50% of feedback identified as most preferred)	S3

The significance of potential social effects is then calculated using the following table

Specification of conditions for assigning significance	Rating	Score
G1 (regardless of any other criteria), or G2 and PC1 and S1/S2 (regardless of distributive equity)	Severe	1
G2 and PC1 and S3 (regardless of distributive equity), or G2 and PC2 and E1/E2 and S1/S2	Major	2
G2 and PC2 and E3 (regardless of support), G3 and PC1 (regardless of extent and support) or G3 and E1/E2 and R1/R2 (regardless of support)	Moderate	3
G3 and E1/E2 and PC2 and S3	Minor	4
G3 and E3 and PC2 and S3	Insignificant	5

1.4 Assumptions applied in the assessment

- There has been no decision as the location of the land application options or ocean option.
- Land (inland or coastal) options are:

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[3] Based on PNCC calculation of most preferred option. Public ranked option preference on PNCC submission forms during the consultation period from 3 June – 10 July 2020.

  - currently used to generate economic livelihoods (e.g. farming or tourism) and
  - have people living on the land who actively participate in their communities:
    - informal social networks (friends and family) and
    - formal networks e.g. resident and rate payers associations, schools, churches, environmental groups
- Conveyance of wastewater outside PNCC is a buried pipeline within existing road corridor with temporary land use changes only. Pump stations assumed to have minimal social effects due to an assumed small footprint.

Comparison of PNCC Consultation options and MCA options:

Option for public consultation	MCA Option
Option 1 – All treated wastewater is discharged to the Manawatū River, with improved removal of phosphorus and nitrogen	1 R2(b)
Option 2 – Treated wastewater discharged to Manawatū River at Tōtara Road, below Opiki Bridge, with some land application	2: Dual R + L
Option 3 – Treated wastewater applied to land, with discharge to the Manawatū River in exceptional circumstances	3 L + R (a) & (b)
Option 4 – Treated wastewater applied to land, with some discharge to the Manawatū River	4: L + R (d) & (e)
Option 5 – Discharge to groundwater via infiltration, with land application in the drier months of the year	Not included in MCA
Option 6 – Most of the treated wastewater discharged to the ocean with some applied to land	6:O + L

1.5 Assessment table

The following table sets out the preliminary assessment of the options by the authors. This will be used as a starting point for discussion at the MCA workshop. The final MCA assessment and score may therefore differ from what is set out below.

Reports relied upon

- Wastewater BPO Shortlist Options (as presented by Richard Peterson on Monday 21 September 2020)
- Traffic Light Workshop Briefing Report, 24 April 2019, Appendix 5 (Social and Community Comparative Assessment)
- Work Package 15.6/7 Shortlisted Options Summary Report, September 2020
- Stage 1 Engagement Summary, 17 December 2018
- Report on Shortlist Consultation V2
- Option descriptions on the PNCC website, https://www.pncc.govt.nz/participate-palmy/have-your-say/nature-calls/

Option	Variant	Assessment					
		Gravity	Distributive equity	Land/water change/ acquisition	Public support	Rating	Draft score
1: R2(b)	River discharge with enhanced treatment	G2	E2	PC1	S2	Major	2
		Significance of the Manawatū River (social/ recreation), and livelihood connection)	Waste water treated in PNCC and discharged into the river via wetland and land passages	Yes with permanent land use changes	27% of the public nominated Option 1 as "most preferred"		
	River discharge with enhanced treatment, and a small % to land	G2	E1	PC1	S2	Severe	1
		Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and/or part of the water conveyed out of PNCC so treated water can be 'applied' outside the PNCC area	Yes with permanent land use changes	27.23% of the public nominated Option 1 as "most preferred"		
2: Dual R + L		G2	E1	PC1	S1	Severe	1

Option	Variant	Assessment					
		Gravity	Distributive equity	Land/water change/ acquisition	Public support	Rating	Draft score
	Two river discharge points and a small % to land	Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river (Opiki River discharge located outside PNCC) and/or part of the water conveyed out of PNCC so treated water can be 'applied' outside the PNCC area	Yes with permanent land use changes	16.95% of the public nominated Option 2 as "most preferred"		
3: L+R (a) & (b)	97 % applied to an inland land application site and a discharge to river in exceptional circumstances	G2	E1	PC1	S2	Severe	1
		Impacts on land that is currently supports livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be	Yes with permanent land use changes	27.41% of the public nominated Option 3 as "most preferred"		

Option	Variant	Assessment					Draft score
		Gravity	Distributive equity	Land/water change/ acquisition	Public support	Rating	
			'applied' outside the PNCC area				
	97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	G2	E1	PC1	S2	Severe	1
		Impacts on land that is currently supports livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be 'applied' outside the PNCC area	Yes with permanent land use changes	27.41% of the public nominated Option 3 as "most preferred"		
4: L + R (d) & (e)	45 % applied to an inland land application site and a river discharge for the remainder of the time	G2	E1	PC1	S3	Severe	1
		Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be	Yes with permanent land use changes	8.30% of the public nominated Option 4 as "most preferred"		

Option	Variant	Assessment				Rating	Draft score
		Gravity	Distributive equity	Land/water change/ acquisition	Public support		
			'applied' outside the PNCC area				
	55 % applied to an inland land application site and a river discharge for the remainder of the time	G2	E1	PC1	S3	Severe	1
		Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be 'applied' outside the PNCC area	Yes with permanent land use changes	8.30% of the public nominated Option 4 as "most preferred"		
	45 % applied to a coastal land application site and a river discharge for the remainder of the time	G2	E1	PC1	S3	Severe	1
		Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be	Yes with permanent land use changes	8.30% of the public nominated Option 4 as "most preferred"		

Option	Variant	Assessment					Draft score
		Gravity	Distributive equity	Land/water change/ acquisition	Public support	Rating	
			'applied' outside the PNCC area				
	55 % applied to a coastal land application site and a river discharge for the remainder of the time	G2	E1	PC1	S3	Severe	1
		Significance of the Manawatū River (livelihoods and recreation) and impacts on land that is currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be 'applied' outside the PNCC area	Yes with permanent land use changes	8.30% of the public nominated Option 4 as "most preferred"		
6: Ocean	Ocean discharge, with a small % to land	G2	E1	PC1	S3	Severe	1
		Significance of ocean (recreation and livelihoods) and impacts on land currently supporting livelihoods	Waste water treated in PNCC and part of the water discharged into the river and part of the water conveyed out of PNCC so treated water can be	Yes with permanent land use changes	6.76% of the public nominated Option 6 as "most preferred"		

Option	Variant	Assessment					Draft score
		Gravity	Distributive equity	Land/water change/ acquisition	Public support	Rating	
			'applied' outside the PNCC area				
	Ocean discharge	G2	E2	PC2	S1	Major	2
		Significance of ocean (recreation and livelihoods) and impacts on land currently supporting livelihoods	Waste water treated in PNCC and conveyed to the ocean for discharge	No need for land acquisition	6.76% of the public nominated Option 4 as "most preferred"		

Note: Option 5, which involved a mix of groundwater discharge and land application, was removed from the short list during the short list development phase of the project.

Appendix 3: MCA Workshop Material & Notes

PALMERSTON NORTH

NATURE CALLS

Wastewater BPO
Day 1

Collaborative MCA

9th & 10th November

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Karakia

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Welcome from the Mayor

5 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

MCA – Workshop Agenda

Sara Dennis - Just Add Lime

5 mins

Agenda for Day 1- Gain Insight & shared understanding

Technical specialist

- How they went about scoring specific criteria & why

Understanding the Options

- Consolidated scores from specialist’s
- Discuss to collectively understand/further group input
- Build up an integrated story about each option - integrated specialist view

Overall option score variation

- scoring high/low

Collectively agree weighting (if any, will apply overnight)

Refresh MCA scores based on collective inputs/enhanced understanding (if any, will apply overnight)

Breaks

Morning Tea	10.30 – 10.45
Lunch	12.30 – 1.15
Afternoon Tea	3.15 – 3.30

Agenda for Day 2 – Trade off between the options

Weighting Sensitivity Testing

- Weighted option scoring results
- Lock in the weighting(if any)

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Summary wrap up

- Option story

Next steps

- What further information do we need going forward

PALMERSTON NORTH NATURE CALLS

Introduction

Robert Van Bentum – Transport & Infrastructure Manager

Melaina Voss – BPO Project Manager

10 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Wastewater Project Charter Tu-Tohinga

PALMERSTON NORTH
NATURE CALLS

VISION PAE TAWHITI

Management of the City's wastewater which enables growth, protects and enhances the environment and contributes to improving the health and mauri of the Manawatū River.

Ko te whakahaere I te parawai o Papioea, e pai ait e tipu o te taonga, e rauhītia ai te taiao, e piki anō ai te ora me te mauri o Te Awa o Manawatū.

TREATY COMMITMENT TE MANAWA TITIKAHA KI TE TIRITI O WAITANGI

As per National Policy Statement on freshwater, provide for the involvement of iwi and hapū, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision-making regarding freshwater planning;

PROJECT OBJECTIVES PAE TATA

A best practicable option wastewater management solution that is developed in partnership with Rangitāne o Manawatū which:

1. Protects public health and minimises public health risks.
2. Minimises adverse environmental effects on air, land and water;
3. Is sustainable, enduring, and resilient;
4. Contributes to improving the health and mauri of the Manawatū River;
5. Takes an integrated approach to the management of the Manawatū River Catchment including understanding cumulative effects;
6. Enhances peoples use and enjoyment of the Manawatū River
7. Is affordable and cost effective;
8. Minimises whole of life carbon emissions and optimises resource recovery;
9. Is innovative while being evidence based;
10. Facilitates long term growth and economic development
11. Is developed with the active engagement of the community and key stakeholders

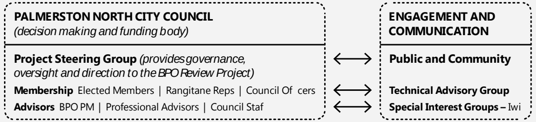
VALUES UARA

Decision making processes followed during the project shall be:

a. Evidence based;
b. Efficient and timely;
c. Undertaken to meet the requirements of the current resource consent (in terms of the scope of the BPO review); and
d. Consistent with the National Policy Statement for Freshwater Management, the National Policy Statement on Urban Development Capacity and the One Plan.
e. PNCC and Horizons work collaboratively in developing the best practicable option for the management of the City's wastewater.

PROJECT STRUCTURE TE HANGA O TE KAUPAPA

The current roles and responsibilities of the groups associated with the project are summarised in the infographic to the right –



PALMERSTON NORTH CITY COUNCIL
(decision making and funding body)

Project Steering Group *(provides governance, oversight and direction to the BPO Review Project)*

Membership Elected Members | Rangitane Reps | Council Officers

Advisors BPO PM | Professional Advisors | Council Staff

ENGAGEMENT AND COMMUNICATION

Public and Community

Technical Advisory Group

Special Interest Groups – Iwi

STAKEHOLDER ENGAGEMENT TE WHAI WĀHITANGA MAI O TE HUNGA WHAIPĀNGA

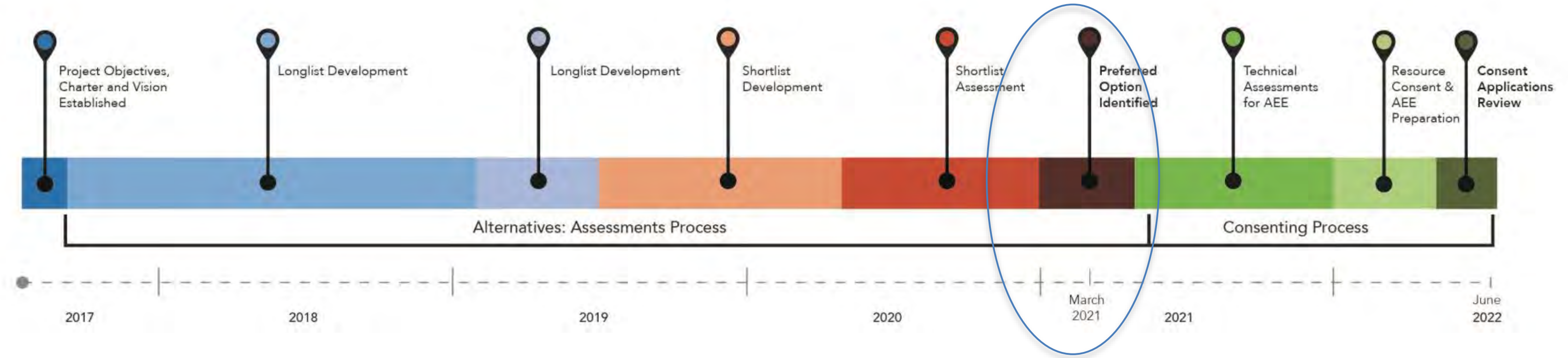
This section will outline the focus and broad approach to community and stakeholder engagement. A draft Communication and Engagement Plan is being prepared.

What we have achieved so far

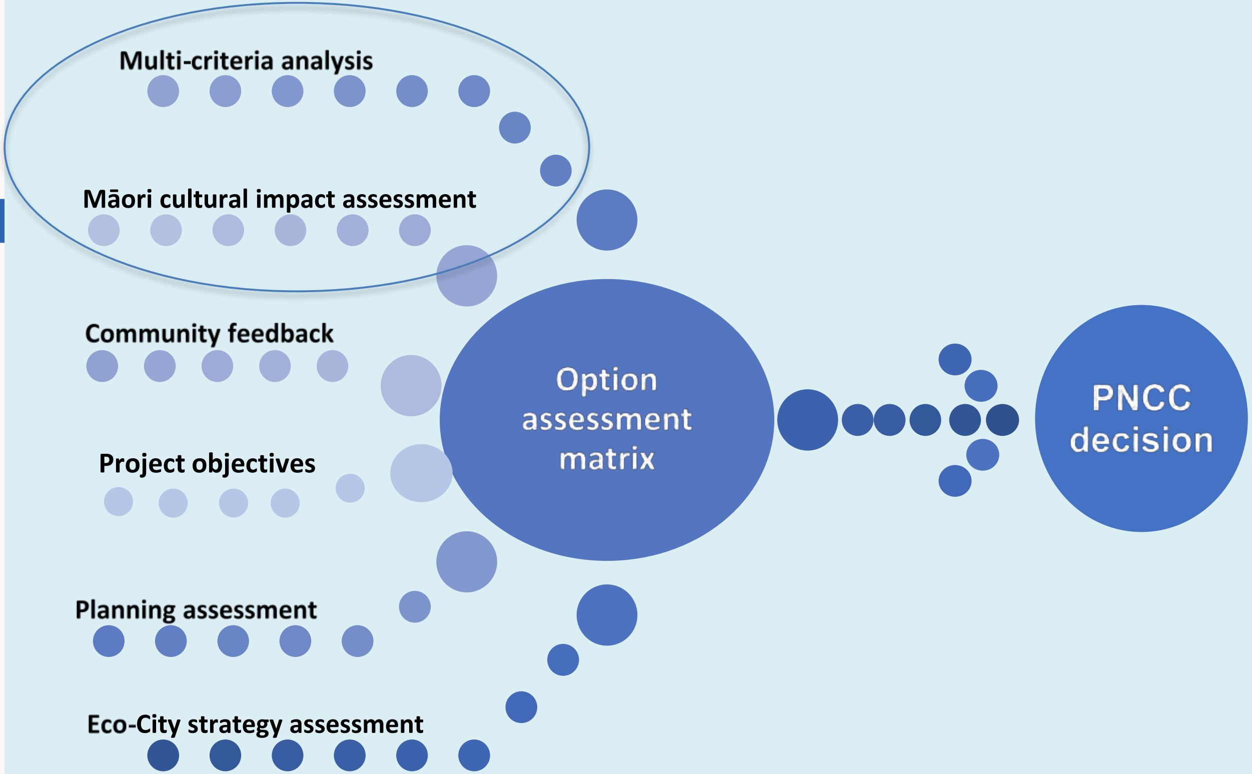
- Contextual review and understanding of our future growth and infrastructure needs
- Development of longlist options, evaluation and refinement to a shortlist
- Investigation into potential receiving environments and the environmental and environmental legislation constraints
- Closely working with Horizons Regional Council
- Community and stakeholder engagement
- Closely working with Rangitane o Manawatu along the way. Now working with neighbouring Iwi.

Where we are in our decision-making process

MILESTONES AND HIGH LEVEL PROJECT PROGRAMME NGĀ PAE TUTUKI ME TE HŌTAKA TIRO WHĀNUI

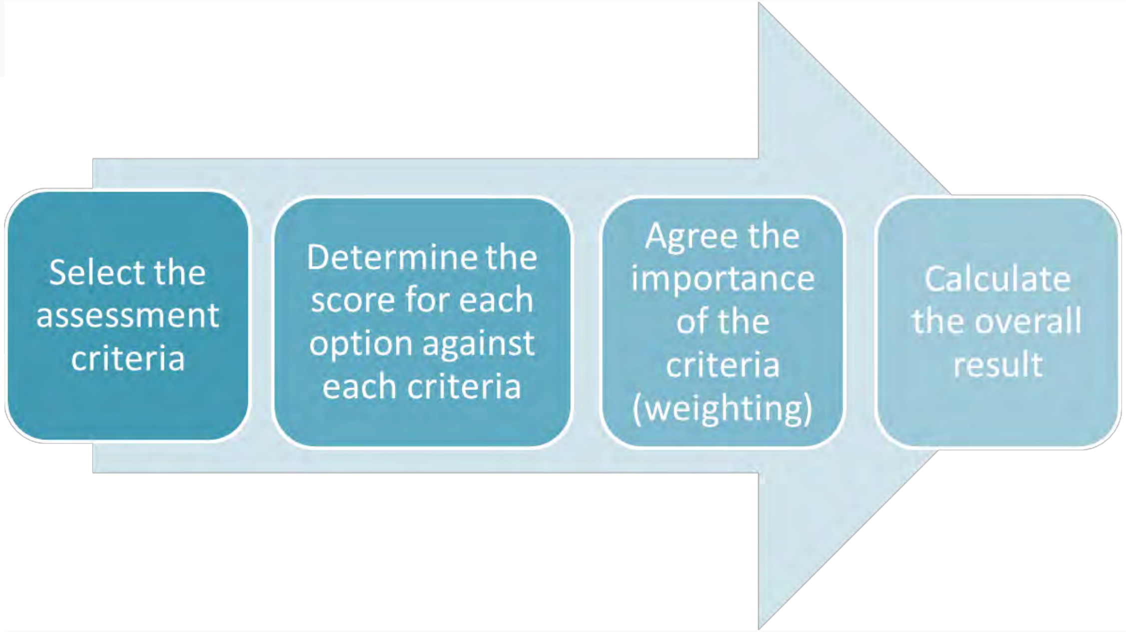


Overall Approach



Multi-Criteria Analysis (MCA)

- Systematic way of comparing options using a range of criteria
- For complex problems it provides a **relatively** simple way of comparing their merits
- MCA does have limitations that need to be kept in mind - inherent ‘subjectivity’ and unconscious bias of the participants – sensitivity testing
- Use a collaborative workshop process, involving partners and stakeholders



Select the assessment criteria

Determine the score for each option against each criteria

Agree the importance of the criteria (weighting)

Calculate the overall result

Specialist Assessment

Sara Dennis – 2 hours with

8 Specialists 15 mins each

PALMERSTON NORTH

NATURE CALLS

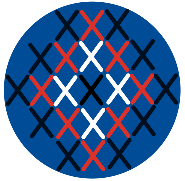
Cultural Context

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Assessment Criteria

Public Health

Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)



Māori Cultural Values

Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga

Financial Implications

Comparative capital, operational, whole of life costs of the option. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.

Natural Environment

Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology

Resilience

Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.

Growth & Economic Development

Will the option support the population and economic growth anticipated for the City by Council?

Social & Community Considerations

Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option

Technology & Infrastructure

Degree to which the option:

- Uses reliable & proven technology
- Can be staged
- Able to be constructed
- Constructed within app timeframe
- Allows resource recovery/beneficial re-use

Jim Bradley – Stantec
Brett Munro – MidCentral DHB
Stephen Palmer – Regional Public Health

Public Health

Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)

Public Health

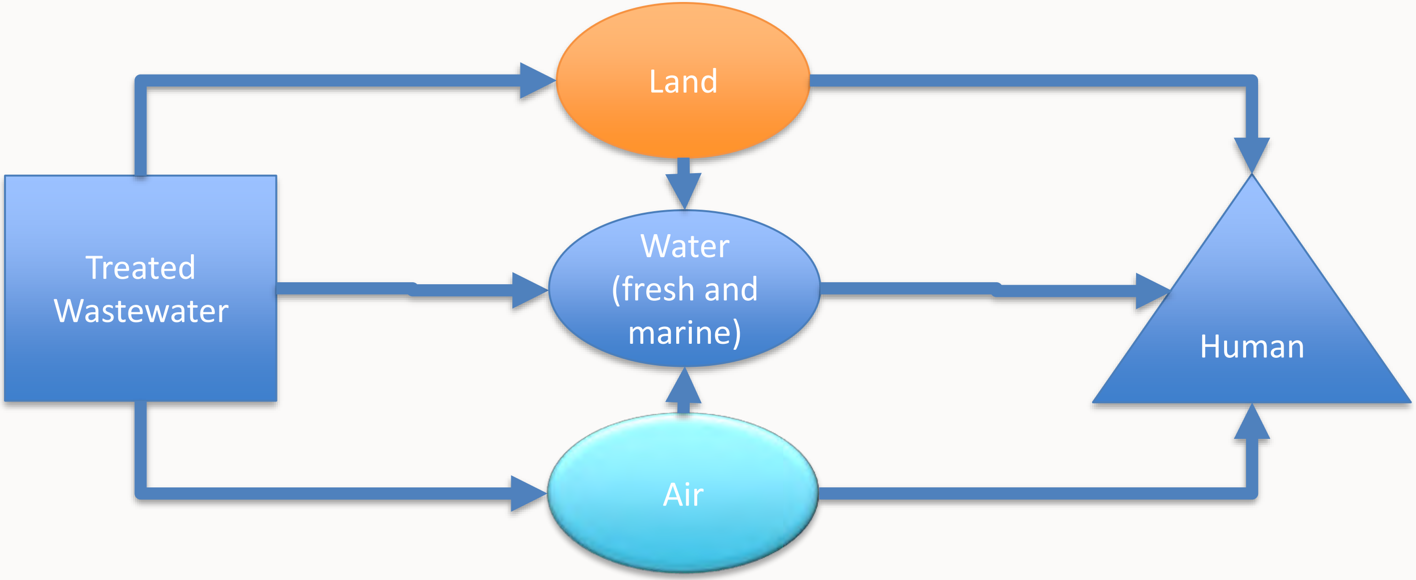
Methodology is based on the potential for Public Health Risk from human contact with the treated wastewater

Uses a conceptual exposure pathway methodology

Recommended criteria based on number of identified critical exposure pathways:

- differentiates between options
- focuses on critical pathways
- reflects the potential difficulty in managing the risk to public health resulting from the treated wastewater

Public Health – Conceptual Exposure Pathways



Land

Treated Wastewater

Water (fresh and marine)

Human

Air

Public Health

Criteria Selection

1 Low	2 Low - medium	3 medium	4 Medium - high	5 High
Catastrophic: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a major illness, which is likely to be dangerous to sensitive members of the community	Major: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a moderate illness, which may be dangerous to sensitive members of the community	Moderate: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a minor illness	Minor: health effects are limited to a single person, single household or single group of people who can be readily identified and contacted by the public health authorities and the consent holder for appropriate advice who experience a minor illness	Insignificant: illness resulting from the treated wastewater discharge is indiscernible above the normal background level of illness in the community.

Keith Hamill – River Lake
Olivier Ausseil – Aquanet
Aslan Perwick – PDP

Natural Environment

Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology

Natural Environment: Key considerations

Rivers and Lakes

- Nutrients to Manawatū causing periphyton growth and exceeding OP targets (used PointSim Model)
- Effects on river less at high flows and downstream of Opiki.
- Risk from land treatment to small streams / lakes (considered N leaching rate cf. current landuse, irrigation area/location)

Coastal

- Near shore zone and benthic habitats near the outfall.

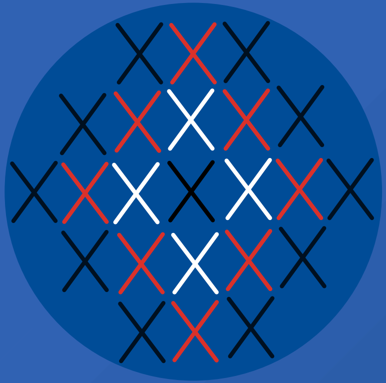
Groundwater & Soils

- N leaching rate, seasonal application, ability to avoid sensitive areas and apply buffer zones.

Natural Environment Scoring Criteria

Score	Adverse Effect	Description	Example
1	Very High	Major loss or change in baseline conditions.	One Plan (OP) targets regularly exceeded. Risk of chronic toxicity.
2	High	Major change in baseline conditions.	
3	Moderate	Moderate change in baseline but generally acceptable.	OP targets generally met but risk of occasional exceedance. Minor effects on soils.
4	Low	Small shift from baseline.	
5	Very Low	Very slight change from baseline.	Negligible ecological effects. Risk to exceeding OP targets is very low. Negligible to positive effect on GW. Benefits to soils.

Jonathan Proctor – Rangitane
Danielle Harris - Rangitane



Māori Cultural Values

Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga

Context

- The assessment was undertaken by the Rangitāne o Manawatū representatives and Te Ao Turoa staff. Key concepts focused on;
    - Cultural Values
    - Cultural Landscapes
    - Atua
    - Potential Acceptance to our people

- Options discussed in 3-4 half day hui. Values and assessments undertaken in 2 wananga

- Rangitāne o Manawatū also invited neighbouring Iwi Ngati Apa, Muaupoko and Ngati Kauwhata.

Fundamentals

Protection of Rangitāne o Manawatū, Protection of the River, Enhancement for the people and future

Criteria Selection

Criterion	Description	1	2	3	4	5
Rangitāne Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Rangitāne o Manawatū, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga	Destruction of Rangitāne culture, connections and kaitiakitanga. Critical effect on Rangitāne o Manawatū	Significant effect or impact on all aspects of Rangitāne Mana, Toanga, Atua and natural resources	Major impact on all aspects of Rangitāne significant sites and natural resources	Minimal impact on Rangitāne significant sites and natural resources	Minimal to no effect on Rangitāne o Manawatū

Māori
Cultural
Values

Significance

- The Mana of Rangitāne o Manawatū would be recognised through having the activities contined within in the Manawatū / Rangitāne o Manawatū Rohe

- The Manawatū River is not to be further impacted

- The Coast and its resources are not to be impacted or threatened

- Must be future focused, plan for growth, three waters development – more important than short time cost

- Rangitāne o Manawatū believe the is an error not to make continued improvements in treatment before discharge– strong desire to work towards treating to "drinking water standards"

- Neighbouring Iwi maintain the ability to make their own decisions and contribution.

PALMERSTON NORTH
NATURE CALLS

Julie Boucher – Just Add Lime

Social & Community Considerations

Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option

Social &
Community
Considerations

Context

- Based on engagement to date
- Not dependent on specific location
- Consideration of distributional impacts
- Accepted methodology

Social & Community Considerations

Criteria Selection

Criteria	Description	Level
Gravity	Option will cause death or adverse health effects that could lead to significant reduction in quality of life and/or longevity and/or continued exposure is generally likely to lead to long term limiting illness or disease	G1
	Infringement in access to: • Basic life necessities (including education, livelihood etc) and/or • Cultural, economic, natural or social infrastructure/assets that have been identified as highly valued by identified groups or subject matter experts • Ecosystem services identified as priority to livelihoods[1], health, safety or culture by identified groups or subject matter experts	G2
	All other impacts	G3
Distributive equity	Waste water treated in PNCC and part of the water discharged into the river and/or part of the water conveyed out of PNCC area so treated water can be applied to land outside the PNCC area	E1
	Waste water treated in PNCC area and all discharge into the river within PNCC or piped to the ocean for discharge	E2
	Waste water treated in PNCC area and treated water applied to land wholly within PNCC area	E3

Social & Community Considerations

Criteria Selection cont

Criteria	Description	Level
Need for land acquisition and degree of permanence of land use change	Yes with permanent land/water use changes	PC1
	Yes with temporary land/water use changes (able to be reversed) or no need for acquisition	PC2
Public support for the option[2]	Little or no support based on feedback from the public (<25% of feedback identified as most preferred)	S1
	Feedback doesn't provide a clear indication of support (25 – 50% feedback identified as most preferred)	S2
	High level of support based on feedback from the public (>50% of feedback identified as most preferred)	S3

Social & Community Considerations

Significance

The significance of potential social effects is then calculated using the following table

Specification of conditions for assigning significance	Rating	Score
G1 (regardless of any other criteria), or G2 and PC1 and S1/S2 (regardless of distributive equity)	Severe	1
G2 and PC1 and S3 (regardless of distributive equity), or G2 and PC2 and E1/E2 and S1/S2	Major	2
G2 and PC2 and E3 (regardless of support), G3 and PC1 (regardless of extent and support) or G3 and E1/E2 and R1/R2 (regardless of support)	Moderate	3
G3 and E1/E2 and PC2 and S3	Minor	4
G3 and E3 and PC2 and S3	Insignificant	5

PALMERSTON NORTH
NATURE CALLS

Anna Bridgeman - Stantec

Resilience

Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.

Resilience Categories

Natural Hazards

- Risks of earthquakes
- Land movement and erosion
- Flooding
- Storm surge/tsunami

Climate Change and Adaptation

- High intensity rainfall peaks
- Prolonged wet weather periods
- Prolonged dry periods
- Prolonged dry periods resulting in an increase of low flows in the Manawatū River flows,
    - increased levels of treatment (phosphorous and nitrogen removal for greater periods of time)
- Sea level rise

Resilience Criterion

Method of Assessment

- Degree to which option is resilient to natural hazards & climate change – from LOW to HIGH
- Comparative comparison between the options
- Overall score given based on the average of sub-category scores

Criterion	Description	1	2	3	4	5
Resilience	Degree to which the option is resilient to • natural hazards • climate change	Low degree of resilience	Low – Medium degree of resilience	Medium degree of resilience	Medium – High degree of resilience	High degree of resilience

PALMERSTON NORTH
NATURE CALLS

Melaina Voss – Stantec
Richard Peterson - Stantec

Growth & Economic Development

Will the option support the population and economic growth anticipated for the City by Council?

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Growth & Economic Development

Context

- Based on growth projects for the next 35 years – 50 years
- No specific sites identified
- Considering Councils growth and economic development strategies as well as the regions plans (known)
- Consideration of capacity to provide a sub-regional scheme ie additional flows and loads as well as proximity to connect other wastewater systems

Growth & Economic Development

Criteria Selection

Criterion	Description	1	2	3	4	5
Growth and Economic Development	The degree to which the options will: • Support the population and economic growth anticipated for the City by Council? • Support / restrict further up-scaling to accommodate a sub-regional scheme?	Low degree	Low – Medium degree	Medium degree	Medium – High degree	High degree

PALMERSTON NORTH
NATURE CALLS

Morning Tea

10.30 – 10.45am

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Anna Bridgeman - Stantec

Technology & Infrastructure

Degree to which the option:

- Uses reliable & proven technology
- Can be staged
- Able to be constructed
- Constructed within app timeframe
- Allows resource recovery/beneficial re-use

Technology & Infrastructure Categories

- Can be Staged
- Is able to be constructed and operational within 5 years of the commencement of the consent
- Allows for resource recovery / beneficial re-use
- Infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme
- Involves Operational/Technical Complexity
- Involves Operational Risk

Criteria Selection

- Each of the six sub-criteria were scored with regards to how well the option aligned with that sub-criteria.
  - LOW to HIGH for alignment with the first four sub-criteria
  - HIGH to LOW for Operational Complexity & Risk
- The overall draft score is an average of these six scores, rounded to the nearest 0.5
- Each sub-criteria given equal weighting.
- Average has been used rather than the lowest score as it is not believed that any one of these sub-criteria is the governing factor in the selection of the BPO.

Criterion	Description	1	2	3	4	5
Technology and Infrastructure	Degree to which the option: • can be staged • is able to be constructed and operational within 5 years of the commencement of the consent • allows for resource recovery / beneficial re-use • infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme • involves Operational Complexity • involves Operational Risk	Low degree of alignment with sub-criteria and/or High Operational Complexity and Risk	Low – Medium degree of alignment with sub-criteria and/or Medium-High Operational Complexity and Risk	Medium degree of alignment with sub-criteria and/or Medium Operational Complexity and Risk	Medium – High degree of alignment with sub-criteria and/or Low-Medium Operational Complexity and Risk	High degree of alignment with sub-criteria and/or Low Operational Complexity and Risk

Technology & Infrastructure Criterion

Method of Assessment

- Each of the six sub-criteria were scored with regards to how well the option aligned with that sub-criteria.
    - LOW to HIGH for alignment with the first four sub-criteria
    - HIGH to LOW for Operational Complexity & Risk
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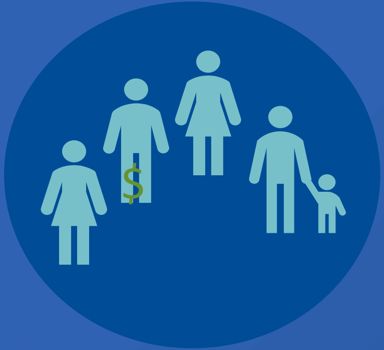
Anna Bridgeman - Stantec



Financial Implications

Comparative capital, operational, whole of life costs of the option. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.

Financial Implications Comparative Assessment

Methodology

- **Step 1** – Development of capital cost and operational and maintenance cost for each component

- **Step 2** – NPV assessment using Capital Cost and OPEX estimates
    - 35 year NPV from 2025
    - 6% discount rate
- **Step 3** – Sub-criteria of Capital, O&M and NPV given a weighting
- **Step 4** – Sub-criteria score for Option X = ((1 – (cost of option X / highest cost)) x 4) +1
- **Step 5** – Overall score = Combination of Sub-criteria scores x weighting

Financial Implications Comparative Assessment

Sensitivity

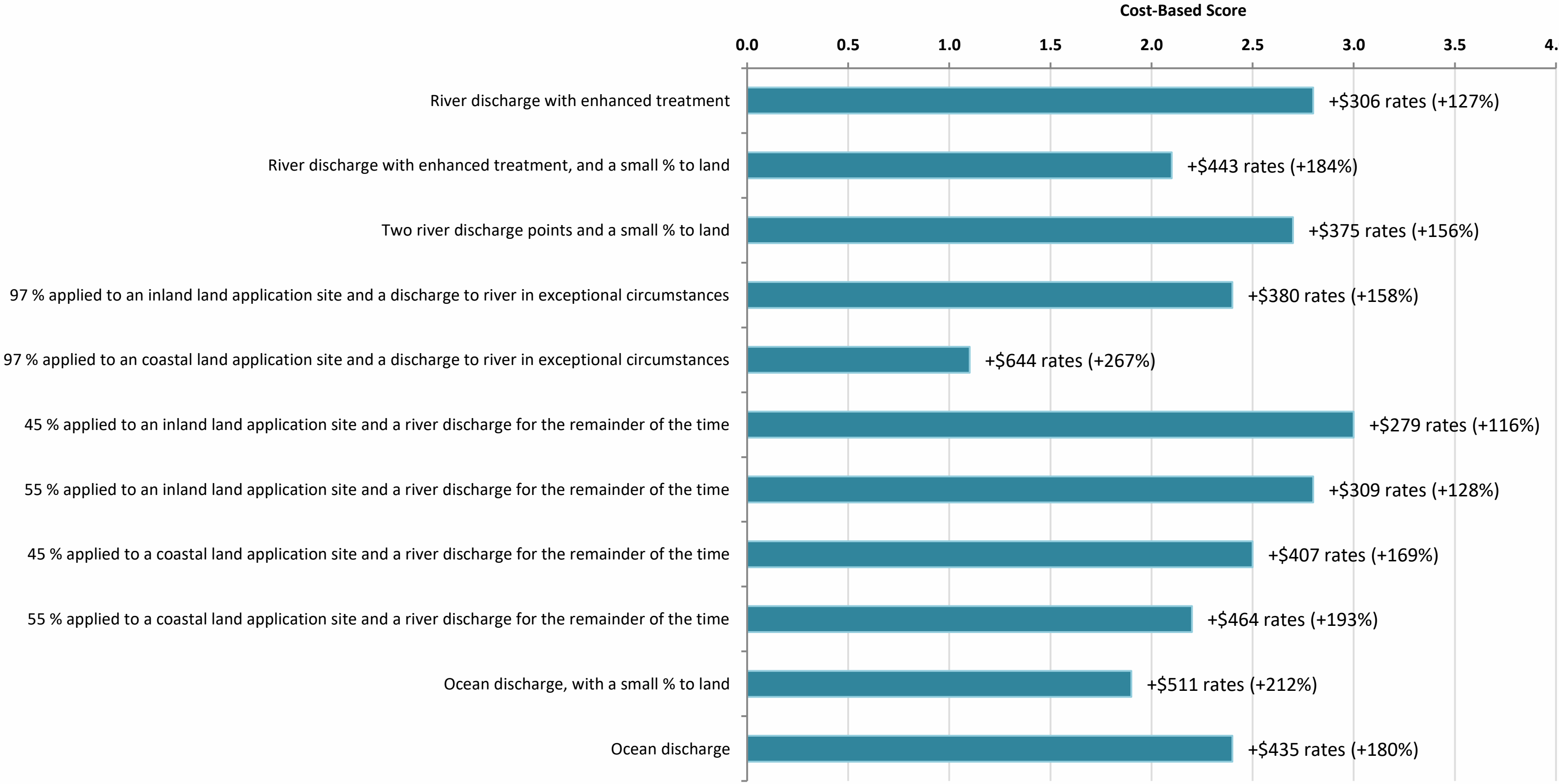
- **Discount Rate**
  - 6% discount rate has been used through for the option development in the longlist and shortlist phases.
  - Treasury now recommends a 5% discount rate for infrastructure projects
  - Changing the discount rate to 4% and 8% increased or decreased the NPV between 3 - 10% higher and 2 - 7% lower respectively for the options,
    - greatest change 'River with enhanced treatment options'.
    - The level of change dependent on operational and maintenance costs and the return received from crops/forestry for the option.

- **Sub-Criteria Weighting**
  - Initial weighting of 37%, 30% and 33% for cost, O&M and NPV respectively
  - Changing this weighting did not change the top four – some movement between them, but no change overall

PALMERSTON NORTH

NATURE CALLS

A FRESH LOOK AT HOW WE MANAGE WASTEWATER



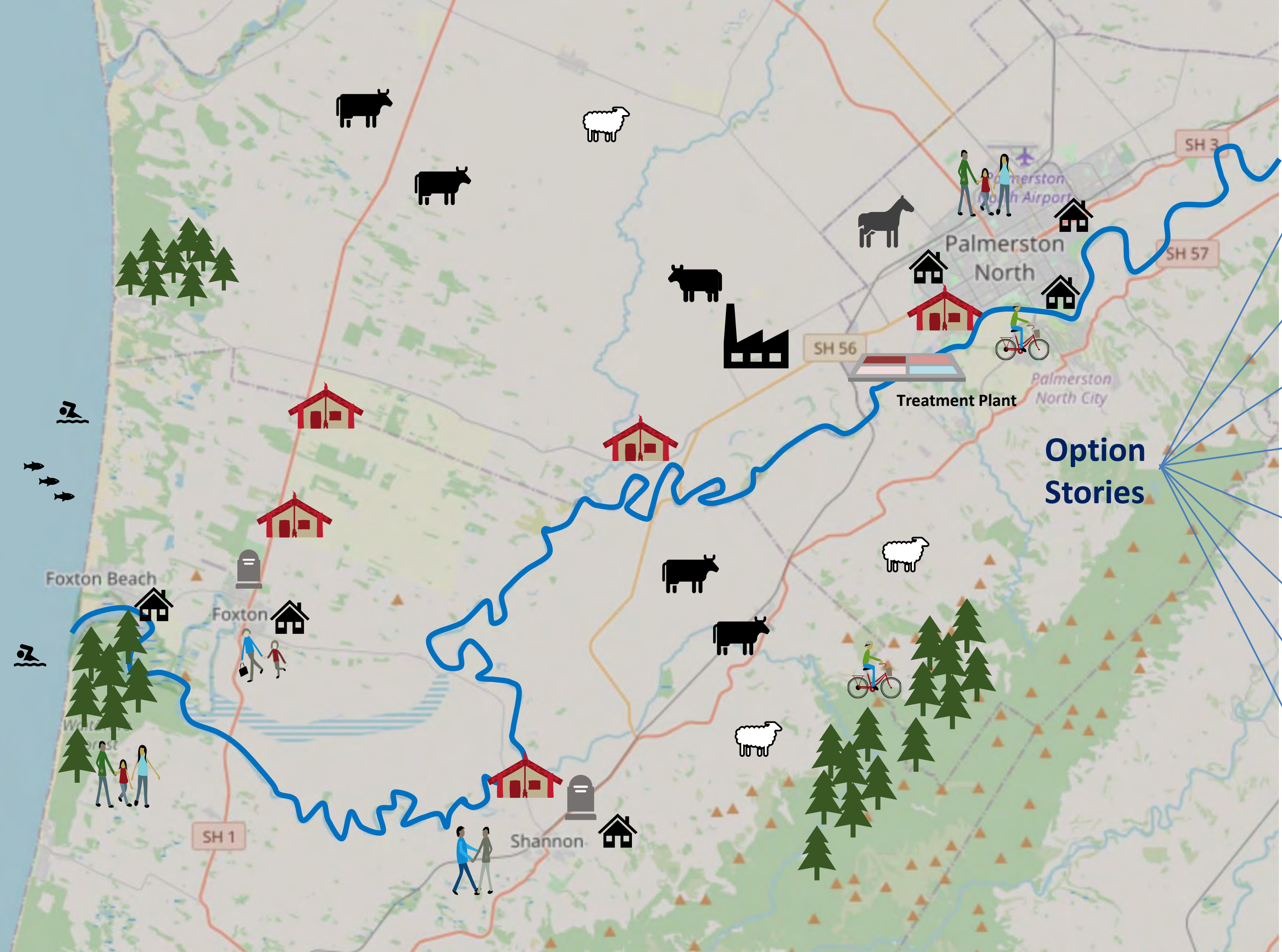
PALMERSTON NORTH
NATURE CALLS

Understanding the options

Robert Van Bentum – Transport & Infrastructure Manager
Melaina Voss – BPO Project Manager

2 ½ hours

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER



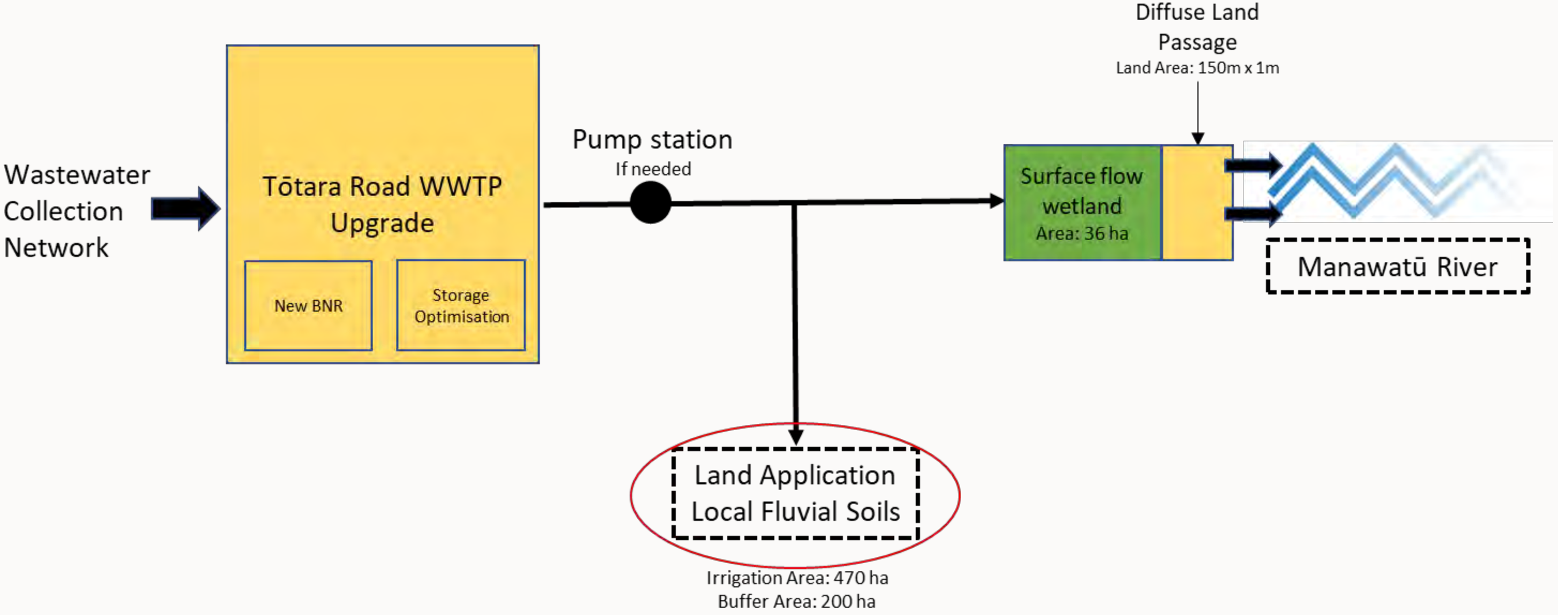
Option Stories

- Public Health
- Māori Cultural Values
- Natural Environment
- Resilience
- Financial Implications
- Technology & Infrastructure
- Growth & Economic Development
- Social & Community Considerations

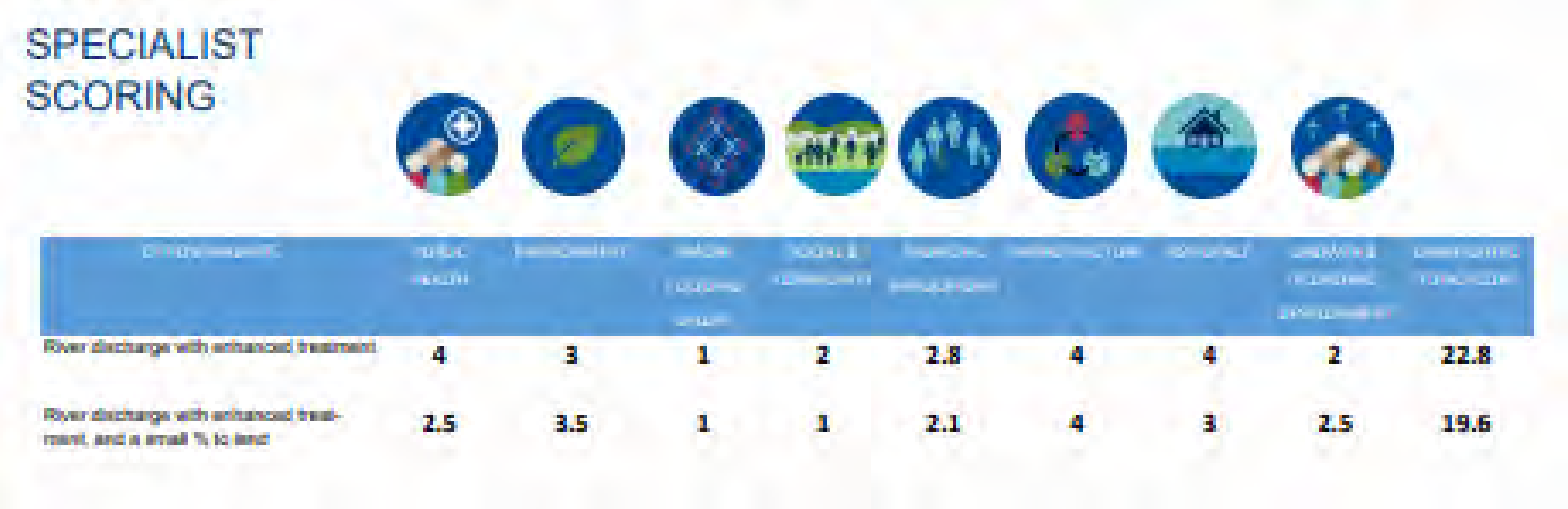
Option 1 - River discharge with enhanced treatment

30 mins

Option 1 – Schematic & Description



Option 1 - Scoring



SPECIALIST SCORING

[illegible]	PUBLIC HEALTH	ENVIRONMENT	[illegible]	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	[illegible]	[illegible]	[illegible]
River discharge with enhanced treatment	4	3	1	2	2.8	4	4	2	22.8
River discharge with enhanced treatment, and a small % to land	2.5	3.5	1	1	2.1	4	3	2.5	19.6

Group Discussion

- What are the challenges of this option?
- What is positive's about this option?
- What additional information do you need?
- Any questions for the specialists?

PALMERSTON NORTH

NATURE CALLS

Lunch Break

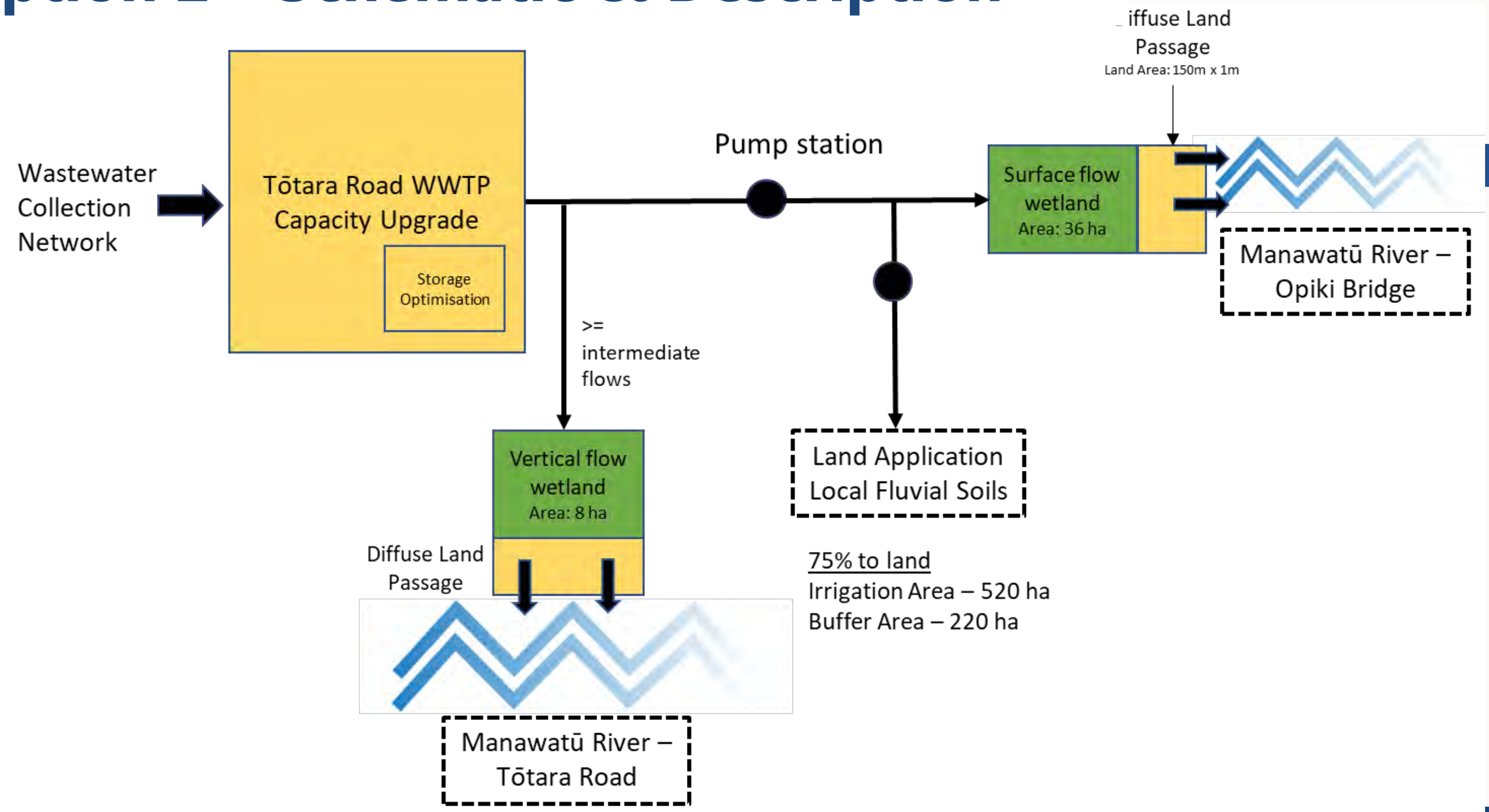
12.30 – 1.15pm

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Option 2 - Two River Discharge Points

30 mins

Option 2 – Schematic & Description



Wastewater Collection Network

Tōtara Road WWTP Capacity Upgrade

Storage Optimisation

Pump station

>= intermediate flows

Vertical flow wetland
Area: 8 ha

Diffuse Land Passage

Manawatū River – Tōtara Road

Land Application Local Fluvial Soils

<u>75% to land</u>
Irrigation Area – 520 ha
Buffer Area – 220 ha

Surface flow wetland
Area: 36 ha

iffuse Land Passage
Land Area: 150m x 1m

Manawatū River – Opiki Bridge

Option 2 - Scoring

SPECIALIST SCORING

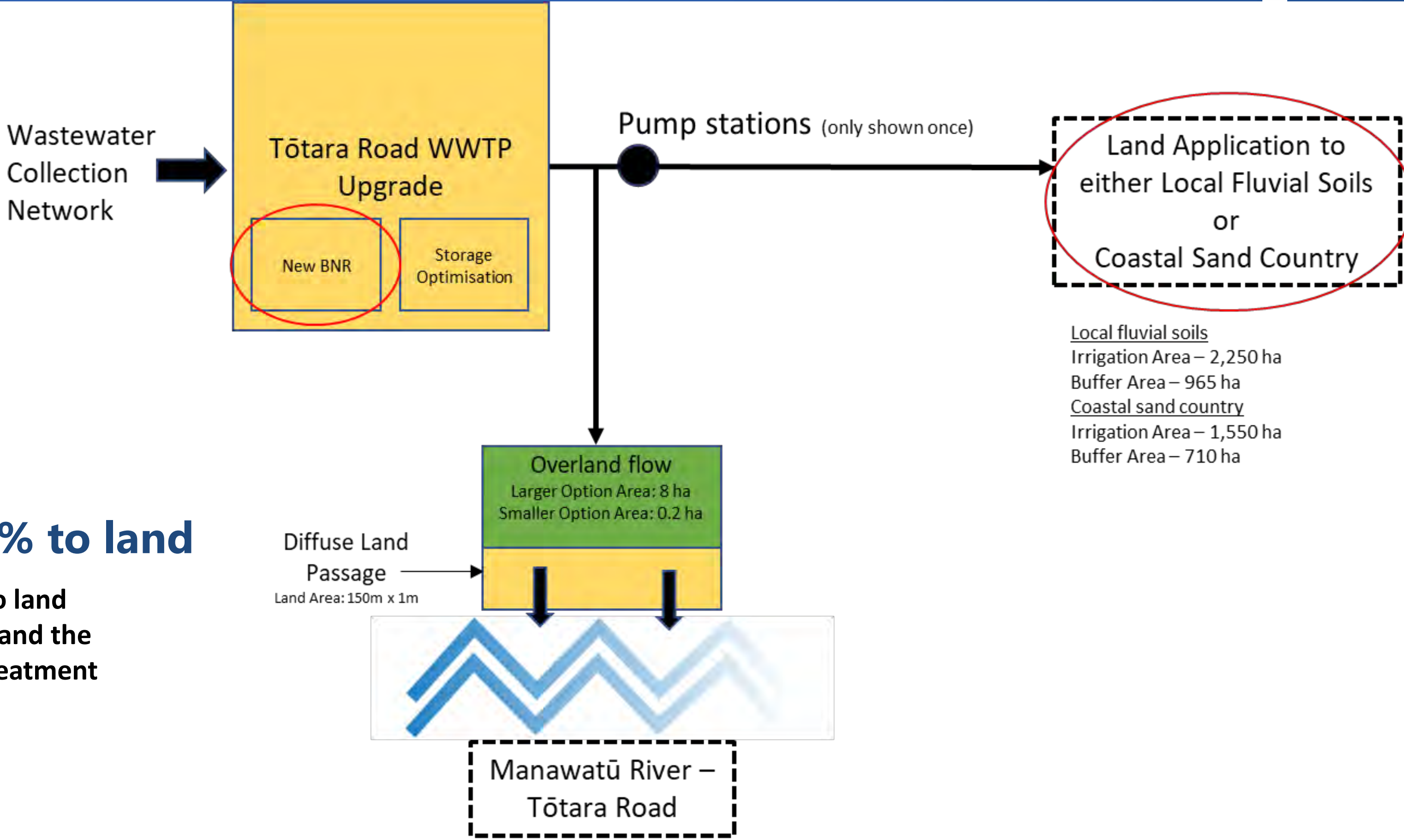
OPTION	PUBLIC HEALTH	ENVIRONMENT	MĀORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	RESILIENCE	GROWTH & ECONOMIC DEVELOPMENT	UNWEIGHTED TOTAL SCORE
Two river discharge points, and a small % to land	4	4	1	1	2.7	3	3.5	2.5	21.7

Option 3 - 97% to land

30 mins

Option 3 – 97% to land

Variation relates to land application location and the associated level of treatment



Wastewater Collection Network

Tōtara Road WWTP Upgrade

New BNR

Storage Optimisation

Pump stations (only shown once)

Land Application to either Local Fluvial Soils or Coastal Sand Country

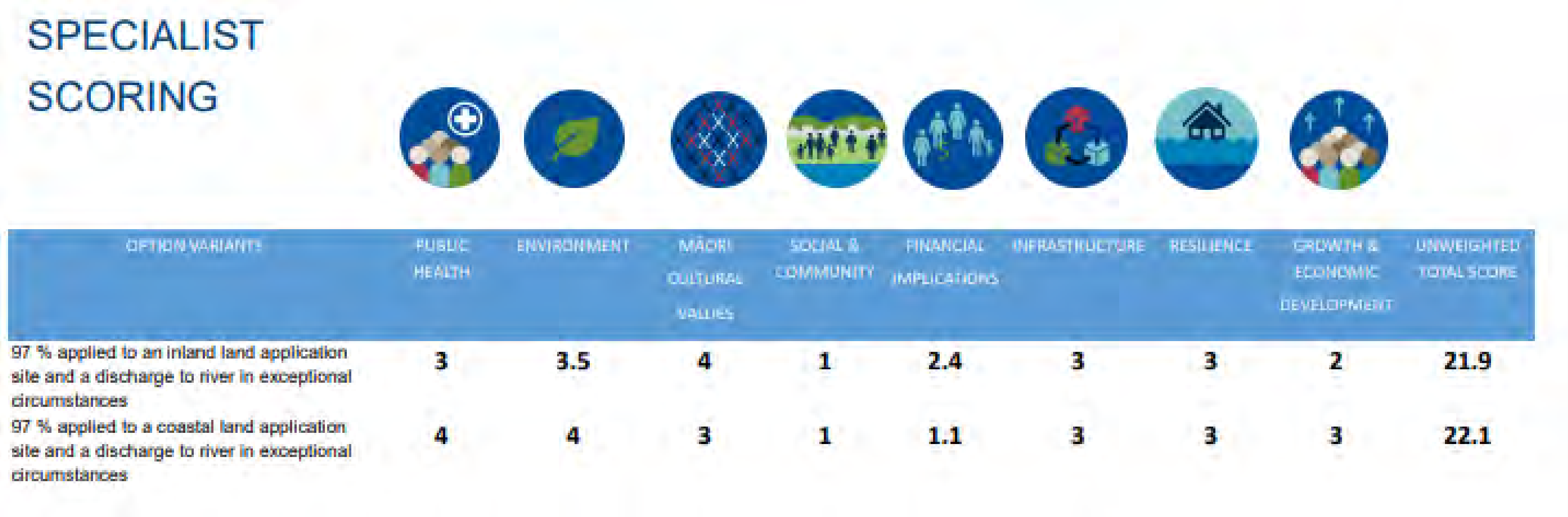
Local fluvial soils
Irrigation Area – 2,250 ha
Buffer Area – 965 ha
Coastal sand country
Irrigation Area – 1,550 ha
Buffer Area – 710 ha

Overland flow
Larger Option Area: 8 ha
Smaller Option Area: 0.2 ha

Diffuse Land Passage
Land Area: 150m x 1m

Manawatū River – Tōtara Road

Option 3 - Scoring



SPECIALIST SCORING

OPTION VARIANTS	PUBLIC HEALTH	ENVIRONMENT	MĀORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	RESILIENCE	GROWTH & ECONOMIC DEVELOPMENT	UNWEIGHTED TOTAL SCORE
97 % applied to an inland land application site and a discharge to river in exceptional circumstances	**3**	**3.5**	**4**	**1**	**2.4**	**3**	**3**	**2**	**21.9**
97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	**4**	**4**	**3**	**1**	**1.1**	**3**	**3**	**3**	**22.1**

PALMERSTON NORTH NATURE CALLS

HE TIROHANGA HOU KI TE WAI PARA

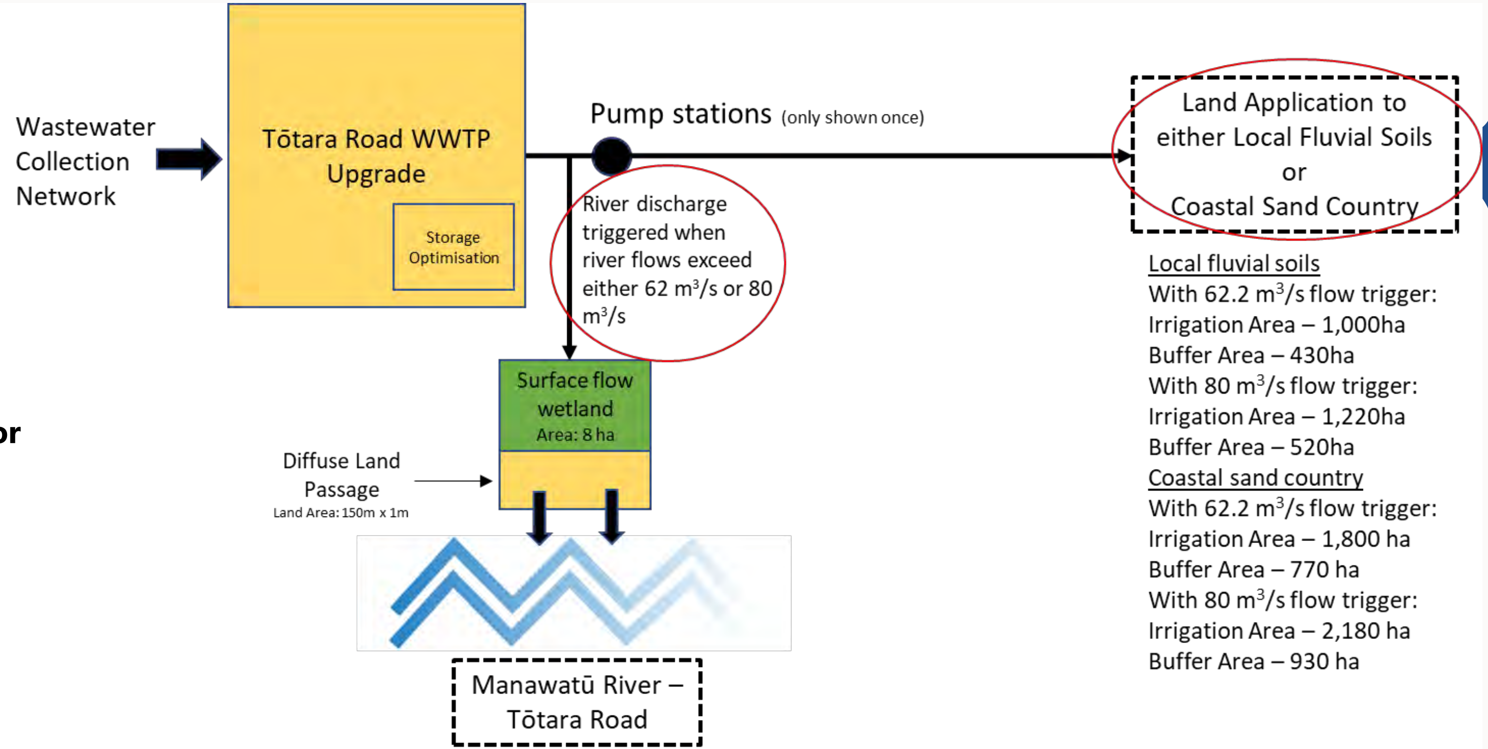
Option 4 - 45 or 55 % applied to land

30 mins

Option 4 – 45 or 55 % applied to land

Variation relates to:

1. **location of land application and**
2. **the flow trigger for river discharge**



Wastewater Collection Network

Tōtara Road WWTP Upgrade

Storage Optimisation

Pump stations (only shown once)

Land Application to either Local Fluvial Soils or Coastal Sand Country

River discharge triggered when river flows exceed either 62 m³/s or 80 m³/s

Surface flow wetland
Area: 8 ha

Diffuse Land Passage
Land Area: 150m x 1m

Manawatū River – Tōtara Road

Local fluvial soils
With 62.2 m³/s flow trigger:
Irrigation Area – 1,000ha
Buffer Area – 430ha
With 80 m³/s flow trigger:
Irrigation Area – 1,220ha
Buffer Area – 520ha
Coastal sand country
With 62.2 m³/s flow trigger:
Irrigation Area – 1,800 ha
Buffer Area – 770 ha
With 80 m³/s flow trigger:
Irrigation Area – 2,180 ha
Buffer Area – 930 ha

Option 4 - Scoring

SPECIALIST SCORING

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	1	3.0	3	3.5	3	22.5
55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	1	2.8	3	3.5	3	23.3
45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.5	3	2.5	2	18
55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.2	3	2.5	2	17.7

PALMERSTON NORTH

NATURE CALLS

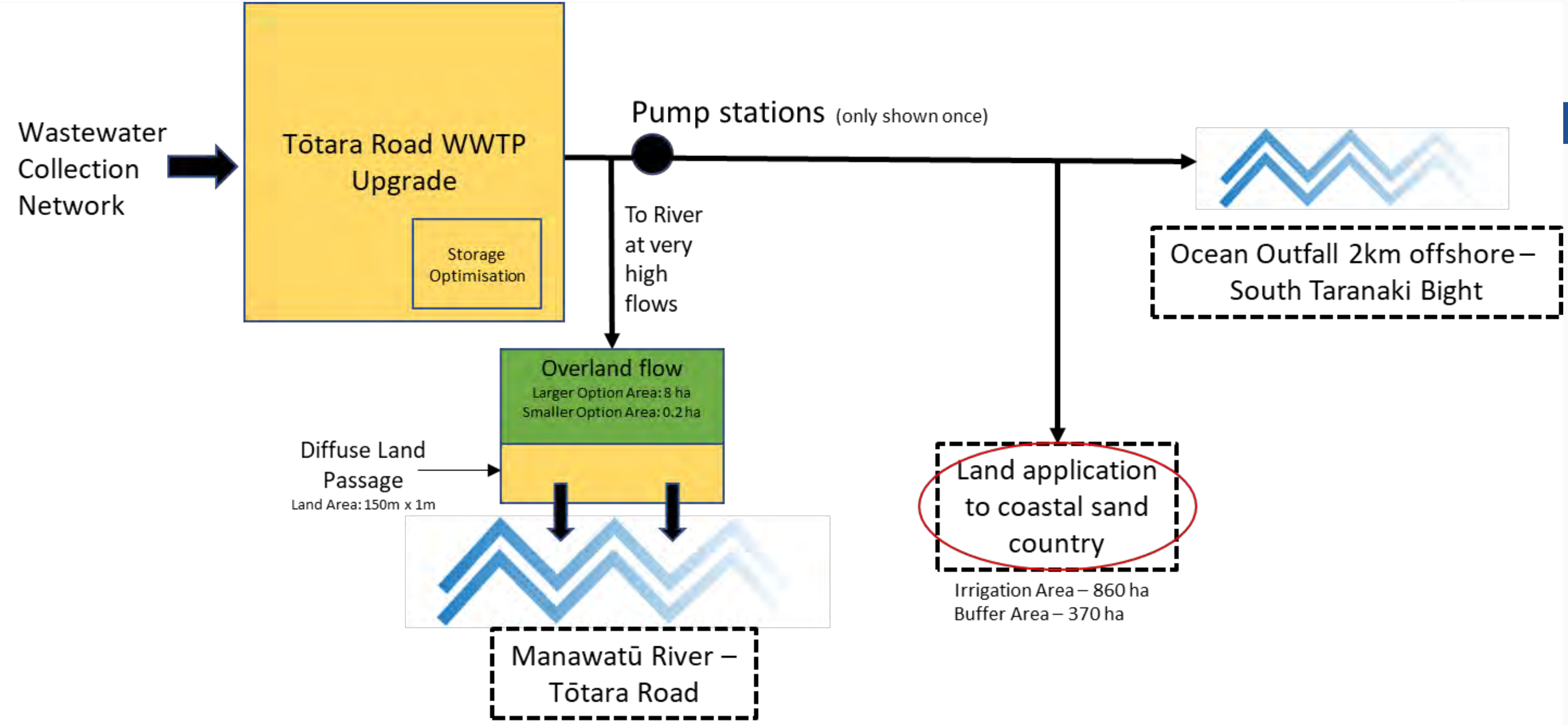
Option 6 - Ocean

30 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Option 6 – Ocean

Variation relates to whether this option includes land application



Wastewater Collection Network

Tōtara Road WWTP Upgrade

Storage Optimisation

Pump stations (only shown once)

To River at very high flows

Overland flow
Larger Option Area: 8 ha
Smaller Option Area: 0.2 ha

Diffuse Land Passage
Land Area: 150m x 1m

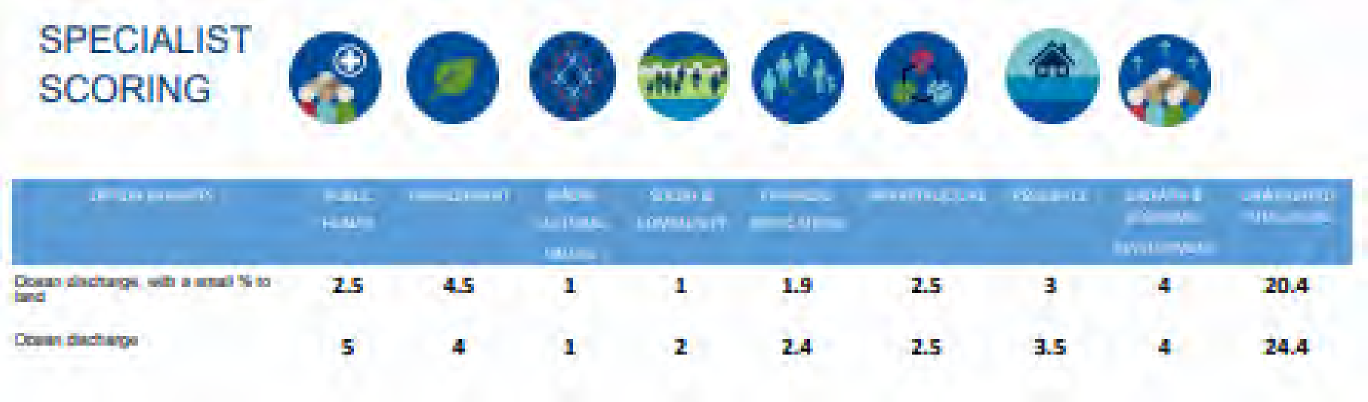
Manawatū River – Tōtara Road

Ocean Outfall 2km offshore – South Taranaki Bight

Land application to coastal sand country

Irrigation Area – 860 ha
Buffer Area – 370 ha

Option 6 - Scoring



SPECIALIST SCORING

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ocean discharge, with a small % to land	2.5	4.5	1	1	1.9	2.5	3	4	20.4
Ocean discharge	5	4	1	2	2.4	2.5	3.5	4	24.4

PALMERSTON NORTH

NATURE CALLS

Afternoon Tea

3.15 – 3.30pm

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Option Scoring Consolidation

Melaina Voss - 30 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Comparative Option Scoring

Options	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development	Combined score
1: R2(b)	4	3	1	2	2.8	4	4	2	22.8
	2.5	3.5	1	1	2.1	4	3	2.5	19.6
2: Dual R + L	4	4	1	1	2.7	3	3.5	2.5	21.7
3: L+R (a) & (b)	3	3.5	4	1	2.4	3	3	2	21.9
	4	4	3	1	1.1	3	3	3	22.1
4: L + R (d) & (e)	3	4	2	1	3	3	3.5	3	22.5
	3	4	3	1	2.8	3	3.5	3	23.3
	2	3	2	1	2.5	3	2.5	2	18
	2	3	2	1	2.2	3	2.5	2	17.7
6: Ocean	2.5	4.5	1	1	1.9	2.5	3	4	20.4
	5	4	1	2	2.4	2.5	3.5	4	24.4

PALMERSTON NORTH

NATURE CALLS

Assessment Criteria Weighting

Melaina Voss- 55 mins

Weighting or No Weighting?

Should assessment criteria weighting be applied??

- **Yes?**
- **No?**
- **Undecided?**

Group Discussion - Weighting or No Weighting – Which Criteria

YES - assessment criteria weighting should be applied??

- **Discuss and record why? +**
- **Which assessment criteria more important?**
- **What weighting could be applied?**

NO - assessment criteria weighting should be applied??

- **Discuss and record why?**

Undecided? – Join a group until you decided

Step 1 - All groups record thoughts onto post it notes and group on Butchers paper
Step 2 - Collate all Yes/No outputs onto wall and summarise

Weighting Sensitivity Testing

- What weighting scenarios would you like to see in Day 2?
- Scenarios will be applied overnight?

Day 1 - Summary

We have collectively:

- Been briefed by the Assessment Specialists
- Considered each option and the criteria assessment
- Considered the benefits/non benefits of weighting the criteria
- Agreed what you would like to see in day 2 for weighting sensitivity testing

Agenda for Day 2 – Trade off between the options

Weighting Sensitivity Testing

- Weighted option scoring results
- Lock in the weighting(if any)

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Summary wrap up

- Option story

Next steps

- What further information do we need going forward

PALMERSTON NORTH

NATURE CALLS

Thinking over night

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Close from the Mayor

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Wastewater BPO
Day 2

Collaborative MCA

9th & 10th November

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Karakia

PALMERSTON NORTH
NATURE CALLS

Welcome from the Mayor

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

MCA – Workshop Agenda

Sara Dennis - Just Add Lime

5 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Agenda for Day 2 – Trade off between the options

Weighting Sensitivity Testing

- Weighted option scoring results
- Lock in the weighting(if any)

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Summary wrap up

- Option story

Next steps

- What further information do we need going forward

Breaks

Morning Tea	10.15 – 10.35
Lunch	12.35 – 1.15
Afternoon Tea	?? – ??

PALMERSTON NORTH
NATURE CALLS

Weighting Sensitivity Testing

Part 1 - Specialists/Workshop Weighting

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

PALMERSTON NORTH

NATURE CALLS

Morning Tea

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Weighting Sensitivity Testing

Part 2 – Project Teams Weighting

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

PALMERSTON NORTH
NATURE CALLS

Weighting Sensitivity Testing

Part 3 – Comparing the Differences

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

PALMERSTON NORTH NATURE CALLS

HE TIROHANGA HOU KI TE WAI PARA

Lunch

PALMERSTON NORTH
NATURE CALLS

Preferred Option(s)

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

PALMERSTON NORTH
NATURE CALLS

Afternoon Tea

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Wrap-Up

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

XXX

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

XXX

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Wastewater BPO
Day 1

Collaborative MCA

9th & 10th November

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Karakia

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Welcome from the Mayor

5 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

MCA – Workshop Agenda

Sara Dennis - Just Add Lime

5 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Agenda for Day 1- Gain Insight & shared understanding

Technical specialist

- How they went about scoring specific criteria & why

Understanding the Options

- Consolidated scores from specialist’s
- Discuss to collectively understand/further group input
- Build up an integrated story about each option - integrated specialist view

Overall option score variation

- scoring high/low

Collectively agree weighting (if any, will apply overnight)

Refresh MCA scores based on collective inputs/enhanced understanding (if any, will apply overnight)

Breaks

Morning Tea	10.30 – 10.45
Lunch	12.30 – 1.15
Afternoon Tea	3.15 – 3.30

Agenda for Day 2 – Trade off between the options

Weighting Sensitivity Testing

- Weighted option scoring results
- Lock in the weighting(if any)

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Summary wrap up

- Option story

Next steps

- What further information do we need going forward

PALMERSTON NORTH

NATURE CALLS

Introduction

Robert Van Bentum – Transport & Infrastructure Manager

Melaina Voss – BPO Project Manager

10 mins

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Wastewater Project Charter Tu-Tohinga

PALMERSTON NORTH
NATURE CALLS

VISION PAE TAWHITI

Management of the City's wastewater which enables growth, protects and enhances the environment and contributes to improving the health and mauri of the Manawatū River.

Ko te whakahaere I te parawai o Papioea, e pai ait e tipu o te taonga, e rauhītia ai te taiao, e piki anō ai te ora me te mauri o Te Awa o Manawatū.

TREATY COMMITMENT TE MANAWA TITIKAHA KI TE TIRITI O WAITANGI

As per National Policy Statement on freshwater, provide for the involvement of iwi and hapū, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision-making regarding freshwater planning;

PROJECT OBJECTIVES PAE TATA

A best practicable option wastewater management solution that is developed in partnership with Rangitāne o Manawatū which:

1. Protects public health and minimises public health risks.
2. Minimises adverse environmental effects on air, land and water;
3. Is sustainable, enduring, and resilient;
4. Contributes to improving the health and mauri of the Manawatū River;
5. Takes an integrated approach to the management of the Manawatū River Catchment including understanding cumulative effects;
6. Enhances peoples use and enjoyment of the Manawatū River
7. Is affordable and cost effective;
8. Minimises whole of life carbon emissions and optimises resource recovery;
9. Is innovative while being evidence based;
10. Facilitates long term growth and economic development
11. Is developed with the active engagement of the community and key stakeholders

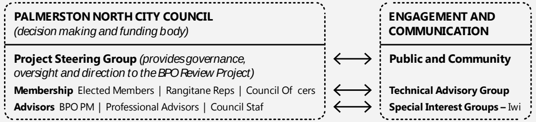
VALUES UARA

Decision making processes followed during the project shall be:

a. Evidence based;
b. Efficient and timely;
c. Undertaken to meet the requirements of the current resource consent (in terms of the scope of the BPO review); and
d. Consistent with the National Policy Statement for Freshwater Management, the National Policy Statement on Urban Development Capacity and the One Plan.
e. PNCC and Horizons work collaboratively in developing the best practicable option for the management of the City's wastewater.

PROJECT STRUCTURE TE HANGA O TE KAUPAPA

The current roles and responsibilities of the groups associated with the project are summarised in the infographic to the right –



PALMERSTON NORTH CITY COUNCIL
(decision making and funding body)

Project Steering Group *(provides governance, oversight and direction to the BPO Review Project)*

Membership Elected Members | Rangitane Reps | Council Officers

Advisors BPO PM | Professional Advisors | Council Staff

ENGAGEMENT AND COMMUNICATION

Public and Community

Technical Advisory Group

Special Interest Groups – Iwi

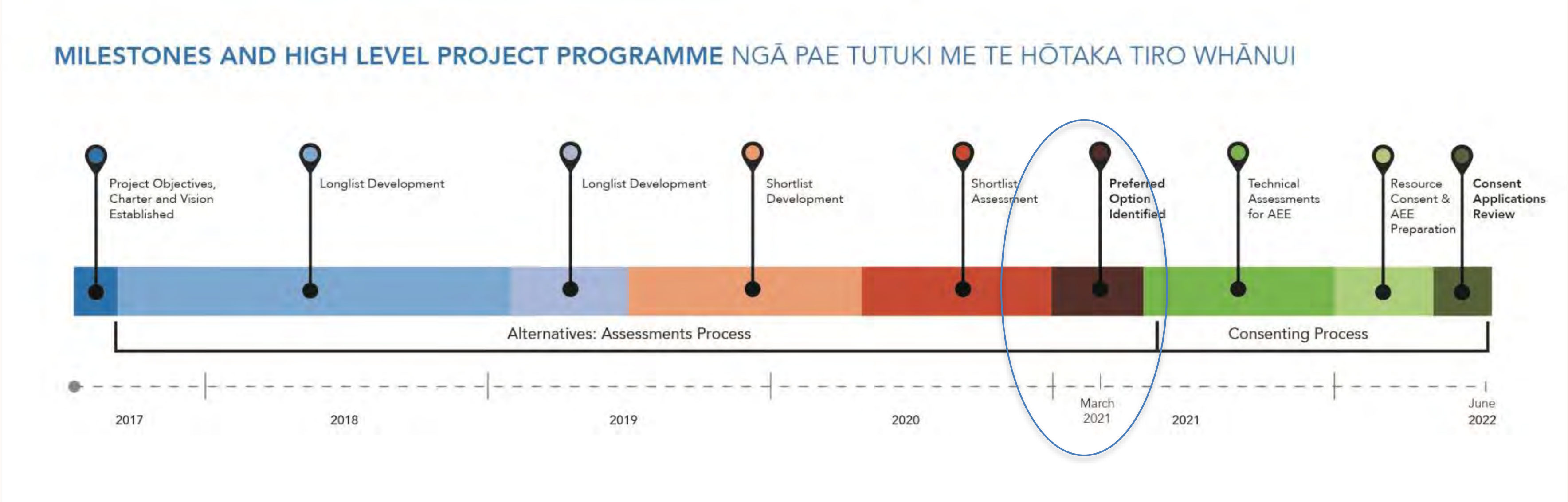
STAKEHOLDER ENGAGEMENT TE WHAI WĀHITANGA MAI O TE HUNGA WHAIPĀNGA

This section will outline the focus and broad approach to community and stakeholder engagement. A draft Communication and Engagement Plan is being prepared.

What we have achieved so far

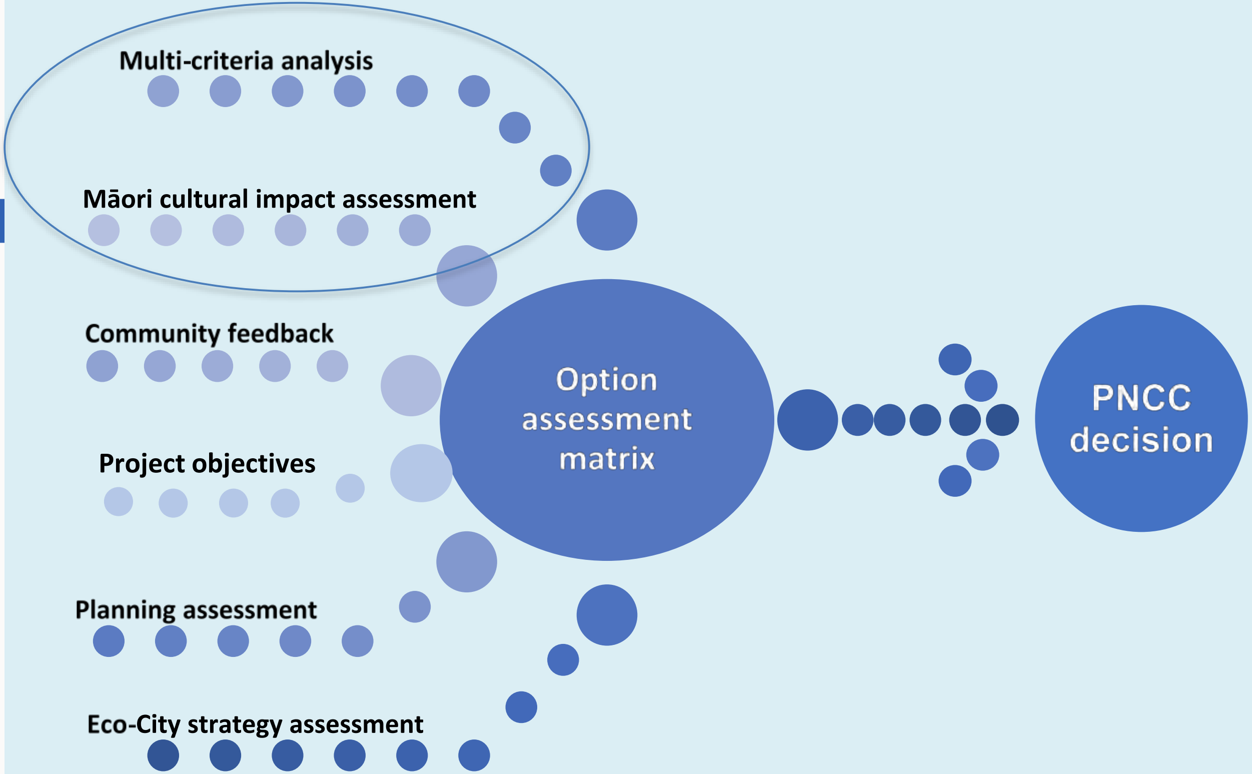
- Contextual review and understanding of our future growth and infrastructure needs
- Development of longlist options, evaluation and refinement to a shortlist
- Investigation into potential receiving environments and the environmental and environmental legislation constraints
- Closely working with Horizons Regional Council
- Community and stakeholder engagement
- Closely working with Rangitane o Manawatu along the way. Now working with neighbouring Iwi.

Where we are in our decision-making process



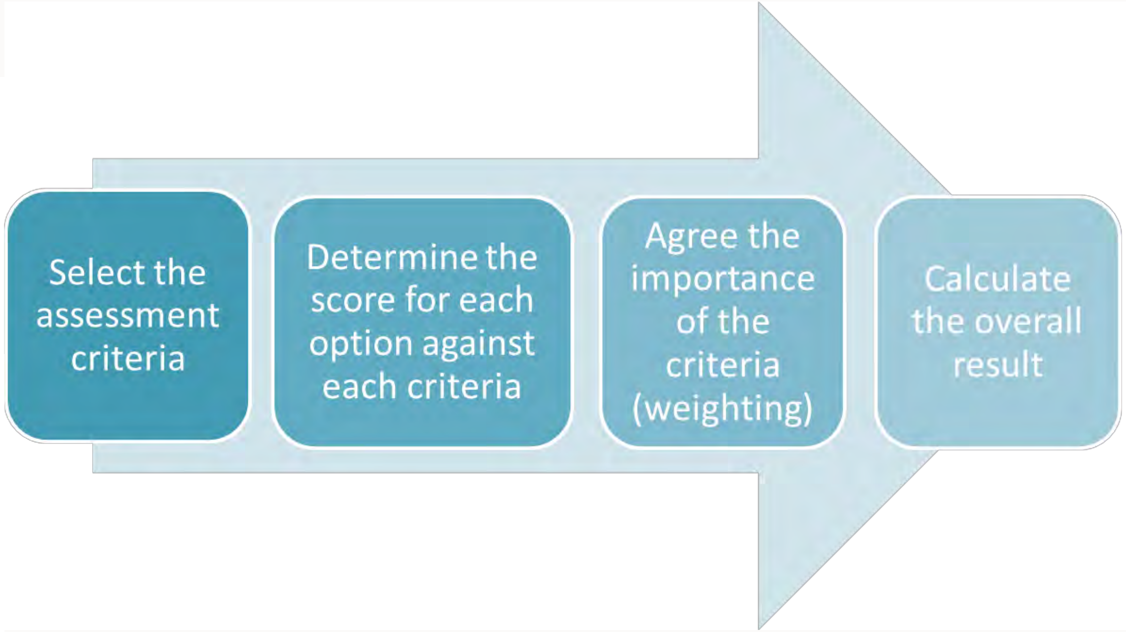
MILESTONES AND HIGH LEVEL PROJECT PROGRAMME NGĀ PAE TUTUKI ME TE HŌTAKA TIRO WHĀNUI

Overall Approach



Multi-Criteria Analysis (MCA)

- Systematic way of comparing options using a range of criteria
- For complex problems it provides a **relatively** simple way of comparing their merits
- MCA does have limitations that need to be kept in mind - inherent ‘subjectivity’ and unconscious bias of the participants – sensitivity testing
- Use a collaborative workshop process, involving partners and stakeholders



Select the assessment criteria

Determine the score for each option against each criteria

Agree the importance of the criteria (weighting)

Calculate the overall result

PALMERSTON NORTH
NATURE CALLS

Specialist Assessment

Sara Dennis – 2 hours with
8 Specialists 15 mins each

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Cultural Context

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Assessment Criteria

Public Health	Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)
Māori Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga
Financial Implications	Comparative capital, operational, whole of life costs of the option. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.
Natural Environment	Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology
Resilience	Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.
Growth & Economic Development	Will the option support the population and economic growth anticipated for the City by Council?
Social & Community Considerations	Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option
Technology & Infrastructure	Degree to which the option: • Uses reliable & proven technology • Can be staged • Able to be constructed • Constructed within app timeframe • Allows resource recovery/beneficial re-use

Jim Bradley – Stantec
Brett Munro – MidCentral DHB
Stephen Palmer – Regional Public Health

Public Health

Degree of public exposure to health risks in treated wastewater (including through land application or re-use options)

Public Health

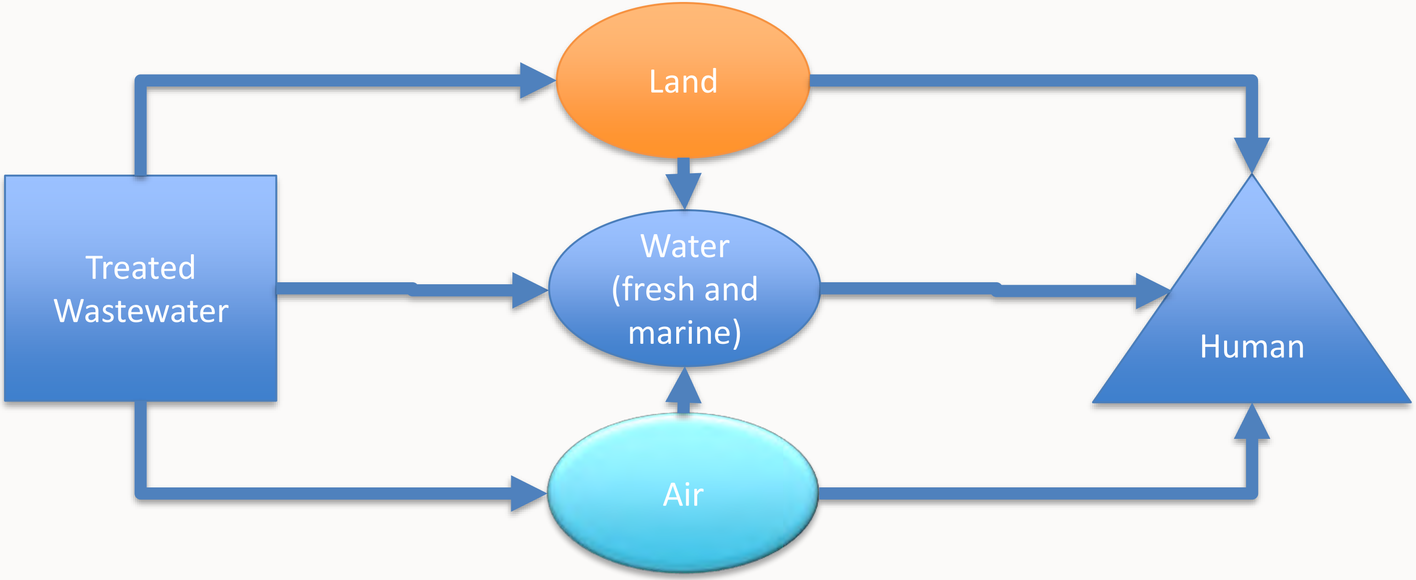
Methodology is based on the potential for Public Health Risk from human contact with the treated wastewater

Uses a conceptual exposure pathway methodology

Recommended criteria based on number of identified critical exposure pathways:

- **differentiates between options**
- **focuses on critical pathways**
- **reflects the potential difficulty in managing the risk to public health resulting from the treated wastewater**

Public Health – Conceptual Exposure Pathways



Public
Health

Criteria Selection

1 Low	2 Low - medium	3 medium	4 Medium - high	5 High
Catastrophic: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a major illness, which is likely to be dangerous to sensitive members of the community	Major: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a moderate illness, which may be dangerous to sensitive members of the community	Moderate: health effects affect a larger group of people across a wider area, which requires a larger scale of public health response with contact tracing. All persons affected only experience a minor illness	Minor: health effects are limited to a single person, single household or single group of people who can be readily identified and contacted by the public health authorities and the consent holder for appropriate advice who experience a minor illness	Insignificant: illness resulting from the treated wastewater discharge is indiscernible above the normal background level of illness in the community.

Keith Hamill – River Lake
Olivier Ausseil – Aquanet
Aslan Perwick – PDP

Natural Environment

Potential adverse environmental effects on the receiving environment (including the Manawatū River), particularly in relation to water quality (including the matters listed in s107 (1) (c) to (g)), soils, aquatic ecology and terrestrial ecology

Natural Environment: Key considerations

Rivers and Lakes

- Nutrients to Manawatū causing periphyton growth and exceeding OP targets (used PointSim Model)
- Effects on river less at high flows and downstream of Opiki.
- Risk from land treatment to small streams / lakes (considered N leaching rate cf. current landuse, irrigation area/location)

Coastal

- Near shore zone and benthic habitats near the outfall.

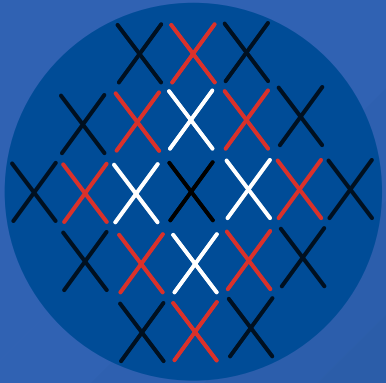
Groundwater & Soils

- N leaching rate, seasonal application, ability to avoid sensitive areas and apply buffer zones.

Natural Environment Scoring Criteria

Score	Adverse Effect	Description	Example
1	Very High	Major loss or change in baseline conditions.	One Plan (OP) targets regularly exceeded. Risk of chronic toxicity.
2	High	Major change in baseline conditions.	
3	Moderate	Moderate change in baseline but generally acceptable.	OP targets generally met but risk of occasional exceedance. Minor effects on soils.
4	Low	Small shift from baseline.	
5	Very Low	Very slight change from baseline.	Negligible ecological effects. Risk to exceeding OP targets is very low. Negligible to positive effect on GW. Benefits to soils.

Jonathan Proctor – Rangitane
Danielle Harris - Rangitane



Māori Cultural Values

Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga

Context

- The assessment was undertaken by the Rangitāne o Manawatū representatives and Te Ao Turoa staff. Key concepts focused on;
    - Cultural Values
    - Cultural Landscapes
    - Atua
    - Potential Acceptance to our people

- Options discussed in 3-4 half day hui. Values and assessments undertaken in 2 wananga

- Rangitāne o Manawatū also invited neighbouring Iwi Ngati Apa, Muaupoko and Ngati Kauwhata.

<u>Fundamentals</u>

Protection of Rangitāne o Manawatū, Protection of the River, Enhancement for the people and future

Māori Cultural Values

Criteria Selection

Criterion	Description	1	2	3	4	5
Rangitāne Cultural Values	Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Rangitāne o Manawatū, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga	Destruction of Rangitāne culture, connections and kaitiakitanga. Critical effect on Rangitāne o Manawatū	Significant effect or impact on all aspects of Rangitāne Mana, Toanga, Atua and natural resources	Major impact on all aspects of Rangitāne significant sites and natural resources	Minimal impact on Rangitāne significant sites and natural resources	Minimal to no effect on Rangitāne o Manawatū

Māori
Cultural
Values

Significance

- The Mana of Rangitāne o Manawatū would be recognised through having the activities contined within in the Manawatū / Rangitāne o Manawatū Rohe
- The Manawatū River is not to be further impacted
- The Coast and its resources are not to be impacted or threatened
- Must be future focused, plan for growth, three waters development – more important than short time cost
- Rangitāne o Manawatū believe the is an error not to make continued improvements in treatment before discharge– strong desire to work towards treating to "drinking water standards"
- Neighbouring Iwi maintain the ability to make their own decisions and contribution.

Julie Boucher – Just Add Lime

Social & Community Considerations

Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option

Social & Community Considerations

Context

- Based on engagement to date
- Not dependent on specific location
- Consideration of distributional impacts
- Accepted methodology

Social & Community Considerations

Criteria Selection

Criteria	Description	Level
Gravity	Option will cause death or adverse health effects that could lead to significant reduction in quality of life and/or longevity and/or continued exposure is generally likely to lead to long term limiting illness or disease	G1
	Infringement in access to: • Basic life necessities (including education, livelihood etc) and/or • Cultural, economic, natural or social infrastructure/assets that have been identified as highly valued by identified groups or subject matter experts • Ecosystem services identified as priority to livelihoods[1], health, safety or culture by identified groups or subject matter experts	G2
	All other impacts	G3
Distributive equity	Waste water treated in PNCC and part of the water discharged into the river and/or part of the water conveyed out of PNCC area so treated water can be applied to land outside the PNCC area	E1
	Waste water treated in PNCC area and all discharge into the river within PNCC or piped to the ocean for discharge	E2
	Waste water treated in PNCC area and treated water applied to land wholly within PNCC area	E3

Social & Community Considerations

Criteria Selection cont

Criteria	Description	Level
Need for land acquisition and degree of permanence of land use change	Yes with permanent land/water use changes	PC1
	Yes with temporary land/water use changes (able to be reversed) or no need for acquisition	PC2
Public support for the option[2]	Little or no support based on feedback from the public (<25% of feedback identified as most preferred)	S1
	Feedback doesn't provide a clear indication of support (25 – 50% feedback identified as most preferred)	S2
	High level of support based on feedback from the public (>50% of feedback identified as most preferred)	S3

Significance

The significance of potential social effects is then calculated using the following table

Specification of conditions for assigning significance	Rating	Score
G1 (regardless of any other criteria), or G2 and PC1 and S1/S2 (regardless of distributive equity)	Severe	1
G2 and PC1 and S3 (regardless of distributive equity), or G2 and PC2 and E1/E2 and S1/S2	Major	2
G2 and PC2 and E3 (regardless of support), G3 and PC1 (regardless of extent and support) or G3 and E1/E2 and R1/R2 (regardless of support)	Moderate	3
G3 and E1/E2 and PC2 and S3	Minor	4
G3 and E3 and PC2 and S3	Insignificant	5

Anna Bridgeman - Stantec

Resilience

Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.

Resilience Categories

Natural Hazards

- Risks of earthquakes
- Land movement and erosion
- Flooding
- Storm surge/tsunami

Climate Change and Adaptation

- High intensity rainfall peaks
- Prolonged wet weather periods
- Prolonged dry periods
- Prolonged dry periods resulting in an increase of low flows in the Manawatū River flows,
  - increased levels of treatment (phosphorous and nitrogen removal for greater periods of time)
- Sea level rise

Resilience Criterion

Method of Assessment

- Degree to which option is resilient to natural hazards & climate change – from LOW to HIGH
- Comparative comparison between the options
- Overall score given based on the average of sub-category scores

Criterion	Description	1	2	3	4	5
Resilience	Degree to which the option is resilient to • natural hazards • climate change	Low degree of resilience	Low – Medium degree of resilience	Medium degree of resilience	Medium – High degree of resilience	High degree of resilience

Melaina Voss – Stantec
Richard Peterson - Stantec

Growth & Economic Development

Will the option support the population and economic growth anticipated for the City by Council?

Growth & Economic Development

Context

- Based on growth projects for the next 35 years – 50 years
- No specific sites identified
- Considering Councils growth and economic development strategies as well as the regions plans (known)
- Consideration of capacity to provide a sub-regional scheme ie additional flows and loads as well as proximity to connect other wastewater systems

Growth & Economic Development

Criteria Selection

Criterion	Description	1	2	3	4	5
Growth and Economic Development	The degree to which the options will: • Support the population and economic growth anticipated for the City by Council? • Support / restrict further up-scaling to accommodate a sub-regional scheme?	Low degree	Low – Medium degree	Medium degree	Medium – High degree	High degree

PALMERSTON NORTH

NATURE CALLS

Morning Tea

10.30 – 10.45am

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Anna Bridgeman - Stantec

Technology & Infrastructure

Degree to which the option:

- Uses reliable & proven technology
- Can be staged
- Able to be constructed
- Constructed within app timeframe
- Allows resource recovery/beneficial re-use

Technology & Infrastructure Categories

- Can be Staged
- Is able to be constructed and operational within 5 years of the commencement of the consent
- Allows for resource recovery / beneficial re-use
- Infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme
- Involves Operational/Technical Complexity
- Involves Operational Risk

Criteria Selection

- Each of the six sub-criteria were scored with regards to how well the option aligned with that sub-criteria.
  - LOW to HIGH for alignment with the first four sub-criteria
  - HIGH to LOW for Operational Complexity & Risk
- The overall draft score is an average of these six scores, rounded to the nearest 0.5
- Each sub-criteria given equal weighting.
- Average has been used rather than the lowest score as it is not believed that any one of these sub-criteria is the governing factor in the selection of the BPO.

Criterion	Description	1	2	3	4	5
Technology and Infrastructure	Degree to which the option: • can be staged • is able to be constructed and operational within 5 years of the commencement of the consent • allows for resource recovery / beneficial re-use • infrastructure can be up-scaled, prior to and post initial construction, to accommodate a sub-regional scheme • involves Operational Complexity • involves Operational Risk	Low degree of alignment with sub-criteria and/or High Operational Complexity and Risk	Low – Medium degree of alignment with sub-criteria and/or Medium-High Operational Complexity and Risk	Medium degree of alignment with sub-criteria and/or Medium Operational Complexity and Risk	Medium – High degree of alignment with sub-criteria and/or Low-Medium Operational Complexity and Risk	High degree of alignment with sub-criteria and/or Low Operational Complexity and Risk

Technology & Infrastructure Criterion

Method of Assessment

- Each of the six sub-criteria were scored with regards to how well the option aligned with that sub-criteria.
    - LOW to HIGH for alignment with the first four sub-criteria
    - HIGH to LOW for Operational Complexity & Risk
- The overall draft score is an average of these six scores, rounded to the nearest 0.5
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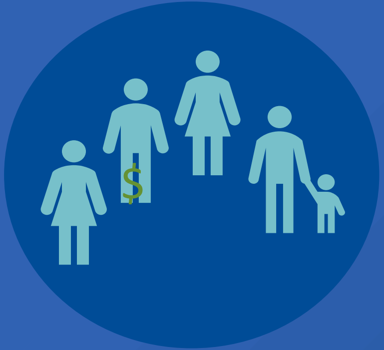
Anna Bridgeman - Stantec



Financial Implications

Comparative capital, operational, whole of life costs of the option. Where relevant to the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.

Financial Implications Comparative Assessment

Methodology

- **Step 1** – Development of capital cost and operational and maintenance cost for each component

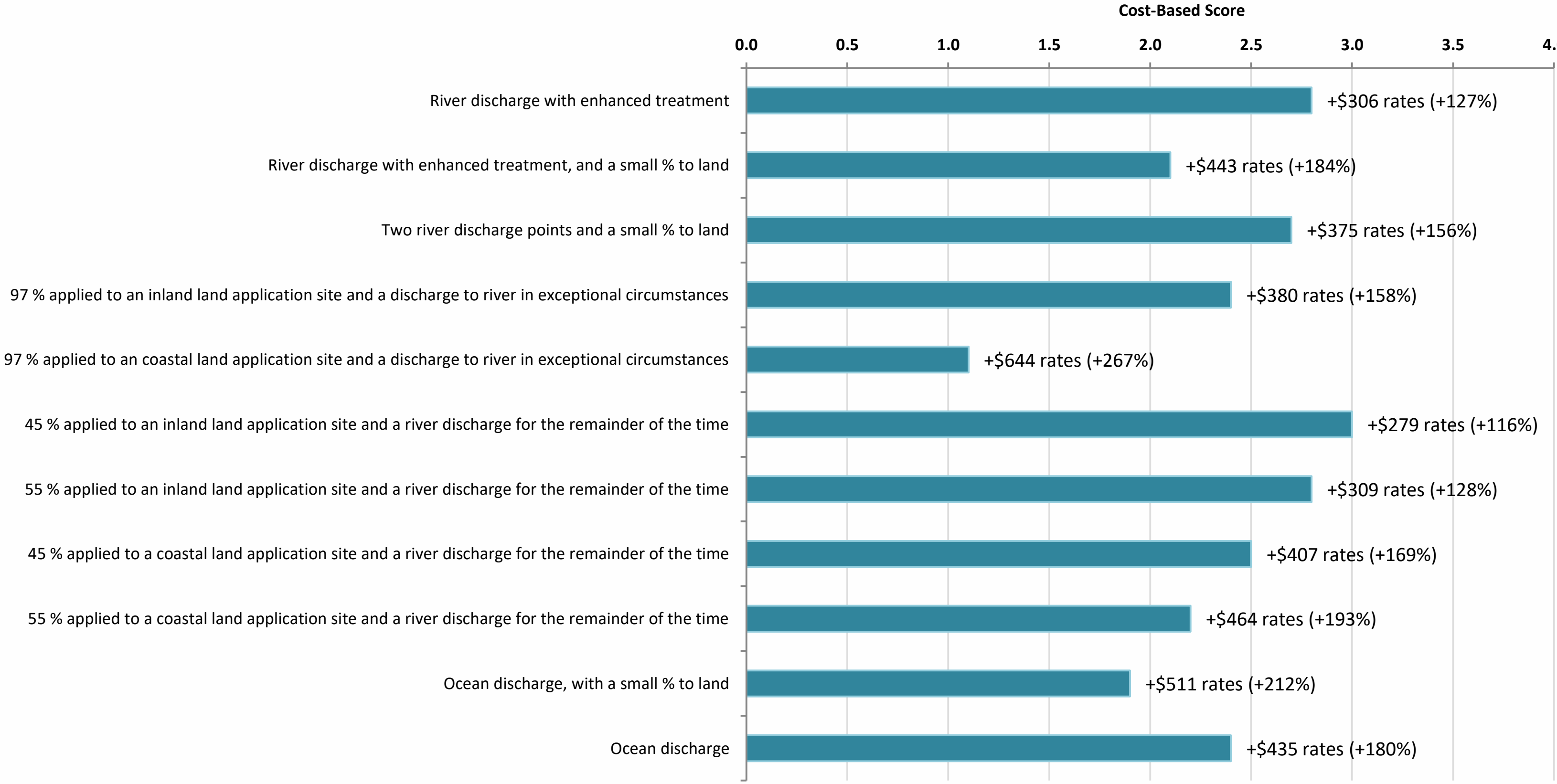
- **Step 2** – NPV assessment using Capital Cost and OPEX estimates
    - 35 year NPV from 2025
    - 6% discount rate
- **Step 3** – Sub-criteria of Capital, O&M and NPV given a weighting
- **Step 4** – Sub-criteria score for Option X = ((1 – (cost of option X / highest cost)) x 4) +1
- **Step 5** – Overall score = Combination of Sub-criteria scores x weighting

Financial Implications Comparative Assessment

Sensitivity

- **Discount Rate**
  - 6% discount rate has been used through for the option development in the longlist and shortlist phases.
  - Treasury now recommends a 5% discount rate for infrastructure projects
  - Changing the discount rate to 4% and 8% increased or decreased the NPV between 3 - 10% higher and 2 - 7% lower respectively for the options,
    - greatest change 'River with enhanced treatment options'.
    - The level of change dependent on operational and maintenance costs and the return received from crops/forestry for the option.

- **Sub-Criteria Weighting**
  - Initial weighting of 37%, 30% and 33% for cost, O&M and NPV respectively
  - Changing this weighting did not change the top four – some movement between them, but no change overall


Cost-Based Score
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
River discharge with enhanced treatment
+$306 rates (+127%)
River discharge with enhanced treatment, and a small % to land
+$443 rates (+184%)
Two river discharge points and a small % to land
+$375 rates (+156%)
97 % applied to an inland land application site and a discharge to river in exceptional circumstances
+$380 rates (+158%)
97 % applied to an coastal land application site and a discharge to river in exceptional circumstances
+$644 rates (+267%)
45 % applied to an inland land application site and a river discharge for the remainder of the time
+$279 rates (+116%)
55 % applied to an inland land application site and a river discharge for the remainder of the time
+$309 rates (+128%)
45 % applied to a coastal land application site and a river discharge for the remainder of the time
+$407 rates (+169%)
55 % applied to a coastal land application site and a river discharge for the remainder of the time
+$464 rates (+193%)
Ocean discharge, with a small % to land
+$511 rates (+212%)
Ocean discharge
+$435 rates (+180%)

PALMERSTON NORTH

NATURE CALLS

Understanding the options

Robert Van Bentum – Transport & Infrastructure Manager

Melaina Voss – BPO Project Manager

2 ½ hours

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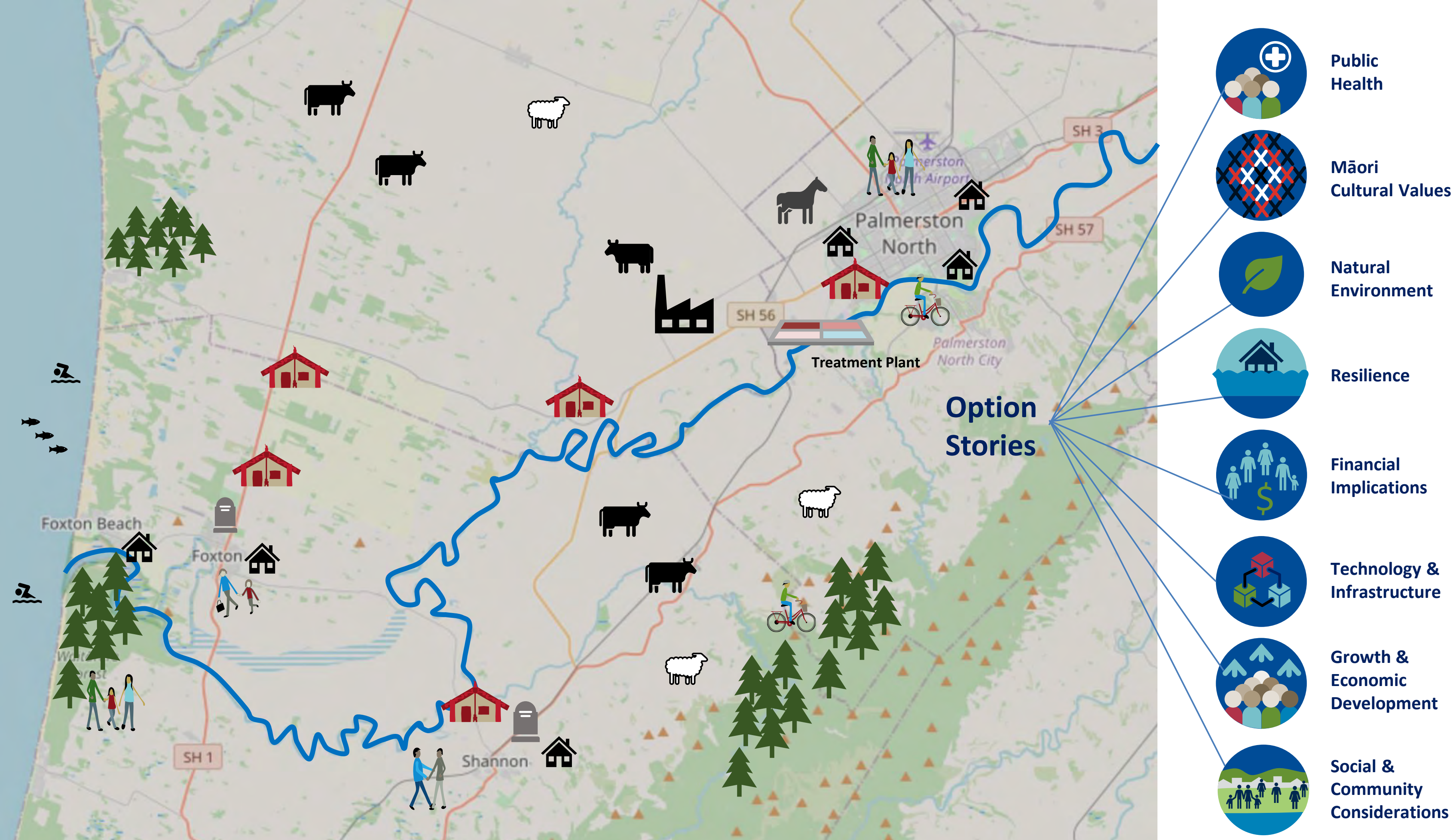


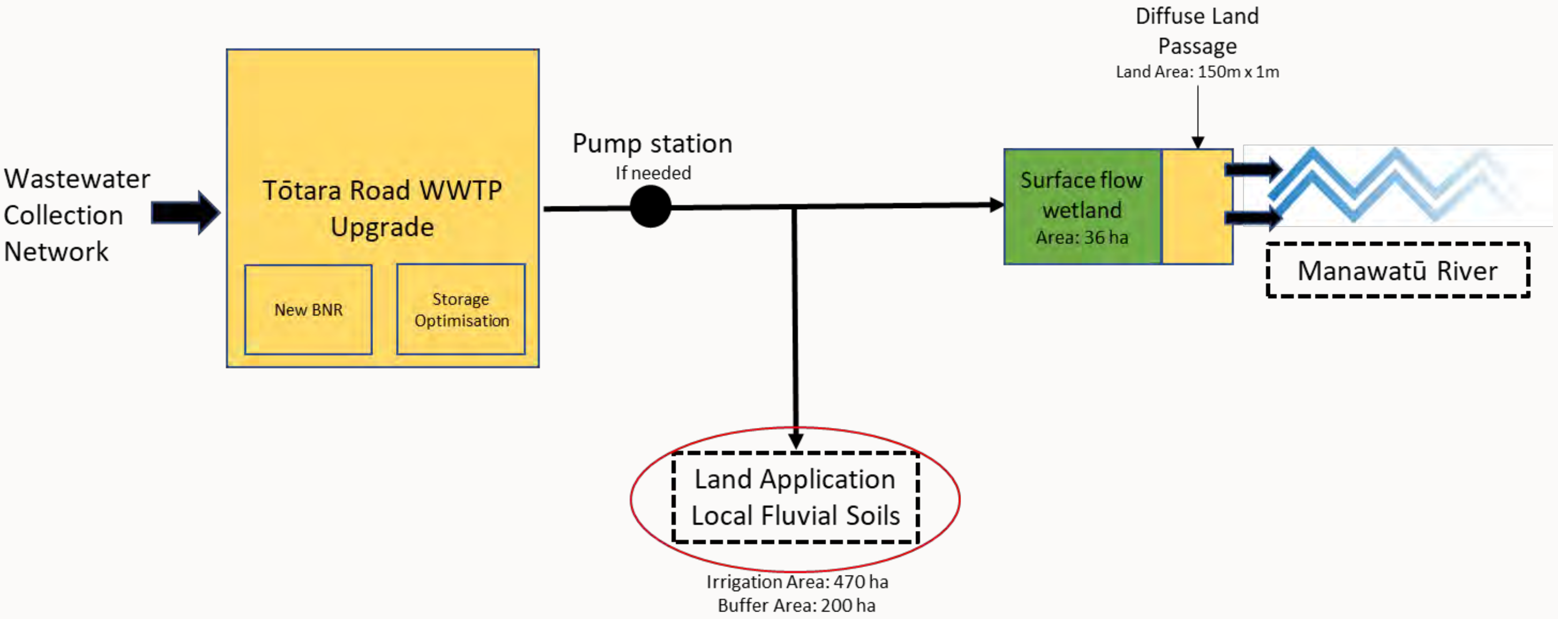
Option Stories

- Public Health
- Māori Cultural Values
- Natural Environment
- Resilience
- Financial Implications
- Technology & Infrastructure
- Growth & Economic Development
- Social & Community Considerations

Option 1 - River discharge with enhanced treatment

30 mins

Option 1 – Schematic & Description



Wastewater Collection Network

Tōtara Road WWTP Upgrade

New BNR

Storage Optimisation

Pump station

If needed

Surface flow wetland

Area: 36 ha

Diffuse Land Passage

Land Area: 150m x 1m

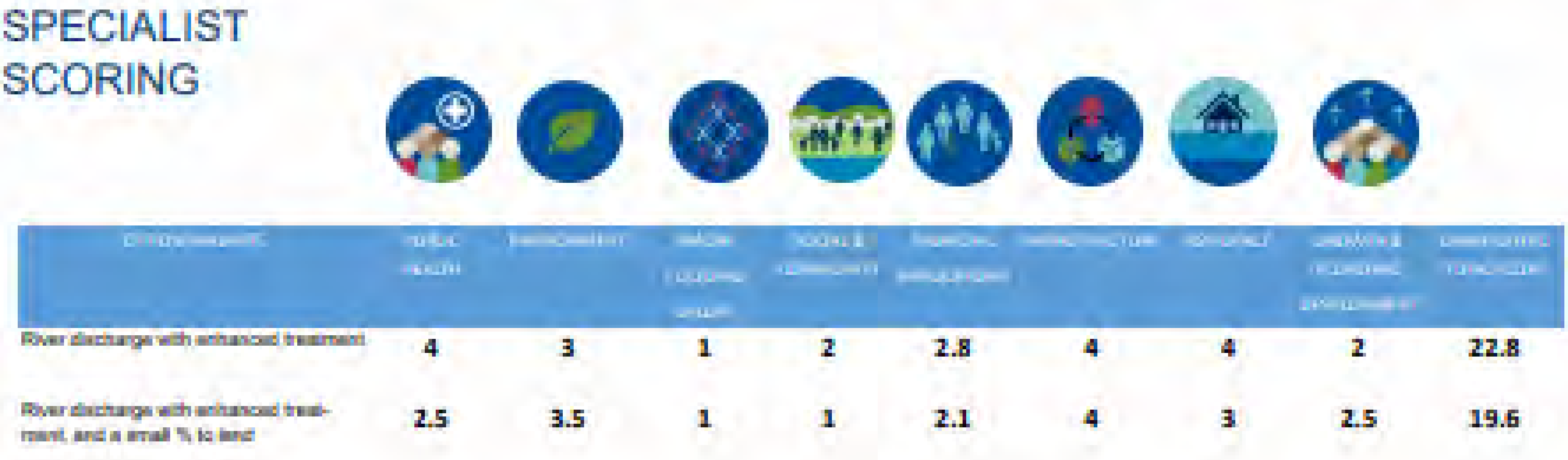
Manawatū River

Land Application Local Fluvial Soils

Irrigation Area: 470 ha

Buffer Area: 200 ha

Option 1 - Scoring



SPECIALIST SCORING

[illegible]	PUBLIC HEALTH	ENVIRONMENT	MĀORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	[illegible]	[illegible] & ECONOMIC DEVELOPMENT	[illegible]
River discharge with enhanced treatment	4	3	1	2	2.8	4	4	2	22.8
River discharge with enhanced treatment, and a small % to land	2.5	3.5	1	1	2.1	4	3	2.5	19.6

Group Discussion

- What are the challenges of this option?
- What is positive's about this option?
- What additional information do you need?
- Any questions for the specialists?

PALMERSTON NORTH

NATURE CALLS

Lunch Break

12.30 – 1.15pm

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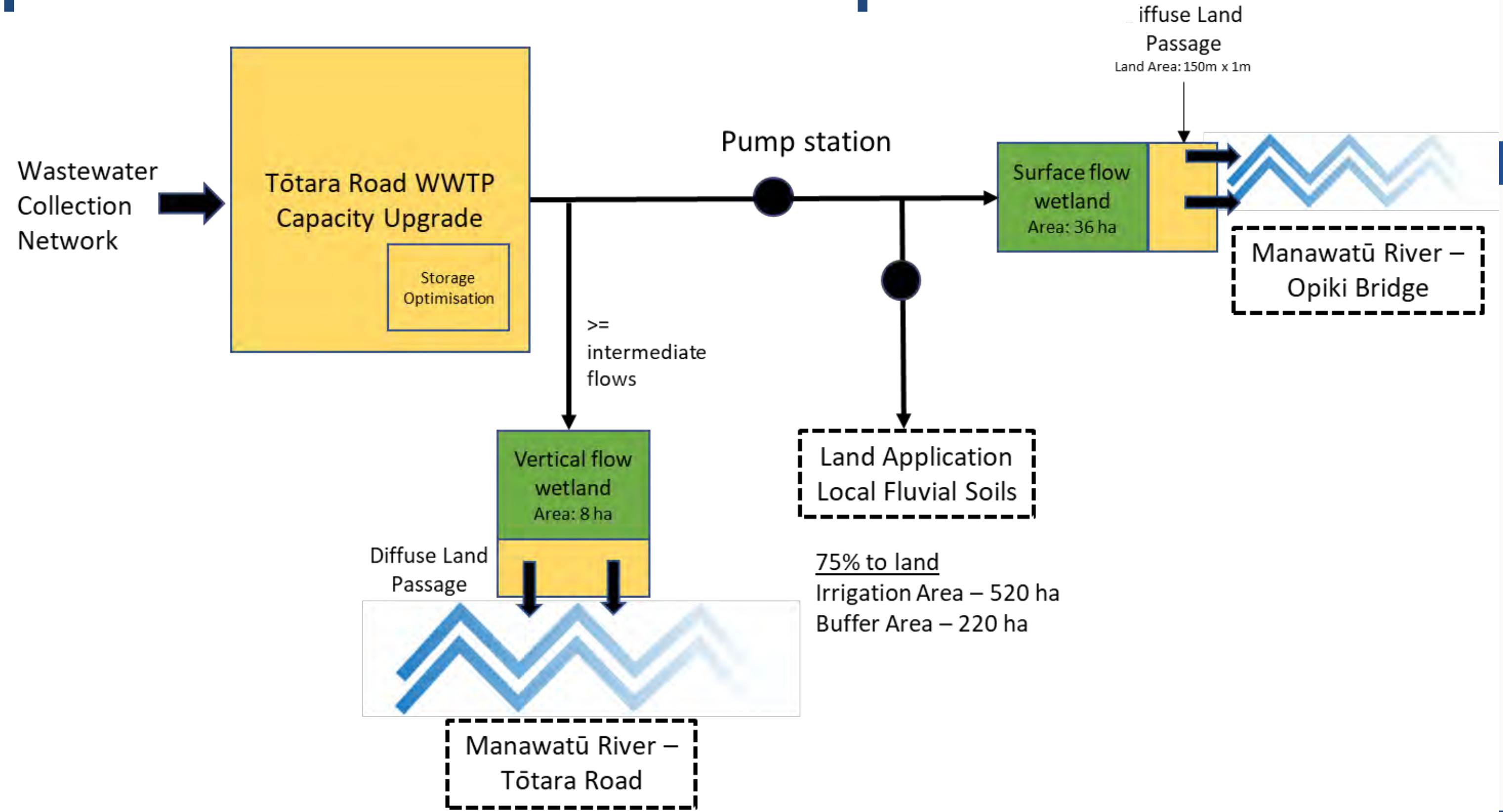
Option 2 - Two River Discharge Points

30 mins

Option 2 – Schematic & Description



75% to land
Irrigation Area – 520 ha
Buffer Area – 220 ha

Option 2 - Scoring

SPECIALIST SCORING

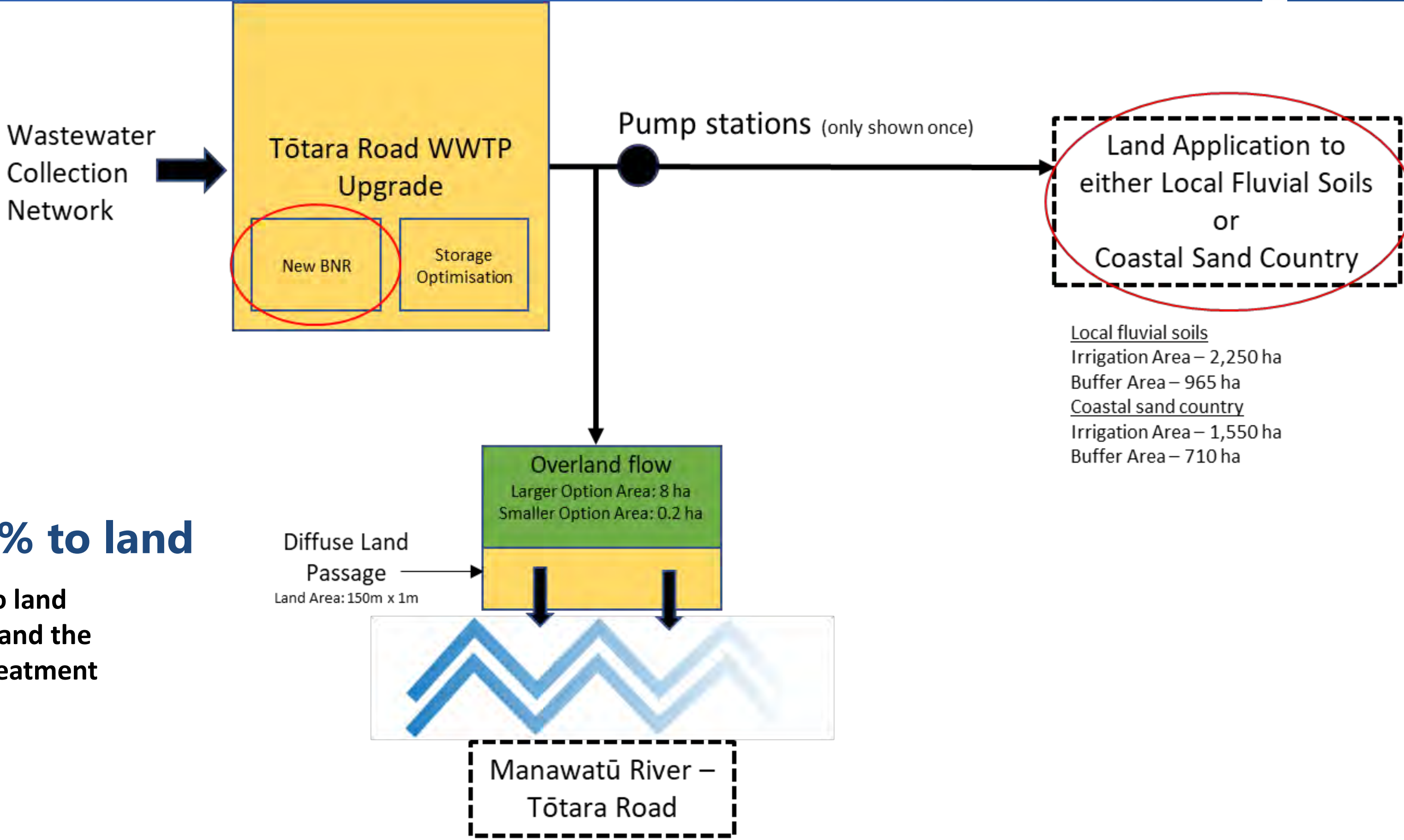
OPTION	PUBLIC HEALTH	ENVIRONMENT	MAORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	RESILIENCE	GROWTH & ECONOMIC DEVELOPMENT	UNWEIGHTED TOTAL SCORE
Two river discharge points, and a small % to land	4	4	1	1	2.7	3	3.5	2.5	21.7

Option 3 - 97% to land

30 mins

Option 3 – 97% to land

Variation relates to land application location and the associated level of treatment



Wastewater Collection Network

Tōtara Road WWTP Upgrade

New BNR

Storage Optimisation

Pump stations (only shown once)

Land Application to either Local Fluvial Soils or Coastal Sand Country

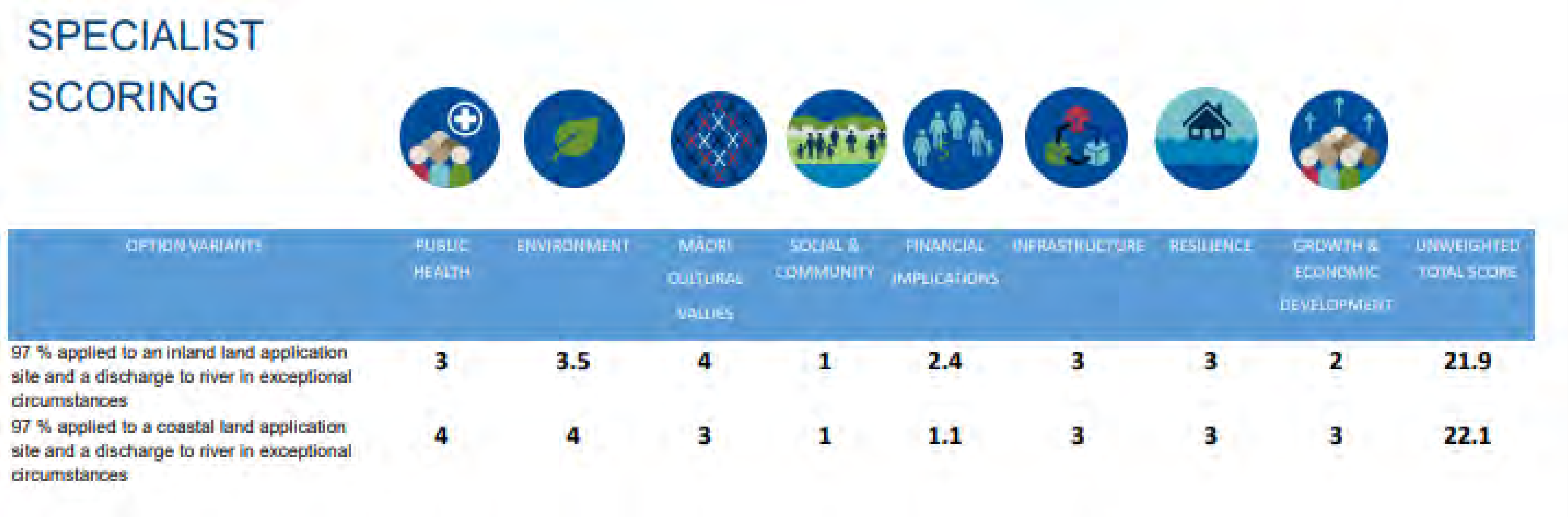
Local fluvial soils
Irrigation Area – 2,250 ha
Buffer Area – 965 ha
Coastal sand country
Irrigation Area – 1,550 ha
Buffer Area – 710 ha

Overland flow
Larger Option Area: 8 ha
Smaller Option Area: 0.2 ha

Diffuse Land Passage
Land Area: 150m x 1m

Manawatū River – Tōtara Road

Option 3 - Scoring



SPECIALIST SCORING

OPTION VARIANTS	PUBLIC HEALTH	ENVIRONMENT	MĀORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	RESILIENCE	GROWTH & ECONOMIC DEVELOPMENT	UNWEIGHTED TOTAL SCORE
97 % applied to an inland land application site and a discharge to river in exceptional circumstances	3	3.5	4	1	2.4	3	3	2	21.9
97 % applied to a coastal land application site and a discharge to river in exceptional circumstances	4	4	3	1	1.1	3	3	3	22.1

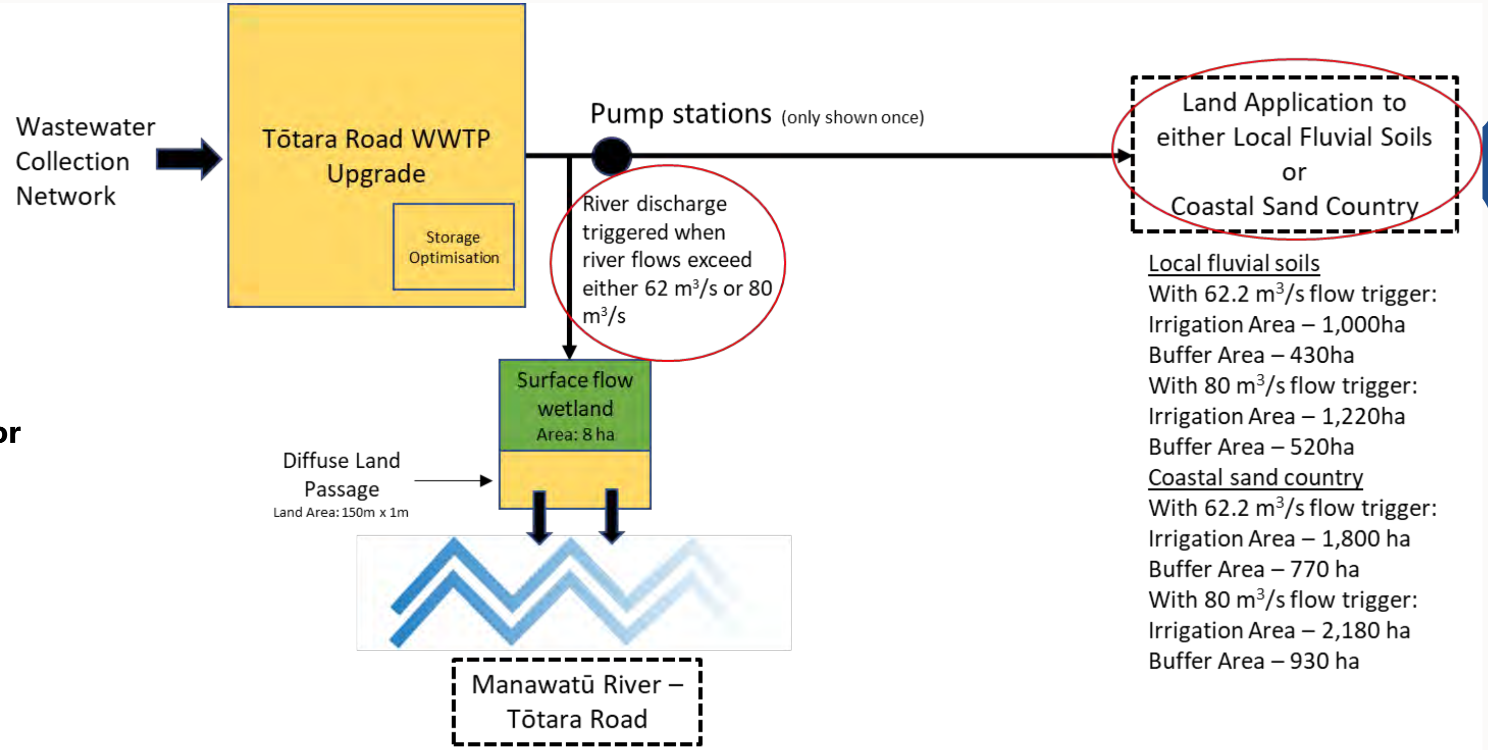
Option 4 - 45 or 55 % applied to land

30 mins

Option 4 – 45 or 55 % applied to land

Variation relates to:

1. **location of land application and**
2. **the flow trigger for river discharge**



Wastewater Collection Network

Tōtara Road WWTP Upgrade

Storage Optimisation

Pump stations (only shown once)

Land Application to either Local Fluvial Soils or Coastal Sand Country

River discharge triggered when river flows exceed either 62 m^3/s or 80 m^3/s

Surface flow wetland
Area: 8 ha

Diffuse Land Passage
Land Area: 150m x 1m

Manawatū River – Tōtara Road

Local fluvial soils
With 62.2 m^3/s flow trigger:
Irrigation Area – 1,000ha
Buffer Area – 430ha
With 80 m^3/s flow trigger:
Irrigation Area – 1,220ha
Buffer Area – 520ha
Coastal sand country
With 62.2 m^3/s flow trigger:
Irrigation Area – 1,800 ha
Buffer Area – 770 ha
With 80 m^3/s flow trigger:
Irrigation Area – 2,180 ha
Buffer Area – 930 ha

Option 4 - Scoring

SPECIALIST SCORING

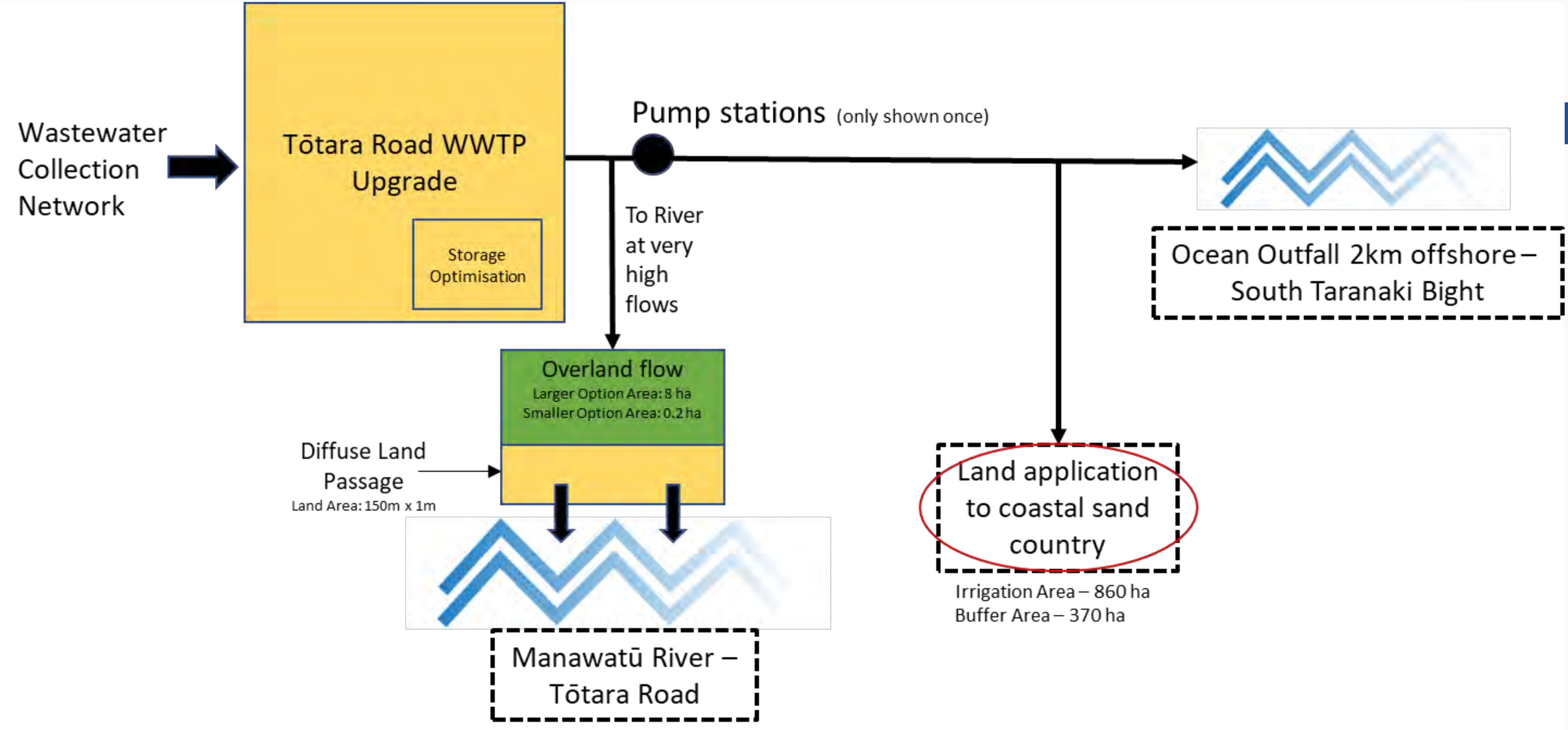
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
45 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	2	1	3.0	3	3.5	3	22.5
55 % applied to an inland land application site and a river discharge for the remainder of the time	3	4	3	1	2.8	3	3.5	3	23.3
45 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.5	3	2.5	2	18
55 % applied to a coastal land application site and a river discharge for the remainder of the time	2	3	2	1	2.2	3	2.5	2	17.7

Option 6 - Ocean

30 mins

Option 6 – Ocean

Variation relates to whether this option includes land application



Wastewater Collection Network

Tōtara Road WWTP Upgrade

Storage Optimisation

Pump stations (only shown once)

To River at very high flows

Overland flow
Larger Option Area: 8 ha
Smaller Option Area: 0.2 ha

Diffuse Land Passage
Land Area: 150m x 1m

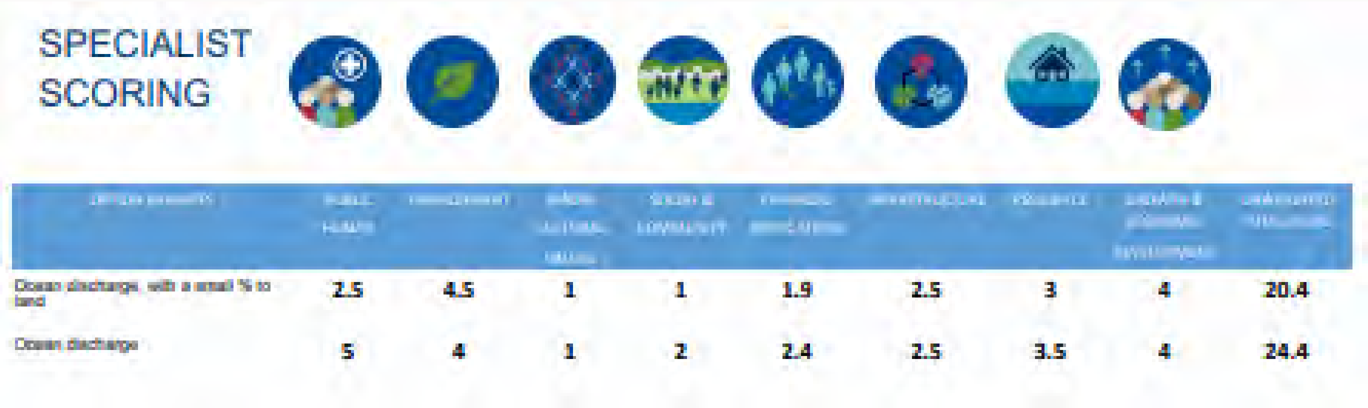
Manawatū River – Tōtara Road

Land application to coastal sand country

Irrigation Area – 860 ha
Buffer Area – 370 ha

Ocean Outfall 2km offshore – South Taranaki Bight

Option 6 - Scoring



SPECIALIST SCORING

OPTION SHORTLIST	PUBLIC HEALTH	ENVIRONMENT	MĀORI CULTURAL VALUES	SOCIAL & COMMUNITY	FINANCIAL IMPLICATIONS	INFRASTRUCTURE	RESILIENCE	GROWTH & ECONOMIC DEVELOPMENT	UNWEIGHTED TOTALS
Ocean discharge, with a small % to land	2.5	4.5	1	1	1.9	2.5	3	4	20.4
Ocean discharge	5	4	1	2	2.4	2.5	3.5	4	24.4

PALMERSTON NORTH

NATURE CALLS

Afternoon Tea

3.15 – 3.30pm

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

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NATURE CALLS

Option Scoring Consolidation

Melaina Voss - 30 mins

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NATURE CALLS

A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Comparative Option Scoring

Options	Public health	Natural environment	Māori cultural values	Social & community	Financial implications	Technology & infrastructure	Resilience	Growth & economic development	Combined score
1: R2(b)	4	3	1	2	2.8	4	4	2	22.8
	2.5	3.5	1	1	2.1	4	3	2.5	19.6
2: Dual R + L	4	4	1	1	2.7	3	3.5	2.5	21.7
3: L+R (a) & (b)	3	3.5	4	1	2.4	3	3	2	21.9
	4	4	3	1	1.1	3	3	3	22.1
4: L + R (d) & (e)	3	4	2	1	3	3	3.5	3	22.5
	3	4	3	1	2.8	3	3.5	3	23.3
	2	3	2	1	2.5	3	2.5	2	18
	2	3	2	1	2.2	3	2.5	2	17.7
6: Ocean	2.5	4.5	1	1	1.9	2.5	3	4	20.4
	5	4	1	2	2.4	2.5	3.5	4	24.4

Day 1 - Summary

We have collectively:

- Been briefed by the Assessment Specialists
- Considered each option and the criteria assessment
- Considered the benefits/non benefits of weighting the criteria
- Agreed what you would like to see in day 2 for weighting sensitivity testing

Agenda for Day 2 – Trade off between the options

Weighting Sensitivity Testing

- Weighted option scoring results
- Lock in the weighting(if any)

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Summary wrap up

- Option story

Next steps

- What further information do we need going forward

PALMERSTON NORTH

NATURE CALLS

Close from the Mayor

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH
NATURE CALLS

Wastewater BPO
Day 2

Collaborative MCA

9th & 10th November

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

PALMERSTON NORTH

NATURE CALLS

Welcome from the Mayor

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

MCA – Workshop Agenda

Sara Dennis - Just Add Lime

5 mins

Agenda for Day 2 – Weighting & Trade off between the options

Determining the Weighting

Apply the Weighting

Weighting Sensitivity Testing

Preferred Option(s)

- Can we shortlist a preferred option(s)?

Next steps

- What further information do we need going forward

PALMERSTON NORTH
NATURE CALLS

Updated: Option Scoring Consolidation

Melaina Voss

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

PALMERSTON NORTH

NATURE CALLS

Assessment Criteria Weighting

Robert Van Bentum – Transport & Infrastructure Manager
Melaina Voss – BPO Project Manager
Jim Bradley – Stantec

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Weighting Process

The mechanics of the spread sheet

- The weighting must add up to 100%
- Xx
- Xx
- xx
- Live sensitivity testing

Group Work: Weighting Approach

Step 1

- Specialist Group - Determine weighting and then apply to Assessment criteria
- Council/Stakeholders – Determine weighting and then apply to Assessment criteria

Step 2

- Each group presents back rationale for weighting (why)
- Compare the Assessments and identify and discuss the differences

Step 3

- Agree on weighting

Step 4

- Apply the agreed weighting
- Apply the agreed weighting without Finance

Step 1: Determine Weighting and Apply

Specialist Group – Lead by Jim **45 mins**

- Determine weighting and then apply to Assessment criteria

Council/Stakeholder group – Lead by Melania **45 mins**

- Determine weighting and then apply to Assessment criteria

  - Two groups 15 mins each group
  - Come together as one group 30 mins discuss and agree weighting and the apply to the assessment criteria

Step 2: Rationale for Weighting (Why) and Comparing the Differences

Report back on rationale of weighting (Why)

- Specialist Group – Lead by Jim 10 mins
- Council/Stakeholder group – Lead by Robert 10 mins

Compare the Assessments

- Identify and discuss the differences – Lead by Melaina 10 mins

PALMERSTON NORTH

NATURE CALLS

Morning Tea

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Step 3: Consolidated Weighting

- Agree one set of consolidated weighting – Lead by Melania 15 mins

Step 4: Assessment Criteria Sensitivity Testing

- Apply the agreed weighting
- Apply the agreed weighting without Finance

Challenge

- For the criteria where there is **not** a score spread
    - What further information do we need?
    - It might be appropriate that some criteria are not differentiating criteria at this stage

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NATURE CALLS

Preferred Option(s)

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Option(s) to take forward

- Top 2
- Top 3

Next Steps

XXXX

XXXX

PALMERSTON NORTH

NATURE CALLS

Close from the Mayor

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

Lunch

PALMERSTON NORTH

NATURE CALLS

XXX

HE TIROHANGA HOU KI TE WAI PARA | A FRESH LOOK AT HOW WE MANAGE WASTEWATER

XXXX

XXXX

XXXX

XXXX

Minutes of Meeting

Wastewater BPO Short Listing Multi Criteria Assessment Workshop

Monday 9th and Tuesday 10th November 2020 at Palmerston North Convention Centre

DRAFT - Workshop Notes

Attendees	Apologies
PNCC Mayor and Councillors - Mayor Grant Smith, Councillors Brent Barrett, Karen Naylor (first day) Bruno Petrenas, Lew Findlay, Patrick Handcock, Renee Dingwall, Susan Baty, Vaughan Dennison, Zulfiqar Butt, Billy Meehan Chair of the PSG – David Warburton PNCC Staff – Robert van Bentum, Melaina Voss, Heather Shorter, Stuart McKinnon, Sheryl Bryant, Sacha Haskill Rangitāne o Manawatū – Danielle Harris, Peter, Jonathon Proctor, Muapoko - Robert Warrington Workshop Facilitator – Sara Dennis (Just Add Lime) Stantec – Jim Bradley (public health), Anna Bridgman (resilience, technology & infrastructure, financial), Paula Hunter (RMA Planning) PDP - Aslan Perwick (groundwater) Aquanet – Olivier Ausseil (freshwater quality and ecology) Keith Hammill (freshwater quality and ecology) Just Add Lime – Julie Boucher (social and community) Health Authorities - Brett Munro- Mid Central Public Health DHB, Dr Stephen Palmer Medical Officer Health (second day) Federated Farmers – Paul Olsen, James Stewart Water Protection Society – Chris Teo Sherell	David Murphy

Day One November 9th 2020

Item

Welcome

Commenced with a Karakia

Mayor and David Warburton welcomed everyone

Sara Dennis (facilitator) outlined the workshop purpose - gain insight and shared understanding of option assessments, and programme for the day

Specialist Assessments

Commenced with an overview of the specialist assessments but not including scores.

Cultural overview – Danielle Harris

- Paramount mauri of River, however there are issues with land application,
- Reserve position if the final option does not add up for Rangitāne

Public Health – Jim Bradley, Brett Munro, Dr Stephen Palmer

- Brett – don't want to fail again - referenced Havelock North
- Jim- Importance of going forward with Public Health Authorities. Emphasised Brett and Stephen involved in the development of the methodology but not scoring.
- Focussed on pathogens (germs), water supply protection, comparative qualitative public health risk assessment approach
- Once have a preferred option will do a quantitative public health risk assessment
- No published methodology in NZ for what we are doing
- Taken a precautionary approach in looking at risk of options
- Scale of public health effects and risk of exposure matrix developed for scoring, taken critical cases
- Conceptual exposure pathways – land, water, air
- MCA score based on number of critical pathways. Least critical number of pathways – scores best. Used a low to high scale with 1 the worst and 5 the best.
- Assumptions - treated wastewater always within specification, not included wastewater operator exposure
- Not looked at beneficial reuse options

<u>Q&A</u>

Chris Teo-Sherrell– If taking a precautionary approach why have you not considered high nitrate levels and the risk of bowel cancer?

Jim Bradley – park this question and get Dr Stephen Palmer to respond tomorrow.

Natural Environment – Keith Hamill (freshwater quality and ecology), Aslan Perwick (land application and groundwater) Olivier Ausseil (freshwater quality and ecology, SIM model), David Cameron (marine waters)

- Nutrient effects on River causing periphyton growth, effects on One Plan Targets - big focus on options achieving targets
- Land discharges – leaching below root zone – depends on soil types, hydrology, lakes and small streams particularly sensitive.
- Foxton estuary – river effects – low risk as high flushing
- Groundwater – leaching rate compare with current land use, summer/winter difference, avoiding sensitive areas, applying buffer zones

<u>Q&A</u>

Peter??? – Any modelling of global warming, algal research

Keith Hamill - no modelling of global warming but have taken this into consideration

Brent Barret – differences in receiving environments – has there been an assessment of each of the receiving environments –

Keith Hamill – yes, each expert did an assessment on the receiving environments, identified worst scoring out of coastal, river, land – generally the worst scoring environment was applied, the alternative was to average the scores for the three environments. Our preference was to take the worst score

Bruno Petrenas – what was the SIM modelling

Olivier Ausseil – in-house model with two parts - water quality module and periphyton module, periphyton harder to model, therefore use risk assessment tool. Model has been used for Feilding and Shannon. It has been enhanced for this project as incorporated site-specific data.

Māori Cultural Values – Danielle Harris and Jonathon Proctor

- These are Rangitāne values – not speaking for other iwi
- Semi qualitative assessment
- Cultural values, cultural landscaped, atua, potential acceptance of our people
- Fundamental is the protection of the mana of river, looking after our own waste activities contained within our rohe, the river has done enough for the City
- Scoring, 1 = destruction of Rangitāne culture and connections with kaitiakitanga
- The coast and its resource should not be impacted on or threatened
- Made an error in options developed – treatment aspiration to achieve drinking water standards – aspirational with a longer term vision

<u>Q&A</u>
David Warburton – is there a significant difference in Rangitāne's view and that of other iwi?
Danielle Harris -Expect they are aligned with our thinking, but they may have identified other options Jonathon Proctor - ensuring solution retained within Rangitāne rohe should address issues
Mayor – coast option not on table, 80% of NZ's discharges are to the coast, why is it the least preferred option?
Jonathon Proctor - two main issues - last untouched bastion, especially for gathering food. The coast is going to be tested with fisheries issues not known to council and planners
Danielle Harris – the coast has also been impacted
Mayor – keeping within rohe – is this possible?
Jonathon – tough call to stay withing rohe, there is some wriggle room in some of the options.

Social and Community Considerations – Julie Boucher

- Complex assessment – it is about people and you need to talk to people, relying on outputs from public engagement to date, not dependent on specific location - geographically agnostic, used accepted methodology built on international social impact assessment guidelines
- Social acceptance is very subjective – different approaches for different people / communities
- Developed sub criteria
  1) gravity highest impact on public health, infringement in access to basic life necessities, ecosystem services, managing impact within area or outside
  2) need for land acquisition and degree of permanence of land use change
  3) public support for option

<u>Q&A</u>
Zulfiqar Butt – concerned about your scoring of the sub-options being opposite to the scoring for the overall options
Chris T?? – public support all withing 25%, scores very narrow band
Julie Boucher – we had to split it somehow, tried not to weight the sub criteria
Chris T?? – further investigations will not be undertaken until there is a preferred option – concerned you don't have geographical footprints
Julie Boucher – we have information on potential locations, but we were instructed not to use it at this stage. We can go back and include this information in our assessments
Bruno Petrenas – what about the social impact of increased rates
Julie Boucher – this is an economic matter and one that Council should consider
Brent Barrett – public support – why looking at support rather than antagonistic position – not a lot of specific feedback around specific options to give this a really strong score
Karen Naylor – Given that a score of 1 is the least desirable and 5 is the winner I am confused about the sub criteria scores being the reverse – need to swap the numbers around to match the scoring for this project.
Julie Boucher – we can do that.

Resilience – Anna Bridgman, Jim Bradley, Aslan Perwick, Peter Brown

- 2 categories for resilience – natural hazards, and climate change and adaptation
- Natural hazards includes – earthquakes, erosion and land movement, flooding, sunami
- Climate change includes wet weather events, dry periods, sea level rise, storm surge
- Looked at both criteria individually and averaged scores – neither had stronger effect than other so averaged

<u>Q&A</u>
Robert van Bentum – explain how each of the receiving environments assessed
Anna Bridgman – for example in the coastal environment storm surge, sunami and forest fires
Zulfigar Butt – why were earthquakes all treated equally for all options
Anna Bridgman - WWTP, pipelines, built to code, longer pipelines requiring more pipeline compared to shorter pipelines.
Chris Teo-Sherell – taking average score compared to public health approach of worst score. Would it be sensible to give worst score- if fails it fails

Anna Bridgman – considered a range of components for each scheme and there was not much variation
Robert van Bentum – natural hazards relates to an event and climate change is adapting over time e.g. longer drier summers more intense rainfall events specific impact on land
Aslan Perwick – crop resilience impacts on amount of treated wastewater storage required, can lift dams up, need to determine what is the risk can it be managed, if floods effect inland schemes can they be moved off the flood plain, captured whole range of scenarios.
Anna Bridgman - outfall designed to deal with sea level rise.
Jim Bradley - operational resilience is addressed in infrastructure category
Chris Teo-Sherell – outfall on seabed, resilience scoring takes into account what you do to design for climate change conditions
Anna Bridgman – outfall partially buried - designed to address storm surge

Growth and Economic Development – Melaina Voss, Richard Peterson

- Used a 35 year consent duration, 50 years asset life and moderate growth rate, also considered how well an option could be adapted to a sub-regional scheme - ability to accommodate other territorial authorities' wastewater – quantity and loads
- Assimilative capacity of receiving environment – relied on work done to date
- Have not identified geographic areas
- Low score – deteriorates economic growth, does not meet growth target, unable to take other territorial authorities' wastewater
- High score – promotes economic growth, take on changes in land use, supports taking on other territorial authorities' wastewater as a sub-regional scheme

<u>Q&A</u>
Vaughan Dennison – limited ability to accept future wet industry
Melaina Voss – we made the assumption that Council would not allow significant increases in wet industry
Vaughan Dennison – med population growth at 1.2% pa
Melaina Voss – we adopted growth projections used in Council's strategic planning documents
Vaughan Dennison - next 10 years looking at upper to high growth projections
Susan Baty – we need to agree base especially looking 35 years out
Robert van Bentum – we have actual flows and loads and then project a number of envelopes including some wet industry and trade waste. Full exploitation of zoned land, key thing to ask – what happens if we need more which options give us the flexibility to accommodate this.
David Warburton – wet industry projections allowing for high and average – pre-treatment before discharge into PNCCs system
David Warburton - did you consider options for land uses
Melaina Voss – we considered at a high-level forestry and cut and carry
Brent Barret – for land discharges did you look at the economic impact changed land use
Melaina Voss – we looked at creating revenue and loss of a farming activity
Brent Barret- did you consider rural access to irrigation
Melaina Voss – meeting with farming community to understand effects

Technology and Infrastructure – Anna Bridgman, Aslan Perwick, Jim Bradley

- Adopted six sub criteria
  1) Whether the option can be staged
  2) Whether the option can be constructed and operational within 5 years of granting consent assumed land would be acquired within 5 years – this was discussed with the Property Group
  3) Ability for resource recovery and beneficial reuse
  4) Whether infrastructure can be upscaled to accommodate sub-regional scheme – only considered infrastructure not receiving environments
  5) Operational complexity
  6) Operational risk
- Scored sub-options 1-4 in terms of alignment, and sub-options 5 and 6in terms of risk
- We averaged the scores

Q&A

Lew Findlay – if land to be purchased in 5 years – have you identified land
Anna Bridgman – no we have not identified land parcels for the land options
Melaina Voss – we have looked at soil types – fluvial (loam) inland soils and sandy coastal soils
Lew Findlay - this whole area very liquefaction prone has allowance been made for this
Anna Bridgman – this factor was considered under resilience
Vaughan Dennison – consideration of the effect on the mana PNCC due to the scale of land required Public Works Act
Melaina Voss – there are a range of mechanisms that can be used to acquire the use of the land – not just the Public Works Act. There could be willing sellers – this will be investigated once areas are identified.
Patrick Handcock – need to be able to keep growing infrastructure - want to build for the future
Anna Bridgman – ability to stage options was considered - stage pipelines to meet capacity, enable improvements to treatment to be made
David Warburton – if go too big too early leads to problems in operation
Robert van Bentum - some receiving environments have limitations also have to pay for that. If build infrastructure that is significantly larger Council can't immediately charge for it e.g. trade waste allowance, so domestic ratepayers will carry these costs

Financial Implications – Anna Bridgman, Rita Whitfield

- Undertook high level cost estimates for each component of the options
- Developed in conjunction with environmental team to ensure any require environmental limits were met
- Assessed capital and operation and maintenance cost and included large contingencies. Whole of life and net present value (NPV) over 35 years, 6% discount rate
- Capital was the most significant cost - capital 37%, operation and maintenance 30% net present value 33%
- Highest cost any option was scored a 1
- Assumed an annual return for inland sites(cut and carry) and a 28 year return for coastal sites for forestry

Q&A

Chris Teo-Sherell – capital and operation and maintenance weighted separately but they all have to be borne by ratepayer
Robert van Bentum – this methodology is widely used. Different options around capital. Operation and maintenance consequential costs now for current ratepayers
Anna Bridgman - borrowing for capital and operation and maintenance costs range $3-4m pa over 35 year period
Karen Naylor – range of ranking quite narrow in terms of scores - 0.1 and 0.2 difference – why not spread across the range.
Robert van Bentum – we can address this in the weighting.
Karen Naylor – what would it have taken to get a score of 5
Anna Bridgman - we knocked out extremes on the long list assessment
Jim Bradley – the status quo would get a score of 5
Patrick Handcock – the operation and maintenance costs variance what is the difference between the river and outfall.
Anna Bridgman it comes down to the size of infrastructure to be operated for the river $8m and the outfall 5m
David Warburton – need to consider both capital and operating costs from a practical financing point of view
Patrick Handcock - Mitigations for harming environment lesser levels of treatment comparing river and outfall
Anna Bridgman – yes the level of treatment is less for the ocean outfall than the river
Stuart McKinnon – some capital costs we can afford and some we can't – can't borrow $500m.
David Warburton - this is where relative weightings apply.
Karen Naylor – impact to land owners
Lew Findlay – 11-12% of our rate payers are on fixed incomes, how are they going to pay for this

Robert van Bentum – we have already fatally flawed some options because of cost. Are there other options that should be fatal flaws around affordability.
Mayor – we need to go through process first before we fatally flaw options further - we might have some funding partners – industry, government,

National Context – Mayor

- Some people are asking why we are going through this process with the government reforms on Three Waters happening
- This is valuable work and it will not be wasted.

David Warburton - this could become an exemplar in terms of the process Council has adopted – opportunity to gain a lot of benefits. Keep on with enthusiasm to do a really good job.

Option Assessments

Option 1 – River Discharge with Enhanced Treatment
<u>Description</u> – Robert van Bentum

- Fine filter through membrane bioreactor technology
- Percentage reduction in the river that relates to PNCC's proportion of nutrients removed
- Cannot guarantee periphyton limits of the One Plan can be met
- Smallest land portion (470ha) – 10% of total discharge during river low flow periods
- Takes the most nutrients out of the environment
- Nitrate levels below drinking water standards
- Includes a wetland

Attendees broke into groups to discuss scores attributed to Option 1 by each specialist
<u>Discussion</u>
Patrick Handcock – can the process accommodate further enhancements in the future, does it allow for even a higher level of treatment
Jim Bradley – yes, there are further treatment enhancements – reverse osmosis which was fatally flawed in the long list because of costs.
Jim Bradley – The options involving discharges to land should they have a higher resilience score as could continue to discharge to land if there was a malfunction at the wastewater treatment plant.
Anna Bridgman – land based schemes have flooding risks, assumed they would be located in a floodplain, exceed hydraulic loading – less resilient overall. Longer the pipelines more things to manage.
Peter (Rangitane) – effect of the treatment system on DNA
Jim Bradley – treatment process includes biological treatment, microfiltration, DNA will either be biologically transformed, removed with particulate matter of stays in the treated wastewater column.
Chris Teo-Sherell – are the differences in the public health scores due to the mitigation put in place for land treatment e.g. buffers, access restrictions
Jim Bradley – went through all pathways – added up critical pathways – could change 2.5 to a 3
Chris Teo-Sherell - is the level of treatment the same for land as for the river?
Jim Bradley – yes
Aslan Perwick – but the land result in additional removal of nitrogen
Vaughn – the cultural value scores don't give any recognition to the land component. Isn't there a compensatory benefit given the discharge is taken out of the river at low flows?
Danielle Harris – the land is only a minor component
Vaughan Dennison – do the social scores reflect the size of land footprint required? Bigger the footprint the bigger the impact
Julie Boucher – no, the score do not reflect the size of the footprints – hard to assess as depends on land uses – if discharging to a forest potentially no impact but if discharging to productive land could be a big impact
Vaughan Dennison – why the differences in the public health scores
Jim Bradley – public health scores for the plus land option look a bit harsh in comparison to some other options when you take the enhanced treatment into account and the treatment provided by land – based on the number of critical pathways – comfortable to change from a score of 2.5 to a 3

Option 2 – Two river discharges + land

Description – Robert van Bentum

- Avoid discharges at Totara Road during lower river flows below median
- This avoids impact on stony bottom of river
- Benefit – don't have to invest in very high levels nitrogen removal.
- Involves discharges to two wetlands. Totara Road much smaller, but much larger wetland at Opiki.
- Discharge close to Palmerston North

Attendees broke into groups to discuss scores attributed to Option 2 by each specialist

Discussion

Patrick – when comparing the public health score for Options 1 and 2, why have both options scored 4 when Option 2 has a lesser level of treatment

Jim Bradley - not discharging from Totara Road at low river levels, moving discharge to Opiki - measuring number of critical pathways. In comparison with option 1 reduce Option 2 public health score from a 4 to 3.5

Olivier Ausseil - the discharge at Opiki avoids river gravels, periphyton risk is lower, other issues to be considered although treatment levels are not as high. Scored better that Option 1 but very little difference

Robert van Bentum – the scoring is based on how well the One Plan targets are met.

Olivier Ausseil - Totara Road pushing nitrogen levels but includes a land component, three receiving environments Totara Road, Opiki in the lower Manawatu and the estuary. Doesn't change situation with estuary. Totara Road taking discharge out over median flow and going to land. Level of certainty greater here than for Option 1

Vaughn Dennison – is the difference in nitrogen going from 2mg/l for Option 1 to 35mg/l for Option 2

Keith Hamill – the Totara Road location is very good at growing periphyton, hence very low nitrogen limit.

Susan Baty – question the social score because it does not consider number of communities affected.

Anna Bridgman - Infrastructure scored a 3 for this option because there is a high element of potential resource recovery, scores lower for upscaling for a sub-regional scheme can address this from a treatment perspective but not from an infrastructure perspective

Option 3 - 97% discharge to land

Description – Robert van Bentum

- Upgraded treatment 35mg/l of nitrogen to 10mg/l of nitrogen because on the coastal soils the 35mg/l requires an extensive amount of land.
- Requires large pipelines, storage areas, lots of pump stations.
- Will involve a constant discharge.
- Two options - inland discharge, coastal discharge.
- Even if there is a higher level treatment already optimised hydraulic limits for the sites

Attendees broke into groups to discuss scores attributed to Option 2 by each specialist

Discussion

Aslan Perwick – the inland site driven by effects on ground water, the coastal effects are on coastal streams and lakes, 21-25kg/ha/year leaching targets, need to get them to a level that will be acceptable for receiving environment. Not ideal inland soils – will not require irrigation in winter – this is manageable but not ideal – washing nutrients through.

Chris Teo-Sherrell- if 97% driving negative outcomes what about 80-70% - is this a linear thing.

Aslan Perwick - once get into wet months really want to get off those soils – significantly better improvements with other options. Winter leaching, but in the summer heaps of uptake. We have got around leaching issue through the treatment.

Robert van Bentum – what sort of uptake of the wastewater.

Aslan Perwick - 50ml/month

David Warburton – what if nitrogen was at 10mg/l on inland soils

Aslan Perwick – it is the hydraulic loading that govern this

Chris Teo-Sherrell– It would be very useful to have information on what is impact would be on the scores if cut off point to go to river is changed to e.g. 80%, 75% etc. of the time
Vaughn Dennison – what are the financial implications of coastal areas versus inland areas – are there other options around financial modelling
Mayor – with growth and economy what are the potential loss of jobs with farming land use change. PNCC's reputation could be challenged by farming community – should the scores be higher for coastal areas but lower for the inland areas?
Mayor – would this be the largest land application scheme in New Zealand?
Jim Bradley – yes, Taupo is currently the largest scheme at 500ha
Melaina Voss – the scoring also considered the ability to adapt to a sub-regional scheme
Susan Baty - all the score sitting in middle
Robert van Bentum - this is where the weighting comes in

Option 4 - 45-55% to land

Description – Robert van Bentum

- No Increase in treatment other than optimisation
- Nitrogen at 35mg/l

Discussion

Aslan Perwick – this option did not score well from an environment perspective because of effects on coastal lakes and streams, soils less effective removing nutrients
Jim Bradley in terms of public health - inland areas only 5 critical pathways, coastal areas have 8 critical pathways because of shellfish and coastal lakes and streams
Chris Teo-Sherrell – what are the implications of the differences in treatment between option 3a and 4
Jim Bradley – Options 3a and 4e on inland soils have nitrogen at 10mg/l and 35mg/l for Option 4d. This is based on land being cheaper than further treatment
Patrick Handcock – the differences in land costs – the cost of the coastal seems too low. What are the differences in income between cut and carry and forestry?
Aslan Perwick - $2,000/ha/year for inland soils (cut and carry) and $1,200ha/year for forestry

Option 6 – Ocean Discharge

Description – Robert van Bentum

- Outfall offshore indicative 2km in length
- Two options one with land discharge in summer and one without land, 50% average dry weather flow to land in summer
- No Increase in treatment other than optimisation and no alum dosing for phosphorous removal

Discussion

Chris Teo-Sherrell – what is the benefit of including land?
Jim Bradley – the environmental benefit is limited, could be commercial benefit if it involves the right land use, but costs associated with land purchase
Keith Hamill – this option good from an environmental perspective, potential land effects good as only a small area of land required and in summer taking out nutrients. Because of the small area of land required able to avoid sensitive lakes.
Jim Bradley – in terms of public health the option without the land component scored a 5 because it had the least critical pathways. The land component could be a dilemma depending on where it is located. Happy to increase 2.5 to 3 based on further comparison with other option scores
Brett Munro - get confirmation from Stephen
Chris Teo-Sherrell – what are the differences between Option 1 score change and Option 6 change
Jim Bradley - Option 1 has higher quality treatment
Aslan Perwick – question the public health score for land component – the discharge is half the flow half the year, smaller land area can avoid stream and lake catchments, very difficult to get to these streams and lakes, need to explore how many people are potentially gathering watercress.
Jim Bradley – agree to raise public health score from a 2.5 to a 3 based on Aslan's reasoning
Keith Hamill - ocean discharge low risk on aquatic life primarily because of the length of the outfall – 2km offshore, involves some nitrogen removal as diverting half the flow to land in the summer.
Keith Hamill - not sure if the 0.5 difference is justified. Very close scores

Melaina Voss – for growth and economics this option had a high score because most acceptable for a sub-regional scheme.
Robert van Bentum – for sub regional schemes the treatment does not have to all be at Totora Road, could be Feilding etc. with agreements to meet particular standards.

General discussion on overall scores, additional information and 'parking lot' list

Robert van Bentum - cores very close, not much difference between the options
Chris Teo-Sherrell – taking a precautionary approach to public health – but what about bowel cancer risk with high nitrates?
Jim Bradley – will get Dr Stephen Palmer to talk about this in the morning
Chris Teo-Sherrell - did the environmental assessments address effects climate change - did modelling look at changing nature of flows.
Olivier Ausseil - modelling is based on historic assessments that looks back 10 years. Synthetic assessments done for land – didn't make much difference as getting drier and wetter. Modelling not queried in Feilding case
Chris Teo-Sherrell – why taking lowest score for the environmental assessments
Keith Hamill – could go to an average score for three environments as could offer more nuances.
Susan Baty – for the social and community scores – need to relook at triggers, reorder to reflect adopted scoring
Brent Barrett – need more clarity around growth projections and whether an option provides for higher growth than anticipated.
Patrick Handcock - questions over the land costs, Council's debt limit, acceptability of land use change, ability to secure land
Jim Bradley - value of residual assets – can pass land asset on unlike a pipeline
Vaughn Dennison - under pitching how we acquire land – forgone conclusions that we are going to get this. Comes with consequences – reputational risk, issue is scale 500ha vs 3,000ha. Council needs to consider its reputation - need to unpack this further
David Warburton - fundamental issues how procurement managed and commercial arrangements. Need recheck land values, coastal may be too low.
Karen Naylor - financials ranges need to be addressed, the bands are too narrow and there are big numbers involved
Patrick Handcock - what we can acquire needs to be possible
Chris Teo-Sherrell – need to investigate lowering thresholds on discharges to land 97% to 85%, 80% etc. consequences for social, economic, cost
David Warburton separate out the difference between BPO from financial point of view. Anna has assessed technical costs. Need a second conversation around procurement and how it comes affordable – separate exercise – how much it costs and who pays.
Brent Barrett – need to assess social high level of opposition as well as high level of support

Agreed changes to scores and further investigations

1) Change the public health score for Option 1 from 2.5 to 3 for the following reasons:
    a. Same level of treatment for the wastewater going to the river and to land
    b. Increase in risk pathways negligible
    c. During dry weather leaching potential is much lower
2) Change the public health score for Option 2 from 4 to 3.5 for the following reasons:
    a. Comparison with option 1 as less degree of treatment
3) Change the public health score for Option 6a from 2.5 to 3 for the following reasons:
    a. Land area is small
    b. Only applied to land six (drier) months of the year
4) Revisit the social and community scores to:
    a. Take into account the land areas required and make assumptions about potential land uses in comparing the coastal areas and the inland areas
    b. Align scoring of sub-criteria with overall scoring approach
    c. Consider public opposition as well as support
5) Resilience score for infrastructure for Option 1 could be a bit extreme – Anna Bridgman to consider changing the score from a 4 to a 3.5
6) Dr Stephen Palmer to address bowel cancer risks associated with high nitrate levels

7) Rerun the environmental scores base on an average score rather than the lowest score
8) Check growth projections
9) Check land cost estimates, especially for coastal areas
10) Revisit the cost groupings to try and achieve greater differentiation of scores
11) PNCC to consider procurement, affordability as a separate exercise
12) Investigate lowering thresholds on discharges to land 97% to 85%, 80% etc.

Day Two November 10th 2020

Commenced with a Karakia
Sara Dennis (facilitator) outlined the programme for the day

Presentation by Medical Officer of Health - Dr Stephen Palmer

Stephen Palmer - need to consider wider determinants of health – while focussed on public health also interested in the wider aspects, particularly equity – providing more to those in need compared to equality and Maori Health – much wider view than just physical Mason Dury Model – healthy environments.

Q&A

Bowel cancer issue and high nitrate levels
Stephen Palmer – this is a different risk profile, we have been assessing pathogens – one dose and you get effects. Also have blue baby syndrome caused by drinking water contaminated with nitrates. The colon rectal cancer issue is about long-term effects
Colon rectal cancer – long way from ascertaining causality - very long-term effects, many, many people drinking water with nitrates. Would not factor this into any public health risk assessment.
Lot of carcinogens get removed from the wastewater through treatment process.

Further discussion on scores

Julie Boucher – revised social and community scores over night to take into account the land areas required
Brent Barrett - how much is based on the actual consultation
Julie Boucher - not weighted sub criteria - grouped options that were preferred
James Stewart - biggest issue for farmers is use of plastic for bailing – cut and carry land use – have you taken into account public perception of this for the cut and carry options.
Julie Boucher - have not taken this into consideration at this stage
Brent Barrett - feedback from consultation - quite a lot of differences. Concerned taking a slice of community inputs, impact on farming community, unwilling sellers – concerned introducing a lens that could be the inverse
Robert van Bentum - natural environment score used the lowest score for each of the receiving environments rather than an average score – is that appropriate?
Keith Hamill – this is a question for the group how much importance do you want to place on the river, groundwater, coastal waters
Mayor - if all options had same level of treatment, they would be easier to test
Robert van Bentum – we have developed the treatment levels of the options depending of achieving receiving environment targets.
Mayor - why can't we do better than just meeting targets – this is a long term solution and targets may change
Robert van Bentum – it all comes down to cost and what is affordable.
Peter (Rangitane) – the public perception is that there is a greater advantage to do better especially from ecological and Māori point of view

- Decision by the workshop attendees to keep lowest score approach for the environment

Chris Teo-Sherrell – in terms of public health it is assumed there would be no adverse human health effects from whatever option chosen – should there be different scores, should the scores be all the same?
Stephen Palmer – the original assessments all came out the same but we then looked at the ability to manage risk.

Jim Bradley - looked the number of critical public health risks and different pathways to manage risk.
Robert van Bentum – more pathways, more environments more opportunities for failures
Aslan Perwick – question Option 6a public health score and whether it should be a 3.5 or a 4 – up to Jim and Stephen to discuss
Anna Bridgman – agreed to change the resilience for infrastructure for Option 1 from 4 to 3.5

Changes to scores, decisions, and actions

1) Include updated social and community scores
2) Retain lowest score approach for the natural environment assessments
3) Confirmed public health score for Option 6a (land component) as 3
4) Change the resilience for infrastructure for Option 1 from 4 to 3.5 for the following reasons:
    a. Option 1(b)

Weighting

Introduction
Robert van Bentum - weighting must add up to 100%
David Warburton – consider the weighting on the impact on project – the importance of the criteria. There is also a weighting on level of confidence of the information provided
Jonathon Proctor – the weighting on the confidence of the information is very important
Councillors and stakeholders broke into two groups to consider weighting of criteria. Considered a weighting with finance and without finance
Specialists did a separate weighting exercise, but only considered weighting without finance

Councillor and stakeholder weighting discussion
Group 1 – Mayor – report back
Weighting with finance – key responsibility of councils is public health - needed a high rating, natural environment and resilience very important because RMA dictates this, cultural values have highest score, social disruption a concern, technology and infrastructure a consequence so no weighting, growth relatively high as must provide for growth
Weighting without finance pared back public health and Natural environment
Group 2 – Councillor Baty – report back
Weighting with finance - had differences in group – wanted public health taken out as it is a given, decided to take a low med and high approach and this is probably why ended up pretty middle of road
Weighting without finance - just recalculated

Specialist weighting discussion
Jim Bradley – report back –
Weighted public health, natural environment, Māori cultural values, and social and community all with 20%, issues with double counting if consider public health in a wider context
Double counting e.g. wider picture of public health, assumed technology is proven, resilience is an unknown,
social and community based on level of importance, not confidence
Degree of confidence in the information and data assessed as – public health 50%, natural environment 70%, Māori cultural values 60%, social and community 20%, infrastructure and technology 80%, resilience 50%, and growth and economy 30%

Combined weighting discussion
David Warburton – some criteria that are outcomes and some that are consequences e.g. natural environment determine resilience and infrastructure and technology is an outcome – design to meet natural environment outcomes.
Issues

- Double counting e.g. Māori cultural values considered in public health and natural environment
- If address equity issue, then Māori cultural values should have the highest weighting
- How to reconcile importance of criteria with confidence in data e.g. lack of data for social and community

- If assume public health is a given for each option then it should have a lower weighting, could make this assumption also for infrastructure and technology
- Should outcome criteria be weighted higher than consequence criteria

David Warburton – let's sit with this at moment but run different scenarios and see what happens

Combined scores without finance

Mayor - Councillors have a different view on social and community weighting because of lack of data, specialist group weighting is higher because it is based on importance. Infrastructure and technology criterion is a consequence therefore councillors weighted it 0%, specialist group weighting 5% so on same wave length

Robert van Bentum - scores similar to raw score

Combined scores with finance

Robert van Bentum - most expensive option ranked second

Patrick Handcock- financial range needs to be recalibrated so there is a wider range. By changing finance weighting only taking away from other criteria – the scale is skewing

Olivier Ausseil - if want to see financial coming through more strongly need to change the scale

Brent Barrett – everything has been compressed because of fatal flawing

Scenarios and ranking approaches

Keith Hamill – proposed to rank the order options from 1 to 11 and standardises all the scales

David Warburton – if you take finance out it becomes a secondary discussion. Identify options without finance and then consider them in terms of affordability

Robert van Bentum - ocean discharge consistently coming first

Jonathon Proctor - not enough information on the local marine conditions, applied high level understanding

Peter (Rangitane) - because outfall coming at top need to do more investigations into local conditions Robert van Bentum - not picking one option – looking for the options that come through to top.

Stephen Palmer - increase Māori cultural values to 40% - without finance makes a difference 97% to land #1, ocean option changes to #4

Brent Barrett – increase social and finance to 40% because the ratepayer of Palmerston North are going to pay for this - Option 1 #2, Ocean outfall #1, Dual River #3

Robert van Bentum – we will write a paper for you on the various weightings and scenario testing done today.

Paula Hunter – we will also include an RMA Part 2 weighting as this required by case law.

David Warburton – we have an envelope of weighting differences – 4 common options

Robert van Bentum - more work required – local marine environment, land acquisition and use, RMA Part 2 weighting and work identified from yesterday.

Melaina Voss – Council is clear on option(s) before we go back to the community

David Warburton – gut reaction why is the ocean option with some land not coming through – this is a practical mix and match

Patrick Handcock – some of land options don't feel right – don't think you have number landowners right

Aslan Perwick – surprised how the river discharges with high treatment not coming through – other projects been involved with most capital going into treatment – do you want to put capital into pipeline rather than treatment.

Robert van Bentum - not rivers per se, but unique situation with the Manawatū River.

Olivier Ausseil – potential for some options to be progressively implemented – could achieve river outcome with option R2

Robert van Benton - we can revisit criteria e.g. natural environment based on One Plan targets, financial with an extend the range. We can pull this together in next couple of weeks

Melaina Voss – need to take stock of where we have got to in terms of the outputs from yesterday and today. We will prepare a paper for PSG on where we have got to and look at Octopus diagram to determine what other works is required. We also have a process underway with other iwi and the outcomes from this need to feed in.

Closing

The Mayor and David Warburton thanked everyone for attending the workshop and all their contributions

Closed with a Karakia
Further investigations from Day Two 1) Recalibration of the financial range so there is a wider range of scores 2) Assessment of local marine conditions for outfall option 3) Prepare a paper on the various weightings and scenario testing undertaken on day two 4) Include a RMA Part 2 weighting 5) Revisit the criteria including adoption the One Plan targets for the natural environment 6) Consider the potential for some options to be progressively implemented 7) Prepare a paper for the PSG on workshop outcome paper for PSG in conjunction with the Octopus diagram to determine what other work is required

Workshop Closed: 12pm Tuesday 10th November 2020

Palmerston North Wastewater
Best Practicable Option (BPO) Review

Summary of Māori Values Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Melaina Voss / Jim Bradley

Report Details

Prepared by:	Melaina Voss	29/07/2021
Checked by:	Jim Bradley	30/07/2021
Reviewed by:	Client / Simpson Grierson	4/08/2021
Approved & Issued by:	Roger Hulme	8/08/2021

Executive Summary

This report has been prepared to assist the Council in identifying preferred options as part of the final Best Practicable Option (BPO) assessment. This assessment forms one of seven assessments comprising the final BPO assessment process.

Technical advisors worked with Iwi to ensure all technical information was freely accessible, prior to the respective values assessments being completed by both Iwi groups.

Cultural Values Assessments have been undertaken by two Iwi within the Manawatu-Whanganui Region, including:

- Rangitāne o Manawatū, who are mana whenua for the Palmerston North area and represented on the BPO Project Steering Group (PSG).
- Hapū that are representative of Ngāti Raukawa. This group also provided representation on behalf of te Rūnunga o Raukawa. Note that Ngāti Whakatere, one of the hapū of Ngāti Raukawa, have elected to be represented independently of te Rūnunga and the hapū involved in this assessment process.

Each of the 11 shortlisted options has been assessed against a clear set of values that are representative of values of the Iwi, Rangitāne o Manawatū and the hapu representative of Ngāti Raukawa.

For Rangitāne o Manawatū, a score of 1 (least aligned) to 5 (most aligned) has been allocated to options assessed against their identified values. This is consistent with the approach used across other assessments. The assessment provided by the Iwi confirms their opposition to the discharge of treated wastewater to the ocean and land located in the coastal area. The assessment also confirmed their preferred solution to comprise treatment to the highest proposed treatment level, with discharge to large land areas located close to Palmerston North (inland).

For Ngāti Raukawa, the Mauri Model[1] was used, allowing Iwi to clearly show where options were enhancing or diminishing hapū values. A scale of -2 (a 'Destroyed' or 'mauri awe' environment) to +2 (enhanced 'mauri ora') was used. The outcome of their assessment identified that none of the options were considered acceptable to the hapu and all options were scored at -1 or -2. However, options with inland land-based discharge and utilising the highest possible treatment of the wastewater is supported as a 'starting point' to move forward on. The hapu are fundamentally opposed to discharging to the ocean or land located in coastal areas.

Overall, both Iwi are aligned in their preference for a BPO that includes the highest proposed treatment level for the wastewater. Both Iwi are aligned in the preference for an option that includes large land areas, where wastewater can become a resource and applied to land located ideally within the Palmerston North area (inland).

With respect to the scales used (1 to 5), both Rangitāne o Manawatū and Ngāti Raukawa advise caution regarding interpretation. Caution is necessary on the basis that the Kaupapa are not all equal in weighting. This means that for some values assessed, it should not be assumed that the high (5) is a 'favourable solution' or low (1) score is only 'severe' to either Iwi. The recommendations and scoring provided for in the original cultural value assessment (CVA) documents (Appendix A and Appendix B) are the first-hand views of the respective iwi and should be referred to in the first instance.

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[1] The Mauri Model was adapted from: Morgan K 2003. The sustainable evaluation of the provision of urban infrastructure alternatives using the tangata whenua Mauri Model within the Smart Growth Sub-Region. Technical report, Mahi Maioro Professionals, Auckland.

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APPENDICES

1 Introduction

1.1 Overview of Assessment Process

An assessment of the short list options has been undertaken to determine levels of alignment for each option, with the respective values of two iwi potentially impacted by the wastewater BPO and involved in previous wastewater consent projects. Their assessments have been undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the Māori values assessments, integrates with the other assessments and processes involved in determining the BPO.

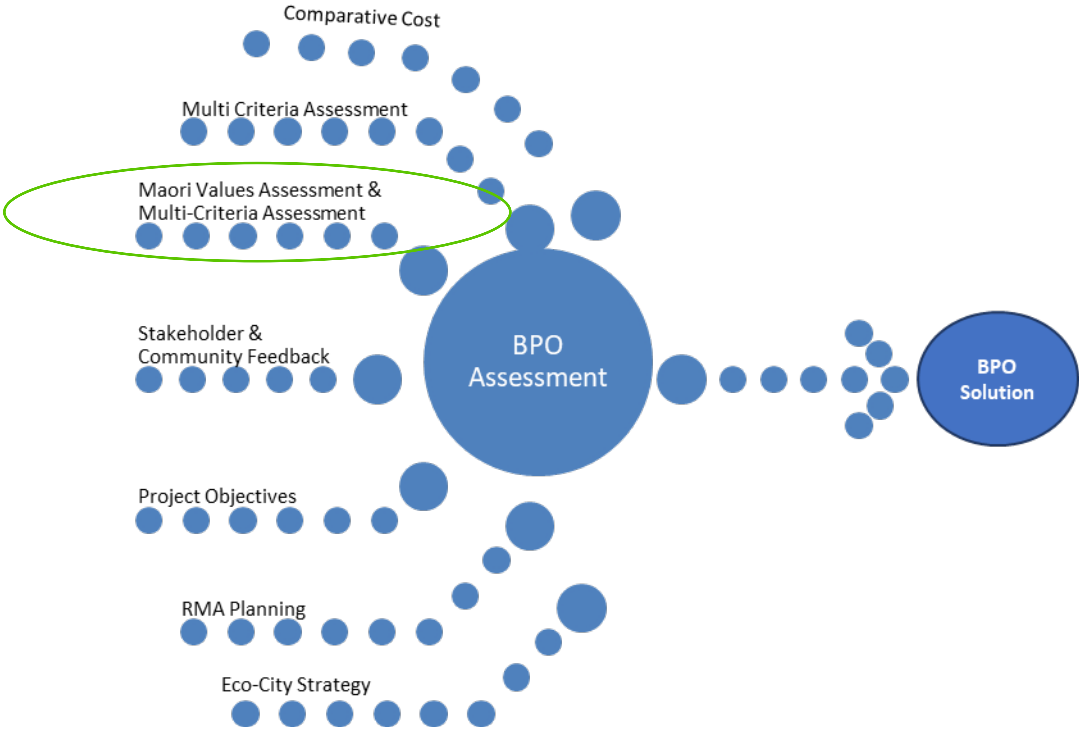


Figure 1 BPO Assessment Process

The Maori Values assessments have been undertaken by two Iwi, made up of the following:

- Rangitāne o Manawatū, who are mana whenua for the Palmerston North area and representative on the BPO Project Steering Group (PSG); and
- Hapū that are representative of Ngāti Raukawa. This group also provided representation on behalf of te Rūnunga o Raukawa. Note that Ngāti Whakatere, one of the hapū of Ngāti Raukawa, have elected to be represented independently of te Rūnunga and the hapū involved in this assessment process.

The assessment processes have involved full access to all technical documentation. Each iwi has provided their own assessment and that assessment relates specifically to the unique set of values held by that iwi. An outline of the methodology used by each of the iwi to undertaking their assessments is provided in Section 3 of this Report and in detail within Appendices A and B of this Report.

1.2 Shortlist Options

The following table lists the shortlist options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, May 2021.

Table 1 Options Description / Reference

Option No.	Option Summary Description
1	**R2(b) River discharge with Enhanced Treatment**
2	**R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow**
3	**Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow**
4	**L+R (a) 97% of the time to Land (inland)**
5	**L+R (b) 97% of the time to Land (coastal)**
6	**L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)**
7	**L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)**
8	**L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L**
9	**L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L**
10	**O+L / Ocean with Land (coastal)**
11	**Ocean discharge**

1.3 Supporting Project Information

The following technical documents have informed the assessment and scoring presented in this report:

- Rangitāne o Manawatū Cultural Values Assessment for Palmerston North City Council wastewater: The Best Practicable Option, June 2021
- Ngati Raukawa Hapū Evaluation of Options, July 2021

2 Methodology for this Assessment

2.1 Classification Process

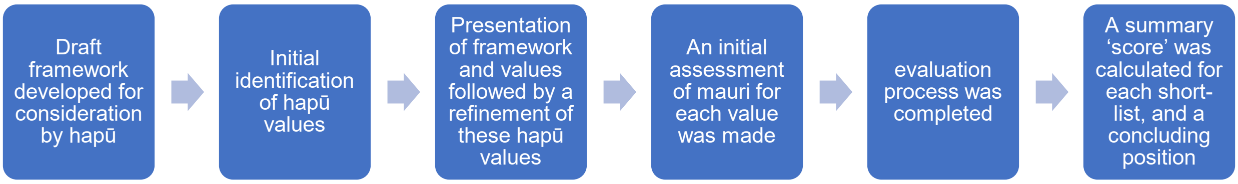
This assessment considers the extent to which a wastewater discharge to a particular receiving environment, aligns with the relevant values of Rangitāne and hapū representing Ngati Raukawa, in comparison to the other receiving environments and treatment levels (the Options).

2.1.1 Rangitāne o Manawatū

The CVA prepared by Rangitāne o Manawatū was developed *"to enable the Iwi to articulate the relationship, values and aspirations that they hold for each of the receiving environments".*[2] Significant work was undertaken by Rangitāne in November 2020 to complete the CVA component of the Multi Criteria Assessment (MCA) for the BPO Project. However, the cultural assessment was limited in scope and it was agreed between the Council's technical team and iwi that a CVA was necessary to clearly represent the values of the iwi for consideration in the overall decision-making process.

2.1.2 Represented hapū of Ngāti Raukawa

The following steps were taken to complete the evaluation and classification process:



- Draft framework developed for consideration by hapū
- Initial identification of hapū values
- Presentation of framework and values followed by a refinement of these hapū values
- An initial assessment of mauri for each value was made
- evaluation process was completed
- A summary 'score' was calculated for each short-list, and a concluding position

A total of five core values have been identified by the hapū, and these are outlined in Appendix B of this report and summarised in Section 3 of this Report.

2.2 Scoring of Options

The following table highlights the scoring classifications used by both iwi. The approaches differ however it is important to recognise that the values have a general (while not direct) alignment, the scale was applied in the same way as the 1 to 5 scoring has been used across each of the other BPO assessments.

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[2] Section 1.3 of the CVA Report prepared by Kahu Environmental, refer Appendix A.

Table 2 Scoring Criteria by Iwi

Rangitāne o Manawatū		Ngāti Raukawa		Revised Score
Alignment	**Score**	**Alignment**	**Score**	
Negligible Impact	5	Enhanced	2	5
Minimal Impact	4	Maintaining	1	4
Major Impact	3	Neutral (mauri tau)	0	3
Significant Impact	2	Diminishing	-1	2
Critical Impact	1	Destroyed (mauri awe)	-2	1

Clear direction is provided by both iwi in their respective assessments (refer Appendix A and B). These assessments individually represent the position of Iwi across their values set, for each of the shortlisted options. The scores applied across the values assessments are to be interpreted with caution, on the basis that options with a score of '5' are not necessarily supported and may not be interpreted the same as in other assessments, which are representing 'strong alignment'. Rangitāne have clearly expressed the need to refer to the values assessment with caution for this reason.

In consultation with Ngāti Raukawa, no options are considered to have achieved strong alignment with the values presented by Ngāti Raukawa. However, there is the opportunity for some options with further refinement to receive limited support, with continued involvement of the Iwi. This specific refinement has yet to be confirmed, however the ongoing relationship is important in progressing the BPO option through refinement and to consent stage.

With respect to the scale applied by Ngāti Raukawa to the scoring of options, the values of -1 and -2 are consistent with the values of 1 and 2 used in the scoring by Rangitāne o Manawatū and also consistent with the overall assessment approach on other assessments. However, scores from '0' to '+2', were not used in the assessment completed by Ngāti Raukawa. We have therefore, not considered the application of values '3' to '5' in the overall assessment, as contrary to the scoring process by Ngāti Raukawa.

Based on the above, the scale applied by Ngāti Raukawa has been converted to the '1' to '5', to allow the scoring process across all assessments to be consistent in measure.

As noted earlier in this report, the values assessments provided in the assessments by both Iwi, provided in Appendix A and B of this report, are to be referred to in the first instance to ensure clarity of interpretation.

3 Assessment & Scoring

3.1 Rangitāne o Manawatū

Table 3 summarises the scores allocated to the options for each of the values recognised by Rangitāne o Manawatū. Appendix A provides the full description of values and rationale for the scores.

Table 3 Scoring of options against the values of Rangitāne o Manawatū

Potential Impacts	**Kaupapa**		**Options Scoring**										
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Rangitāne Values	1	Mana whenua	1	1	1	4	2	3	3	2	2	1	1
	2	Taonga (wāhi tapu)	1	1	1	3	3	2	2	2	2	1	1
	3	Mauri	1	1	1	4	4	3	3	3	3	1	1
	4	Wairua	1	1	1	4	4	3	3	3	3	1	1
Rangitāne Landscapes	5	Manawatū Awa	1	1	1	4	4	3	3	3	3	5	5
	6	Wetlands	1	1	1	3	3	3	3	3	3	1	5
	7	Coast	1	1	1	4	2	3	3	2	2	1	1
	8	Dunes	5	5	5	5	2	5	5	3	3	3	3
	9	Mountains	5	4	4	1	1	2	2	2	2	5	2
Rangitāne atua	10	Ranginui	2	2	1	4	4	4	4	4	4	2	1
	11	Papatūānuku	5	4	4	4	4	4	4	4	4	4	1
	12	Tangaroa	1	1	1	4	4	3	3	3	3	1	1
	13	Haumia-tiketike	5	4	4	4	4	4	4	4	4	4	5
	14	Rongomatane	5	5	5	3	3	4	4	4	4	5	5
Nga uri o Rangitāne	15	Tangata whenua	1	1	1	5	1	3	3	1	1	1	1
	Total Score (out of 75)		**36**	**33**	**32**	**56**	**44**	**49**	**49**	**41**	**41**	**36**	**34**
	Average Score (total)		**2**	**2**	**2**	**4**	**3**	**3**	**3**	**3**	**3**	**2**	**2**

3.2 Ngāti Raukawa

Table 4 summarises the scores allocated to the options for each of the values recognised by Ngāti Raukawa. As advised in Section 2 above, the scores below are modified to align with the scoring categories used across all assessments. For completeness, the scores in the CVA (Appendix B) and the scoring applied to the assessments are both included for reference.

Table 4 Scoring of options against the Values Ngāti Raukawa

Values of Ngāti Raukawa	**Options Scoring**																					
	1		2		3		4		5		6		7		8		9		10		11	
Whakapapa Atua and Whakapapa Tupuna	-2	**1**	-2	**1**	-2	**1**	-1	**2**	-2	**1**	-1	**2**	-1	**2**	-2	**1**	-2	**1**	-2	**1**	-2	**1**
Te Kai Pupuru Maori	-2	**1**	-2	**1**	-2	**1**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-2	**1**	-2	**1**
Hapai O	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-2	**1**	-2	**1**
Manawaroa	-2	**1**	-2	**1**	-2	**1**	-1	**2**	-2	**1**	-1	**2**	-1	**2**	-2	**1**	-2	**1**	-2	**1**	-2	**1**
He ringa miti tai heke	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-1	**2**	-2	**1**	-2	**1**
Total Score (out of 25)		**7**		**7**		**7**		**10**		**8**		**10**		**10**		**8**		**8**		**5**		**5**
Average Score (total)		**1**		**1**		**1**		**2**		**2**		**2**		**2**		**2**		**2**		**1**		**1**

4 Recommendation

4.1 Weighting

The opportunity to weight specific values across the range presented by both Iwi has been considered. Both Iwi have confirmed there is no merit in weighting specific values over others. Therefore, all values have been considered equal in weight.

4.2 Recommended Options

The recommended scoring uses a scale of 1 to 5 to compare how well options align with values identified by Rangitāne o Manawatū and Ngāti Raukawa. Technical advisors and iwi have been involved in the assessment of these options throughout the process.

Both iwi confirmed that options including a significant discharge of treated wastewater to water, including the Manawatū River and ocean, are considered fatally flawed. Options 1 and 2, include enhanced treatment, however this was not considered a sufficient mitigating factor. Options 10 and 11 are considered seriously flawed out of all the options, as identified by both iwi.

Options considering large land areas near the coast (coastal sands), are not scored highly by either iwi, on the basis the values are not met.

Overall, those options with the largest land areas on fluvial soils(inland), achieved a higher ranking based on the highest alignment to both sets of values. The scoring does not recognise that the highest treatment level is desired by both iwi, no matter which receiving environment is being considered.

Table 6 below shows the ranked order of options based on the two iwi assessments.

Table 5 Options ranking against Rangitāne and Raukawa values

Option Description		**Treatment Level**	**Ranking**
1	R2(b) River discharge with Enhanced Treatment	4	7
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to Land at low River flow	4	8
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	2	9
4	L+R (a) 97% of the time to Land (inland)	1	1
5	L+R (b) 97% of the time to Land (coastal)	3	4
6	L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)	2	2
7	L+R (d-2) to Land <62m³/s / 43% of the time to Land (inland)	2	2
8	L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35 mg/L	2	5
9	L+R (e-2) to Land <62m³/s / 43% of the time to Land (coastal) TN = 35 mg/L	2	5
10	O+L / Ocean with Land (coastal)	1	11
11	Ocean discharge	1	10

It is recommended that all options are considered in conjunction with the wider assessment approach, before being recommended for assessment through the BPO Criteria. This will be determined in the BPO Recommendation Report.

Appendix 1: Cultural Values Assessment – Rangitāne o Manawatū

kāhu
ENVIRONMENTAL

Memo

CVA SCORING

TO	MELAINA VOSS
FROM	SIOBHAN KARAITIANA
DATE	JULY 30TH, 2020
SUBJECT	CULTURAL VALUES ASSESSMENT (CVA) SCORING FOR PALMERSTON NORTH CITY COUNCIL BEST PRACTICABLE OPTION (BPO).

Tēna koe Melaina

Within the CVA document some Kaupapa or scoring criteria are grey/unscored options because the proposed option does not relate to the Kaupapa. For example, when considering ocean discharge options, the impact on the Manawatū River is not relevant and thus left grey. You have advised it would be helpful to score these items to be consistent across all the assessments under the BPO criteria. Rather than change the CVA, a memo has been provided that includes the scoring table with the updated scores. Attached within this memo is the updated scoring system. I advise caution regarding interpretation. The Kaupapa are not all considered equal in weighting and it should not be assumed that because a high or low score is now included within a Kaupapa, previously in grey, that it means Rangitāne o Manawatū are any more or less favourable to this option. Thus, Rangitāne o Manawatū (RoM) recommendations contained within the CVA still form RoM overall position.

Ngā mihi maioha

Siobhan Karaitiana
Kaupapa Taiao Specialist

Potential Impacts	Kaupapa	1	1a	2	3	3a	4	4a	5	5a
Rangitāne values	1. Mana Whenua	1	1	1	4	3	2	2	1	1
	2. Taonga (tapu)	1	1	1	3	2	3	2	1	1
	3. Mauri	1	1	1	4	3	4	3	1	1
	4. Wairua	1	1	1	4	3	4	3	1	1
Rangitāne landscapes	5. Manawatū Awa	1	1	1	4	3	4	3	5	5
	6. Wetlands	1	1	1	3	3	3	3	1	5
	7. Coast	1	1	1	4	3	2	2	1	1
	8. Dunes	5	5	5	5	5	2	3	3	3
	9. Mountains	5	4	4	1	2	1	2	5	2
Rangitāne atua	10. Ranginui	2	2	1	4	4	4	4	2	1
	11.	5	4	4	4	4	4	4	4	1
	12.	1	1	1	4	3	4	3	1	1
	13.	5	4	4	4	4	4	4	4	5
	14.	5	5	5	3	4	3	4	5	5
Nga uri o Rangitāne	15.	1	1	1	5	3	1	1	1	1

Rangitāne o Manawatū Cultural Values Assessment

PALMERSTON NORTH CITY COUNCIL WASTEWATER: THE BEST PRACTICABLE OPTION

FOR PALMERSTON NORTH CITY COUNCIL

JUNE 2021

www.kahuenvironmental.co.nz
Martinborough | Taupō | Christchurch

Contents

1 Executive summary

The Cultural Values Assessment has five key findings:

1. PNCC must remove wastewater from all waterbodies to uphold Rangitāne o Manawatū mana, rangatiratanga and lore. Rangitāne are open to a discussion how this can be progressed over time.
2. Tikanga requires that wastewater must be treated to the highest degree prior to being discharged to any part of the environment. Papatūānuku, Ranginui, and Tangaroa are living beings and ancestors that must maintain balance to protect the mauri, wairua, health and wellbeing of Te Ao Māori.
3. Rangitāne prefer land-based discharge, and this must be a key feature of the BPO. The discharge of wastewater on land will have residual impacts on wāhi tapu and significant landscapes that will require the use of buffer zones and other appropriate mitigation.
4. The current location of wastewater processing and discharge is within a significant wāhi tapu and should be moved to another location to align with Rangitāne aspirations for cultural and ecological revival of the river corridor.
5. Rangitāne strongly believe that the city should deal with wastewater within its own geographic area, minimising impacts on iwi with overlapping areas of interest and adjacent communities.

1.1 Introduction

Palmerston North City Council (PNCC) is seeking resource consent for the discharge of human wastewater from Palmerston North City and small surrounding communities like Ashurst and Bunnythorpe.

Rangitāne o Manawatū (Rangitāne) is working alongside PNCC to develop the Best Practicable Option (BPO) to include in the consent application. The discharge permit will allow PNCC to operate infrastructure to collect, treat and discharge wastewater to the environment. Discharge environments that are considered include Rangitāne o Manawatū tūpuna awa (the Manawatū Awa), tūpuna whenua (Manawatū landscape), and tūpuna moana (Manawatū coastline)[1].

PNCC BPO project managers must bring together all technical assessments so that they are positioned to recommend the adoption of a BPO to Palmerston North City Councillors. This Cultural Values Assessment (CVA) has been undertaken to ensure that the BPO chosen

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[1] Bridgman, A. (2021). *Palmerston North Wastewater Best Practicable Option Review: Work Package 15.6/7 Shortlist Options Summary Report*. Palmerston North: Stantec, Pattle Delamore Partners Ltd, Aquanet Consulting Ltd.

has comprehensively considered Rangitāne values and aspirations as mana whenua. Thus, as Treaty Partners Rangitāne hope their values and aspirations are honoured. Rangitāne want to ensure that Te Tiriti o Waitangi is reflected in the planning, delivery and operational phases of the BPO.

1.2 Current State

Wastewater discharge to the Manawatū Awa has been ongoing for over 100 years[2] and the mauri of the awa has been significantly impacted and degraded as a result. The discharge of Palmerston North wastewater to water does not align with Rangitāne lore. Water is the lifeblood of the land and people, it is of fundamental importance to life, a key source of spiritual, cultural, mental and physical wellbeing. Rangitāne firmly believe that polluting the Manawatū Awa is tantamount to polluting oneself.

The PNCC wastewater discharge creates a critical and abrupt impact on the mauri of the entire river ecosystem and on the mauri of Rangitāne people. This impact is described in Tūtohi 1 (Table 1).

Tūtohi 1: Palmerston North Wastewater Impact on the Mauri of the Manawatū Awa.

Upstream	**Downstream**
1. Water has high visual clarity. 2. Smells fresh. 3. More natural levels of algae and sediments. 4. Quality tuna food availability with diverse macroinvertebrate communities. 5. Swimmable and harvestable during parts of the year. 6. Wāhi tapu freely accessible including Turitea, Kuripaka, Ahimate, and Mokomoko. 7. Pockets of moderate and high-value riparian vegetation present. 8. Active kaitiakitanga including planting, pest and weed control. Rangitāne host festivals, lead education initiatives, and undertake and install mahi toi.	9. Water is murky with lots of detritus. 10. Smells musty. 11. Thick slimes bright green and brown, interstitial spaces full of sediment and slime. 12. Poor tuna food availability, typical communities are choronomids, snails and worms. 13. Contact and harvesting unsafe at all times. 14. Wāhi tapu access require special permission. 15. Riparian vegetation is highly degraded and weedy. 16. Kaitiakitanga is only just being revitalised and this includes inter alia developing a bid to secure funding for Marae Tarata ecological and cultural restoration.

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[2] White, J. (2007). *An uneasy relationship:Palmerston North City and the Manawatū River 1941-2006*. Massey University, Palmerston North.

1.3 Methodology

This CVA has been designed to enable Rangitāne to articulate the relationship, values and aspirations that they hold for each of the receiving environments under consideration: awa, whenua and moana. The intent of the CVA is to enable Rangitāne to compare the potential impacts and benefits of each of the shortlist options.

The document builds on the Multi Criteria Analysis (MCA) mahi undertaken in November 2020 by Rangitāne and the wider BPO project team. Rangitāne used a series of questions about important values to frame the comparison of options using a 1-5 scoring system[3]. These values-based questions are set out in Tūtohi 2. The assessment of the shortlist options against Rangitāne values will follow this same MCA process, but the values-based questions will be analysed in greater detail. The assessment explains the extent to which the discharge of wastewater could impact or benefit values in each receiving environment, and it also highlights critical issues.

Tūtohi 2: Rangitāne o Manawatū assessment criteria

Potential Impacts	Kaupapa
Rangitāne values	1. Mana Whenua - will the activity uphold Rangitāne mana?
	2. Taonga (wāhi tapu) - does the activity impact our taonga and significant cultural sites in a negative way?
	3. Mauri - does the activity negatively impact mauri in our rohe?
	4. Wairua - if there are effects from an activity will they negatively impact whānau ora, health and well-being?
Rangitāne landscapes	5. Manawatū Awa - is the activity impacting or impeding our ability to exercise kaitiakitanga over our taonga, the awa, and its role to nourish our rohe and people?
	6. Wetlands - is there a negative impact on our wetlands?

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[3] Bradley, J. & Voss, M. (2021). Palmerston North Wastewater Best Practicable Option Review: Alternative Assessment- MCA Process Report. Palmerston North City Council: Palmerston North.

Potential Impacts	Kaupapa
	7. Coast - is the activity negatively impacting on the (hauora) cultural health of our coastlines?
	8. Dunes - will the sand dune landforms be disrupted?
	9. Mountains - will the activity impact on our sacred peaks?
Rangitāne atua	10. Ranginui - Is Ranganui being respected?
	11. Papatūānuku - is Papatūānuku being cared for?
	12. Tangaroa - is Tangaroa still connected and in balance?
	13. Haumia-tiketike - is Haumia-tiketike still productive?
	14. Rongomatane - is Rongomatane still cared for?
Nga uri o Rangitāne	15. Tangata whenua - is this acceptable to our people?

The BPO Shortlist described in Tūtohi 3 includes options to discharge Palmerston North wastewater to three broad environments: Rangitāne tūpuna awa, tūpuna whenua and Manawatū tūpuna moana.

A number of shortlist options include:

- Significant ongoing discharges to the Manawatū Awa from the Tōtara Road Wastewater Treatment Plant;
- Periods of time when the discharge would go to land and river;
- An option to discharge wastewater to the awa at Opiki;
- Two 97% discharge to land options (including inland and coastal land locations), with the final 3% of discharges (about 10 days per year) to the Manawatū Awa; and
- Full discharge to moana and a variation of some wastewater to coastal land.

A five-tier scoring system in Tūtohi 4 is used to analyse the potential impacts the Palmerston North wastewater discharge may have on Rangitāne values, significant landscapes and sacred sites.

Tūtohi 3: Palmerston North BPO shortlist options.

Option	**Overall Score and Option Description**
1	Awa discharge with enhanced treatment
1a	Awa discharge with enhanced treatment, and a small % to land
2	Two awa discharge points (Totara Road and Opiki) and a small % to land
3	97 % applied to an inland land application site and a discharge to awa in exceptional circumstances
3a	45-55+ % applied to an inland land application site and an awa discharge for the remainder of the time
4	97 % applied to a coastal land application site and a discharge to awa in exceptional circumstances
4a	45-55+ % applied to a coastal land application site and an awa discharge for the remainder of the time
5	Moana discharge, with a small % to land
5a	Moana discharge

Tūtohi 4: Scoring used to assess potential impacts on Rangitāne values from the shortlist options.

Scoring	**Effect status**
🟥	Critical impact
🟧	Significant impact
🟨	Major impact
⬜	Minimal impact
🟩	Negligible impact

2 Ko Manawatū te awa

2.1 Whakapapa

Ancestors of Rangitāne o Manawatū arrived in Aotearoa aboard the Kurahaupō waka over 30 generations ago. Whatonga was a captain of the waka and is the eponymous ancestor whom the people of Rangitāne trace their lineage. He settled in the Heretaunga area (Hawkes Bay) and explored a large part of Aotearoa. Rangitāne was the grandson of Whatonga whose descendants occupy the Manawatū and other areas of the lower North Island and the top of the South Island today. At the turn of the 19th century Rangitāne and Rangitāne whānaunga held mana over nearly the entire drainage basin of the Manawatū Awa for many hundreds of years.

Life centred around the Manawatū Awa, its tributaries, lakes and wetlands, which came to shape the worldview and values system of Rangitāne today[4,5]

2.2 Mahinga kai

The Manawatū Awa provided the primary form of sustenance to support Rangitāne people in the Manawatū. In the past, water levels of wetlands, lakes and rivers were highly variable seasonally and from year to year, the environment supported diverse ecological systems and a wide range of plants and animals. Rangitāne was self-sustaining, only needing to harvest that which could be naturally replaced[6.]

> *“This land contained some of the richest supplies of food……, for crops of kumara and other root vegetables could be cultivated with ease on the fertile alluvial soils of the riverbanks, while a variety of birds and berries could be gathered from the trees of the surrounding forest. However, the most desired items of food in this area were the tuna (eel) that could be caught in huge quantities from the waters of the swamps adjacent to the riverbanks[7]”.*

Tuna thrived in waterways throughout the Manawatū. Rangitāne ancestors were able to harvest large numbers and a diverse range of tuna without reducing the stocks because each site was visited in rotation and according to the season and occasion. Tuna were caught for immediate use, for live storage in watercourses near pā (fortified settlements) and dried for long-term storage[6]. With the transformation of the Manawatū landscape through deforestation, land intensification and drainage, most tuna hunting sites have been lost to Rangitāne. Amongst those remaining, some are managed by permits under the Department

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4 McEwen, J.M. (1986). Rangitāne: A tribal History. Reed Books: Auckland.

5 Wai 182, Rangitāne o Manawatū. Tanenuiarangi Manawatū Incorporated Office of Treaty Settlements.

6 Tanenuiarangi Manawatū Inc (1999). Rangitāne Mahinga Kai Project,. Palmerston North.

7 Dixon, Maren & Ngaire Watson (1983),‘A History of Rangiotu.published by Dunmore Press Ltd., Palmerston North.

of Conservation and others are inaccessible because they are now located on privately owned land.

Rangitāne work proactively with a range of partners in recovering their mana whenua rights to original tuna hunting grounds in the Manawatū.

> *“We were renowned - absolutely renowned - for our eels, and we had very special eels. We had silver-bellied eels that are so hard to come by now. They’re not the real big coarse eels. They were just very fine, and they sort of melted in your mouth*[8]*”.*

2.3 Mātauranga ā Rangitāne

Several sites along the Manawatū Awa were of fundamental importance to Rangitāne: Otangaki, Te Wī, Hokowhitu, Te Kuripaka, Mokomoko, Te Kairanga, Te Motu o Poutoa, Marae Tarata and Puketōtara to name a small few[9]. The Manawatū Awa features prominently in Rangitāne lore. This mātauranga links Rangitāne to the spiritual world. It creates an inseparable bond and a responsibility to protect and enhance the environment physically and metaphysically from misuse and further degradation.

Haunui a Nanaia and the naming of the Manawatū Awa

> The wife of Haunui, Wairaka, ran away with a man named Weku/Weka. Haunui set off in pursuit of the runaways who had gone southward along the coast from Whanganui. As Haunui followed them he named many of the rivers he had to cross on his journey. One morning he came to a river so cold, wide and deep that it made his breath stand still. He called it Manawa-tū, meaning still breath. Haunui overtook Weku/Weka and Wairaka at Pukerua Bay, and on his return journey invoked the god Rongomai to return him to his home on the west coast[10].

Okatia and the creation of the Manawatū Awa

> There once lived a giant tōtara tree on the slopes of Puketoi Range, Wairarapa. The tōtara tree became possessed by a supernatural being called Okatia which settled from the sea breeze of the west coast winds. Under the influence of the spirit, the tree gouged a channel north-westward, before arriving at the Ruahine-Tararua Mountain Belt. Okatia in the form of the tōtara tree hammered its way through the mountain chain creating Te Apiti, or the Manawatū Gorge. Exhausted, Okatia meandered across the Manawatū plains reaching the Foxton river mouth. He floated

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[8] Previous Oral History Interview with Ruth Harris, former CEO of Tanenuiarangi Manawatū Inc.

[9] Lange, R. (2000). The social impact of colonisation and land loss on the iwi of the Rangitikei, Manawatū and Horowhenua Region, 1840-1960. Crown Forestry Rental Trust.

[10] McEwen, J.M. (1986). Rangitāne: A tribal History. Reed Books: Auckland

out to sea and came to rest off the coast of Kāpiti. His name is known as Te Waewae Kapiti o Taraika rāua ko Rangitāne, or Kapiti Island[11].

3 Ko ngā uri o Rangitāne ki te whenua

3.1 Whānau, Hapū, Iwi

Traditional entry to the Manawatū interior was gained by paddling and poling waka along the Manawatū Awa. At each major river bend a permanent or seasonal village or pā existed within Rangitāne history[12,13]. The awa linked hapū (family groups) together, to form who we now know as Rangitāne o Manawatū. Rangitāne is a collective of six hapū. Hapū members work closely together and each hapū has representation on the Rangitāne o Manawatū Settlement Trust. This collaboration forms one avenue of mandate for Rangitāne as an iwi authority[14,15]. The six hapū are set out below in no particular order:

Ngāti Mairehau (also known as Ngai Tuahuriri)

Descend from the land on the east bank of the Manawatū Awa between Turitea and Tokomaru, including over the Tararua Ranges to Pahiatua.

Ngāti Te Kapuarangi

Descend from the land surrounding the current city of Palmerston North.

Ngāti Hineaute

Descend from the land above Te Apiti to the northern area of Palmerston North City.

Ngāti Rangitepaia (also known as Ngāti Rangi)

Descend from the land from the southern boundary of the city to the confluence of the Oroua and Manawatū Awa.

Ngāti Rangiaranaki

Descend from the land above Te Apiti to Palmerston North City with Ngāti Hineaute.

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[11] McEwen, J.M. (1986). Rangitāne: A tribal History. Reed Books: Auckland

[12] Taylor & Sutton (1999). Inventory of Rangitāne Heritage sites in Palmerston North City, 1999. Palmerston North City Council.

[13] Tanenuiarangi Manawatū Inc (1999). Rangitāne Mahinga Kai Project. Palmerston North.

[14] Treaty of Waitangi Claims: Wai 182 the Manawatū Claim.. Retrieved on June 1st, 2021 from https://www.tmi.maori.nz/Treaty.aspx

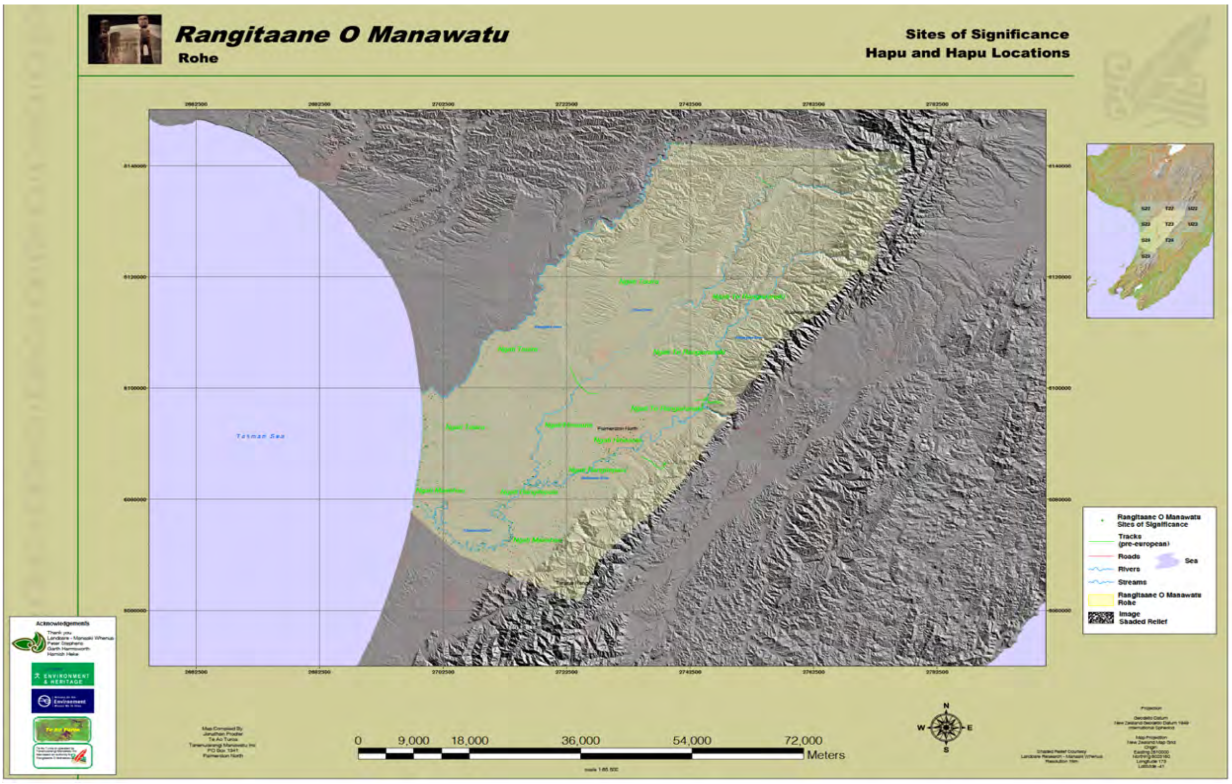
[15] Rangitāne o Manawatū: Deed of Settlement documents (2021). Retrieved on June 1st, 2021 from https://www.govt.nz/browse/history-culture-and-heritage/treaty-settlements/find-a-treaty-settlement/Rangitāne-o-Manawatū/

Ngāti Tauira, Rangitāne – Ngāti Apa hapū

Descend from the land around the upper Oroua River between Ohungarea and Awahuri.

Rangitāne maintain further resource collection areas shared with Ngāti Apa including coastal areas, and in the upper catchments of the Oroua and Pohangina Rivers.

Tūtohi 5: Rangitāne o Manawatū area of interest



3.2 Wāhi tapu

Wāhi tapu are sacred places of whenua (land) and natural features important to Māori in the traditional, spiritual, ritualistic and mythological sense.

Rangitāne maintain the knowledge and relationship with hundreds of wāhi tapu across the Manawatū. They are highly interconnected features generating connection to the landscape, waterways and moana. These wāhi tapu support Rangitāne position as mana whenua in the Manawatū; manifesting a link between the past and present, ancestors, and the surrounding landscape[16]. Wāhi tapu are an imprint of Rangitāne on the whenua, and they include but are not limited to:

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[16] Procter, J.P. (2021). Rangitāne o Manawatū GIS dataset. Confidential collection.

- urupā ie burial grounds;
- places where significant ancestors lived and/or died;
- locations where significant events occurred (both battle grounds and peace-making sites);
- travelling tracks;
- resource collecting areas;
- cultivation clearings;
- ritualistic areas;
- temporary and permanent shelters;
- fortified pā sites;
- entry to the realms of kaitiaki and taniwha;
- mountains and mountain peaks; and
- rivers, wetlands, lakes and forest areas.

The importance of wāhi tapu does not diminish with the passing of time or succession of generations and their status has not been overturned by Crown policy. Rangitāne wāhi tapu still exist today even though deforestation, drainage and stop-banking schemes may have removed their physical evidence. Rangitāne remain mana whenua within the Manawatū today through their continued connection with the awa, whenua and moana.

4 Te Tai o Rehua te moana

4.1 The Tasman Sea

The Tasman Sea is known to Rangitāne as "Te Tai o Rehua" or "the sea of Rehua". Rangitāne believe the star cluster Matariki is personified as the wife of Rehua. Matariki and Rehua had eight children representing eight different areas of wellbeing.

1. Pōhutukawa- is connected to death and those who have passed on;
2. Tupuānuku- is connected to Papatūānuku and food grown in the ground;
3. Tupuārangi- is connected to Ranginui and food that comes from the sky such as birds;
4. Waitī- waitī means to be sweet and is connected to freshwater;
5. Waitā- waitā means to be salty and is connected to the moana;
6. Waipunarangi- is connected to the rain;
7. Ururangi- is connected to the winds of the sky; and

8. HIwa-i-te-rangi- is connected to growth and hope for the coming year.

Matariki and Rehua guided early navigators such as Whatonga across the Pacific Ocean to reach Aotearoa.

4.2 Himatangi- Awahou

On the west coast of Rangitāne rohe there are dune lands and lagoons that sit between the Manawatū and Rangitikei Awa. The sand hills that we see today are however a recent development. The area was originally covered in native vegetation that included manuka and tutu, native grasses and bracken fern on ridges, and clumps of flax, toetoe and raupō in wetter areas. The entire foreshore was once covered with sand-binding plants that restricted the flow of sand inland and the build-up of sand hills.

Beyond the foredune, extensive flats covered in native grasses and shrubs extended almost along the entire coastline. Wetlands developed over time as dune lands slowly shifted through wind and sea action, blocking the run-off of water[17].

4.3 Taonga

Pīngao was an important dune binder, being relatively tolerant of salt water, wind and the seaward face of dunes. Pīango is a taonga species highly valued by Rangitāne for its uses in weaving. The dune hollows were (and in some instances remain) the habitat of some nationally rare and threatened plant species.

Kaimoana was also plentiful and included tohemanga/toheroa, pipi, cockles, tuatua, surf crabs and clams, kahawai, freshwater and saltwater flounder/patiki, and shark[18].

Kararaina Te Wera Tait recalled pipi were particularly plentiful on Himatangi Beach[19]

> *"(The kai moana) was plentiful. There was pipis, toheroas - and you never had to go in the season - the season was the whole year.*
>
> *Eels - plenty of tuna. Whitebait, flounders and cockles. Even our pīngao and all that you got for weaving was plentiful. They were worth picking. Today they're only babies - they're not very tall. Actually, there was a lot of stuff that we used to get out there.*
>
> *The flax out there would have been one of the best varieties of flax for kete and piupiu's. This was told to me by expert weavers, even today.*

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[17] Esler, A. E. (1978). Botany of the Manawatū District New Zealand (Vol. 127, Ser. 127). Wellington: Government Printer.

[18] Tanenuiarangi Manawatū Inc (1999). Rangitāne Mahinga Kai Project. Palmerston North.

[19] Previous Oral History Interview with Kararaina Te Wera Tait

> *We used to get a meal just sitting out there. Put a piece of bread in one (hand) and pipi in the other - or mainly toheroa – because they were big and they were filling."*

Rangitāne managed and sustained their fishery resources for generations. Seasonal settlements were located along the entire west coast of their rohe. In old times Rangitāne from inland and upriver settlements travelled to the west coast on a seasonal basis to gather shellfish to consume immediately, dry and remove for storage. Although the west coast was an occasional travel route for other iwi, many of the archaeological sites can be accurately associated with Rangitāne and Rangitāne whānaunga based on their dating and locations. Shellfish parties would come down to the coast on occasions when a whale was stranded to harvest resources from the beautiful taonga[20].

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20 Tanenuiarangi Manawatū Inc (1999). Rangitāne Mahinga Kai Project. Palmerston North.

5 Rangitāne o Manawatū values system

Rangitāne o Manawatū values, described in Tūtohi 6, apply traditional tikanga and mātauranga to contemporary environmental issues. The description of values assists the reader to interpret the analysis of shortlist options in Section 5.

Tūtohi 6: Description of Rangitāne o Manawatū values.

Values	Definition
Te Ao Māori	Te Ao Māori is a worldview based on the holistic principle that all elements are interrelated. Every part of the environment is understood to have a common genealogy, descending from a common ancestor. The principle ancestors being Io matua te kore (Io the Parentless), Ranginui and Papatūānuku (Sky Father and Earth Mother) and their atua tamariki (Including Tāne Mahuta God of the Forest, Tangaroa God of the Moana and waterways, Haumia-tiketike God of Cultivated Foods, and Rongomātāne God of wild foods).
Mana whenua	The concept of mana whenua is key to understanding the environmental management philosophies of Māori. Mana whenua as defined by the Resource Management Act 1991 (RMA) is the customary authority exercised by an iwi or hapū in an identified area. It is the authority to control and manage a traditional area or resource in relation to prescribed customary and cultural practices. The authority is obtained through the relationship of the people and their ancestral connection to the land. Rangitāne o Manawatū have maintained their position as mana whenua within the Manawatū area for over 500 years.
Tino rangatiratanga	Tino rangatiratanga is absolute sovereignty and self-determination; having ownership, rights, control and authority over original mana whenua lands, waters, and taonga. Article Two of Te Tiriti guarantees Māori tino rangatiratanga, which is fundamental to wellbeing and prosperity.

Mātauranga a Rangitāne	Mātauranga a Rangitāne is the knowledge, comprehension and execution of actions Rangitāne undertake based on their knowledge of their history, values and culture. This knowledge is embedded within pūrākau, waiata, whānau korero and increasingly documented form. It requires tangata whenua to protect and enhance all aspects of the natural world.
Tikanga	Tikanga is a requirement to be achieved, rather than a bottom line found in western science and resource management.
Mauri	Mauri is the life force of all living and non-living things. Mauri is the essential quality and vitality of a being or entity which can be assessed by Rangitāne using qualitative and quantitative tools to detect practices causing damage to the environment and people.
Kaitiakitanga	Kaitiakitanga is the act of guardianship, control of resources and protection of mauri. The process and practices mana whenua undertake to use, protect and celebrate the environment include cultural monitoring, environmental education and restoration, mahi toi, celebrations and ceremonies, participation in planning and RMA matters, management partnerships and co-governance agreements.
Wairuatanga	Wairuatanga is the recognition of the interconnectedness of physical and spiritual dimensions. Wairua is the energy force that connects all aspects of life including the environment. Mana whenua continue to support and uplift the essence of wairuatanga through karakia, rituals and cultural practices.

Whānau ora	 **Whānau** are self-managing and empowered leaders **Whānau** are leading healthy lifestyles **Whānau** are confidently participating in Te Ao Māori (the Māori World) **Whānau** are participating fully in society **Whānau** are economically secure and successfully involved in wealth creation **Whānau** are cohesive, resilient and nurturing **Whānau** are responsible stewards of their living and natural environment
Ritenga	Ritenga are everyday rituals and practices that sustain the wellbeing of people, communities and natural resources. Everything is balanced between regulated and de-regulated states; tapu is to be restricted or sacred; rāhui is temporary restriction; and noa is relaxed or unrestricted. Tapu is an ancient concept that can be interpreted as holy or sacred. It can be defined as a 'spiritual restriction,' or supernatural condition. It involves rules and prohibitions that were central to traditional society to keep everyone safe. Tapu was used to control how people behaved towards each other and to the environment to ensure that society flourished.
Mana-aki-tanga	Manaakitanga is the way in which care, generosity, and respect is expressed towards manuhiri (guests) at the marae and kainga, and towards the environment and atua. Mana of people and places is uplifted when people behave in a manner that aligns with their collective values.
Taonga	Taonga are tangible and intangible components of te ao Māori. Taonga are anything that is of value or treasured including places, people, language, objects, flora and fauna. Taonga are understood through mātauranga a Rangitāne. They are to be cherished, protected and enhanced.

6 Analysis

Tūtohi 8 contains an analysis of how Rangitāne values and significant landscapes could be impacted by the various shortlist options. In some instances, it has been appropriate to advise how the impact could be appropriately addressed by following a hierarchy approach to avoid, reduce, mitigate or compensate for detrimental effects. Critical effects and bottom lines are highlighted. Each shortlist option is then given a score according to the proposed effects status after the effect's mitigation hierarchy has been followed. A summary of the BPO shortlist and effects assessment scoring is included again for the readers ease (Tūtohi 7).

Tūtohi 7: Summary of PNCC BPO shortlist options and assessment scoring

Option	**Overall Score and Option Description**
1	Awa discharge with enhanced treatment
1a	Awa discharge with enhanced treatment, and a small % to land
2	Two awa discharge points (Totara Road and Opiki) and a small % to land
3	97 % applied to an inland land application site and a discharge to awa in exceptional circumstances
3a	45-55+% applied to an inland land application site and an awa discharge for the remainder of the time
4	97 % applied to a coastal land application site and a discharge to awa in exceptional circumstances
4a	45-55+% applied to a coastal land application site and an awa discharge for the remainder of the time
5	Moana discharge, with a small % to land
5a	Moana discharge

Scoring	Effect status
🟥	Critical impact
🟧	Significant impact
🟨	Major impact
🟩	Minimal impact
🟩	Negligible impact

Tūtohi 8: Analysis of the potential impact of shortlist options against Rangitāne o Manawatū values and significant landscapes.

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
Rangitāne o Manawatū values	1. Mana Whenua Will the activity uphold Rangitāne mana?	• The discharge of wastewater, including treated wastewater, to Manawatū waterways will diminish the mana of Rangitāne and the Manawatū Awa. • Discharging wastewater into the rohe of other iwi will also diminish the mana of Rangitāne and heavily impact those other iwi. • 100 % moana and awa discharge options are likely to have the same type and scale of effects if wastewater treatment levels were the same. • Discharge of wastewater to land has the least impact on Rangitāne.	🟥	🟥	🟥	🟩	🟨	🟧	🟧	🟥	🟥
	2. Taonga (wāhi tapu)	• The discharge of wastewater within wāhi tapu is completely inappropriate. • Wāhi tapu include the Manawatū Awa, Te Tai o Rehua and sites of significance.	🟥	🟥	🟥	🟨	🟧	🟨	🟧	🟥	🟥

	Kaupapa	**Kōrero (comments)**	**1**	**1a**	**2**	**3**	**3a**	**4**	**4a**	**5**	**5a**
	Does the activity impact our taonga and significant cultural sites in a negative way?	• There are hundreds of interlinked known, unknown and lost wāhi tapu and taonga across the Manawatū landscape. • Known wāhi tapu could at least be protected if buffer zones were incorporated into land-discharge designs. Buffer zones are ineffective if the discharges are to water. Unknown/lost wāhi tapu will be impacted. • Buffer zones could link together to become contiguous areas where wastewater cannot be applied, these situations are likely to apply to land directly adjacent to the Manawatū Awa and the coastal marine area. • Rangitāne are extremely concerned about eutrophication of the moana foreshore in coastal land discharge options, including the physical, perceived and spiritual impacts on mahinga kai within the foreshore. • Any eutrophication impacts on wāhi tapu must be mitigated and offset. This could include planting mānuka and harakeke to remove nutrients, provide shading and habitat. Iwi should be spiritually reconnected by renewed access to significant areas.	🟥	🟥	🟥	🟨	🟧	🟨	🟧	🟥	🟥
	3. Mauri Does the activity negatively impact mauri in our rohe?	• Any discharge of wastewater to waterways will impact the mauri (life force) of the environment. The amount of wastewater discharged to waterways is exponentially related to mauri. • Treatment must be to the highest standard in all discharge environments to protect the mauri of waterways, land and their cultural values.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	🟥	🟥

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
		• Wastewater discharge must not have any negative impact on local waterways, including ecological health indices such as macroinvertebrate community Indices and oxygen dynamics. • The mixing of contaminants in waterbodies is totally unacceptable and inappropriate way to reduce impact on mauri. • The impact on mauri can only be mitigated by removing wastewater from waterways. • Discharge of wastewater to expansive land areas is also undesirable but is less repugnant than to the awa and moana.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	🟥	🟥
	4. Wairua If there are effects from an activity, will they negatively impact whānau ora, health and well-being?	• Wairua is inextricably linked to te whare tapa and all dimensions of wellbeing and whanau ora. Whānau spiritual health and wellbeing is linked to the health of their waterways and lands. • The effects from wastewater discharges to the awa and moana has a direct detrimental effect on the health and wellbeing of whānau because it prevents them from practicing their traditions of supporting their economic, social, cultural, spiritual and physical needs. • Land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. • A small portion of land-based discharge is unlikely to protect the wairua of Rangitāne or their waterways.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	🟥	🟥

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
Rangitāne o Manawatū landscapes	5. Manawatū Awa Is the activity impacting our kaitiakitanga over our taonga the river and its role to nourish our rohe and people?	• Awapuni has carried the burden of Palmerston North waste and wastewater for over 100 years. The activities have destroyed a place of significant historical and cultural value to Rangitāne, forming a significant part of Rangitāne Treaty Settlement. The resource recovery park and wastewater discharge in the current location continues to prevent Rangitāne from accessing the awa, awa margins and Marae Tarata to undertake cultural and ecological restoration to exercise their kaitiakitanga. • The discharge of wastewater to the awa eliminates the ability of Rangitāne people to bathe and collect mahinga kai in traditional hunting and gathering grounds downstream of the discharge because of the tapu nature of wastewater. This in turn impacts Rangitāne in exercising their kaitiakitanga and the role of the iwi to nourish their people.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	⬜	⬜
	6. Wetlands Is there a negative impact on our wetlands?	• The discharge of wastewater to land will have negative impacts on local wetlands and open water bodies. The potential impact of further land intensification and nutrient loading on wetlands is significant. Everyone has a duty to protect the few natural remnant wetlands remaining. • Rangitāne support the use of plant-based land uses including native forestry, cut and carry/zero grazing and retiring marginal land. • The cultural health of wetlands must be protected and enhanced through the BPO and best management practice like stock exclusion, fencing, planting, pest and weed control.	🟥	🟥	🟥	🟨	🟨	🟨	🟨	🟥	⬜

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
		• Rangitāne do not believe that the discharge of wastewater through artificial wetlands will restore the mauri of the wastewater and protect the Manawatū Awa. Rangitāne are focused on the provisioning of high-water quality discharge standards and treatment levels, including discharge to land and native forestry. Artificial wetlands for wastewater treatment can reduce water quality and are difficult to maintain.	🟥	🟥	🟥	🟨	🟨	🟨	🟨	🟥	⬜
	7. Coast Is the activity negatively impacting on the (Hauora) cultural health of our coastlines?	• The discharge of wastewater to the Manawatū Awa continues to impact the mauri of the estuary and coastal waters as wastewater becomes part of the riverine and coastal food web. • Discharge of wastewater to the moana will transfer the rāhui on bathing and kai gathering from the awa to the coastal area for Rangitāne. This will create widespread uncertainty about where and when it is safe to swim and collect kai. There is a high risk whānau will abandon traditional kai gathering grounds due to the tapu nature of wastewater. • Coastal wastewater discharge will impact on the values of other iwi and Rangitāne relationships. • In certain conditions wastewater can be swept back to the coastline directly risking health and wellbeing during bathing and mahinga kai collection. • Water quality impacts have contributed to the steady decline of coastal mahinga ka. Further stressors on coastal water quality and mahinga kai stocks must be avoided.	🟥	🟥	🟥	🟩	🟨	🟧	🟧	🟥	🟥

	Kaupapa	**Kōrero (comments)**	**1**	**1a**	**2**	**3**	**3a**	**4**	**4a**	**5**	**5a**
	8. Dunes Will the sand dune landforms be disrupted?	- Riverine and inland discharge options do not impact coastal landforms. - A large pipe or network of pipes will be required for coastal moana and coastal land discharge. Impacts will vary depending on choice of route. - Potential impacts include destruction of archaeology, impacts on endangered habitat, taonga, and natural character of coastal landforms.	⬜	⬜	⬜	⬜	⬜	🟧	🟨	🟨	🟨
	9. Mountains Will the activity impact on our sacred peaks?	- The installation of new infrastructure has the potential to influence natural character and visual values, flights paths of manu (birds) and connectivity between maunga to moana. These values will be addressed in the BPO consent application as further details are understood.	⬜	⬜	⬜	⬜	⬜	⬜	⬜	⬜	⬜
Rangitāne o Manawatū atua	10. Ranginui Is Ranganui being respected?	- The highest treatment levels and land discharge options protect Ranginui[21]. - There is the potential to protect both Ranginui and Papatūānuku through the BPO by ensuring treatment to the highest high standard and directing land-use towards native forestry and habitat revitalisation.	🟧	🟧	🟥	🟩	🟩	🟩	🟩	🟧	🟥
	11. Papatūānuku	- Papatūānuku can cleanse and revitalise polluted water within limits. Tāne māhuta is a critical part of this process, ngahere (forest) helps to	⬜	🟩	🟩	🟩	🟩	🟩	🟩	🟩	⬜

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[21] Stantec (2021). Palmerston North Wastewater Best Practicable Option (Review): Draft Carbon Footprint Assessment. Palmerston North City Council: Palmerston North.

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
	Is Papatūānuku being cared for?	soak up nutrients and water cleansing the water. The discharge of well treated wastewater to land in native forestry that does not create any eutrophication of local waterways and wetlands ensures Papatūānuku is being cared for. • Indigenous ecosystem development is preferred because it is closer to the realm of Te Ao Māori, species such as kanuka and manuka have been demonstrated to absorb nutrients and e.coli to a higher degree than exotic forestry, they also improve the mauri of the whole system creating habitat for other taonga species. • Wastewater discharge to land coupled with animal agricultural will create land intensification issues and significantly impact Papatūānuku. • Wastewater discharges to water reduce the impact on Papatūānuku but cause significant adverse effects on other interrelated realms of Te Ao Māori realms.	▨	🟩	🟩	🟩	🟩	🟩	🟩	🟩	▨
	12. Tangaroa Is Tangaroa still connected and in balance?	• Wastewater discharge to water significantly increases the risk of local sedimentation issues, algae blooms and impacts on ecological communities. When this happens Tangaroa, other realms of Te Ao Māori and aquatic environments become disconnected and out of balance. • Aquatic plants, invertebrates, and fish have intrinsic value, they are part of Te Ao Māori and are related to people.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	🟥	🟥

	Kaupapa	Kōrero (comments)	1	1a	2	3	3a	4	4a	5	5a
		• There are significant negative impacts on Rangitāne whānaunga (freshwater and saltwater plants, fish and invertebrates) when wastewater is being discharged into their living environment. • The wastewater treatment processes must be resilient and provide the highest treatment standards to eliminate impacts on Tangaroa in all discharge environments.	🟥	🟥	🟥	🟩	🟨	🟩	🟨	🟥	🟥
	13. Haumia-tiketike Is Haumia-tiketike still productive?	• Wastewater discharge to land is unlikely to impact what is left of the realm of haumia- tiketike within the Manawatū. The agricultural land under survey for discharges include very little uncultivated foods. • Small patches of original and planted bush blocks do not support sustainable harvest and mostly contain only seasonal food quality for taonga. These areas must be protected through the use of buffer systems and best management practices. • The realm of haumia-tiketike must be enhanced through the BPO project through offset and compensation mechanisms.	⬜	🟩	🟩	🟩	🟩	🟩	🟩	🟩	⬜
	14. Rongomātāne Is Rongomātāne still cared for?	• It is inappropriate to discharge wastewater onto fields of cultivated foods. • Rangitāne aren't in a position to assess the impact that the BPO may have on foods currently cultivated in the Manawatū landscape or for the potential diversification of horticulture into the future. This information will need to be considered in the development of the consent application.	⬜	⬜	⬜	⬜	⬜	⬜	⬜	⬜	⬜
Nga uri o Rangitāne	15. Tangata whenua	• Rangitāne vehemently oppose the continued discharge of wastewater to waterways and the moana.	🟥	🟥	🟥	🟩	🟨	🟥	🟥	🟥	🟥

	Kaupapa	**Kōrero (comments)**	**1**	**1a**	**2**	**3**	**3a**	**4**	**4a**	**5**	**5a**
o Manawatū	Is this acceptable to our people.	• Rangitāne require their values and lore incorporated into any future wastewater management in their rohe. • Rangitāne lore requires the city must deal with wastewater within its associated geographic area, reducing impacts on iwi with overlapping areas of interest and adjacent communities.	🟥	🟥	🟥	🟩	🟨	🟥	🟥	🟥	🟥

7 Next steps

Tikanga and lore has a vital place in traditional and contemporary societies to keep whānau, hapū and communities safe physically, emotionally, mentally and spiritually.

Rangitāne urge Palmerston North City Council to uphold the Treaty relationship that Rangitāne and council have been working hard to mature over the past years by recognising and providing for the traditional lore and tikanga of the land within BPO decision making.

Rangitāne will need to undertake at a minimum a Cultural Impact Assessment against the BPO as detailed information is developed. Rangitāne look forward to walking alongside council as Treaty partners as we move through to the BPO development, consenting and execution phases.

Disclaimer

We have used various sources of information to write this report. Where possible, we tried to make sure that all third-party information was accurate. However, it’s not possible to audit all external reports, websites, people, or organisations. If the information we used turns out to be wrong, we can’t accept any responsibility or liability for that. If we find there was information available when we wrote our report that would have altered its conclusions, we may update our report. However, we are not required to do so.

Prepared by: Siobhan Karaitiana
Kaupapa Taiao Specialist, BSc(Hon)ecology

Rangitāne o Manawatū Cultural Values Assessment: BPO for Palmerston North City Council Wastewater

VERSION	DATE	AUTHOR	REVIEWER	COMMENTS
1	28 June 2021		Vanessa Tipoki	
2	2 July 2021		Danielle Harris	
3	5 July 2021		Peter Te Rangi	
4				

Appendix 2: Multi-Criteria Assessment – Ngati Raukawa

PALMERSTON NORTH CITY WASTEWATER TREATMENT PLANT

Hapū evaluation of options
July 2021

1. Evaluation process

The five short-list options for the Palmerston North City Council's Wastewater Treatment Plant (WWTP) consent application were evaluated using the assessment framework developed for this purpose[1]. The assessment framework includes the Mauri Model[2] which is used to indicate whether each of the proposed short-list options for WWTP is enhancing or diminishing hapū values.

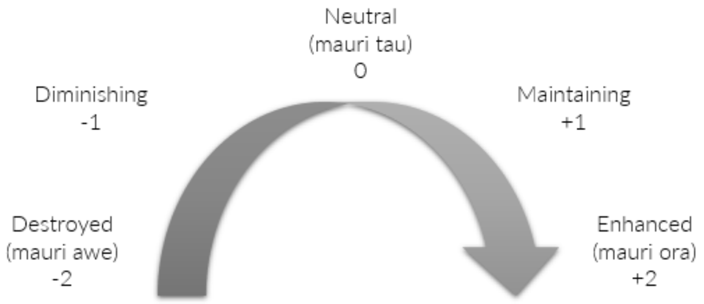

Figure 1: Assessment of mauri using the Mauri Model[2]

The evaluation process taken to date includes the following five steps:

1. Draft framework developed by The Catalyst Group for consideration by hapū
2. Initial identification of hapū values by Hayden Turoa on behalf of hapū
3. Presentation of framework and values at Tumatakahuki hui[3]. Based on this kōrero:
    a. The list of hapū values to include in assessment was refined (from six to five[4])
    b. An initial assessment of mauri for each value was made against several of the short-list options
    c. A general steer on general position for several of the short-list options was provided
4. Supported by The Catalyst Group, the evaluation process (scoring of mauri for each value for each of the short-list options) was completed
5. A summary 'score' was calculated for each short-list, and a concluding position for each short-list option based on the outcome of the assessment identified

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[1] See 'Draft framework for assessing the impacts of PNCC wasterwater treatment plant shortlist options on Ngāti Turanga values'. Memo from The Catalyst Group to Hayden Turoa on behalf of Ngāti Turanga dated 21 April 2021

[2] The Mauri Model was adapted from:
Morgan K 2003. The sustainable evaluation of the provision of urban infrastructure alternatives using the tangata whenua Mauri Model within the Smart Growth Sub-Region. Technical report, Mahi Maioro Professionals, Auckland.

[3] Held at the Raukawa Whanau Ora Ltd offices, 152 Bath St, Levin 5 pm on Wednesday 30 June 2021

[4] A sixth value, Ma Maru (leave an offering for Maru), was initially identified to be included in the assessment framework. On further consideration it was decided this value did not lend itself well to the framework and is better addressed outside of this process. Ma Maru remains relevant to the wider consenting process and can be reintroduced elsewhere in the process.

2. Summary of assessment outcomes

The core values and hapū principles to assess each of the short-list wastewater treatment options against were confirmed as:

Core values/principles	
Whakapapa Atua, and Whakapapa Tupuna	Each hapu and iwi have a whakapapa to the whenua which is an inalienable association to all elements associated (for example, mountains, rivers, lakes, swamps, forests, geothermal activity, oceans, animals – as well as tangata (people)).
Te Kai Pupuru Mouri	Hapu and iwi are the Kai Pupuru Mouri of their taonga, both tangible and in-tangible. Hapu and iwi are integrated, sustainably across the options through a procedural standard that ensure options 'whangai' the 'Mauri'.
Hapai O	What level of abundance can be achieved for hapu and iwi mahinga kai.
Manawaroa	How does the option provide for the environmental resilience and addresses the loss through time, and nutrient deficiencies of waters.
He ringa miti tai heke	Spiritual, customary and recreational use of the Taiao.

The summary of assessment for each-list option is provided below. The **total score** is calculated as the score for each value (-2, -1, 0, +1, +2) divided by five (number of values). However, a score of '-2', mauri awe (destroyed) for **any value** indicates a fatal flaw for that short-list option regardless of scores for other values for the same short-list option.

Following this assessment, short-list options have been colour-coded; red for options that are fundamentally unacceptable to hapū (fatally flawed), orange for options that are unacceptable in their current form, but which are not fatally flawed (at this stage), and green for options that are acceptable to hapū.

The full assessment (including scoring and explanation) for each short-list option is presented at the end of this document.

Summary of hapū assessment against each of the short-list options. Colour code: red = fatally flawed; orange = currently unacceptable (no fatal flaws); green = acceptable to hapū

Option	**Variant**	**Total score**	**Colour code**	**Conclusion**
Option 1: Full River discharge – Full discharge to the Manawatū River at Totara Road with enhanced treatment	(b) 100% discharge to river with enhanced treatment	-1.6	Red	Fundamentally unacceptable to hapū
	(b-2) 100% discharge to river with 75% discharge to land during dry water flow with enhanced treatment.	-1.6	Red	Fundamentally unacceptable to hapū
Option 2: Full River discharge (two locations), with low flow land discharge (Dual L+R**)** – Full discharge to Manawatū River at two locations (Totara Road in high flow and below Oroua confluence in medium flow), with discharge to land in low flow	(a) Full discharge to Manawatū River at Totara Road in high flow; full discharge to Manawatū River below Oroua confluence in medium flow; full discharge to land in low flow.	-1.6	Red	Fundamentally unacceptable to hapū
	(b) Same as (a) but only 75% discharge to land in low flow (to keep wetlands alive).	-1.6	Red	Fundamentally unacceptable to hapū
Option 3: Combined land and river discharge (L+R) – Combined discharge to land and Manawatū River, with discharge to land 97% of the time and discharge to river at Totara Road only in very high flow	(a) Treated WW applied to land 97% of the time, with discharges to the Manawatū River at Totara Road 3% of the time (11 days of highest discharge when river also expected to be high). Land discharge will be inland, fluvial soils.	-1	Orange	Currently unacceptable to hapū
	(b) Same as (a) but land discharge to coastal, sand country soils. Additional treatment also required compared to fluvial soils as there is less uptake of nutrients by forestry on sand country, and leaching needs to be managed	-1.4	Red	Fundamentally unacceptable to hapū

Option	Variant	Total score	Colour code	Conclusion
<u>Option 4:</u> Combined land and river discharge (L+R) – Combined discharge to land and Manawatū River at Totara Road, with discharge to land in low or medium to low flow (43-54% of the time).	(d-1) Treated WW discharged to land when Manawatū River less than 80m^3/s (approx. 53% of the time), with discharge to River when >80m^3/s and highest 3% of days by WWTP flow. Land discharge will be inland, fluvial soils	-1	Orange	Currently unacceptable to hapū
	(d-2) Treated WW discharged to land (fluvial) when Manawatū River less than 62m^3/s (approx. 43% of the time), with discharge to River when >62m^3/s and highest 3% of days by WWTP flow. Land discharge will be inland, fluvial soils	-1	Orange	Currently unacceptable to hapū
	(e-1) Same as d-1 but land discharge to coastal, sand country soils	-1.4	Red	Fundamentally unacceptable to hapū
	(e-2) Same as d-2 but land discharge to coastal, sand country soils	-1.4	Red	Fundamentally unacceptable to hapū
<u>Option 5:</u> Full discharge to ocean	Full discharge to ocean	-2	Red	Fundamentally unacceptable to hapū

FULL ASSESSMENT OF EACH SHORT-LIST OPTION:

Option 1: **Full River discharge** – Full discharge to the Manawatū River at Totara Road with enhanced treatment.

Variant	Values assessment	Score (-2 to +2)	Explanation and conclusion
(b) 100% discharge to river with enhanced treatment.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the awa and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-2	As the kai pupuri mouri for the lower reaches of the awa this plan offers no solutions to the cumulative impacts
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-2	Fails to provide for environmental resilience or addresses the loss through time, and nutrient deficiencies of waters.
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1.6**	**Fundamentally unacceptable to hapū**
(b-2) 100% discharge to river with 75% discharge to land during dry water flow with enhanced treatment.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the awa
	Te Kai Pupuru Mouri	-2	As the kai pupuri mouri for the lower reaches of the awa this plan offers no solutions to the cumulative impacts
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-2	Fails to provide for environmental resilience or addresses the loss through time, and nutrient deficiencies of waters

Variant	Values assessment	Score (-2 to +2)	Explanation and conclusion
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score:	**-1.6**	**Fundamentally unacceptable to hapū**

Option 2: **Full River discharge (two locations), with low flow land discharge (Dual L+R)** – Full discharge to Manawatū River at two locations (Totara Road in high flow and below Oroua confluence in medium flow), with discharge to land in low flow.

Variant	Values assessment	Score (-2 to +2)	Explanation and conclusion
(a) Full discharge to Manawatū River at Totara Road in high flow; full discharge to Manawatū River below Oroua confluence in medium flow; full discharge to land in low flow.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the awa and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-2	As the kai pupuri mouri for the lower reaches of the awa this plan offers no solutions to the cumulative impacts
	Hapai O	-1	Unsatisfactory level of treatment to enable the collection of kai
	Manawaroa	-2	Fails to provide for environmental resilience or addresses the loss through time, and nutrient deficiencies of waters.
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to enable the collection of kai
	Total score	**-1.6**	**Fundamentally unacceptable to hapū**
(b) Same as (a) but only 75% discharge to land in low flow (to keep wetlands alive).	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the awa and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-2	As the kai pupuri mouri for the lower reaches of the awa this plan offers no solutions to the cumulative impacts

Variant	Values assessment	Score (-2 to +2)	Explanation and conclusion
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-2	Fails to provide for environmental resilience or addresses the loss through time, and nutrient deficiencies of waters.
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1.6**	**Fundamentally unacceptable to hapū**

Option 3: **Combined land and river discharge (L+R) – Combined discharge to land and Manawatū River**, with discharge to land 97% of the time and discharge to river at Totara Road only in very high flow.

Variant	Values assessment	Score (-2 to +2)	
(a) Treated WW applied to land 97% of the time, with discharges to the Manawatū River at Totara Road 3% of the time (11 days of highest discharge when river also expected to be high). Land discharge will be inland, fluvial soils.	Whakapapa Atua, and Whakapapa Tupuna	-1	Provides limited avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	As the kai pupuri mouri for the lower reaches of the awa this option offers limited solutions to the cumulative impacts to the awa, noting that the awa will receive some discharge
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-1	Fails to adequately address the loss over time, or build resilience of the awa by allowing some discharge to the awa to remain
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai

Variant	Values assessment	Score (-2 to +2)	
	Total score	**-1**	**Currently unacceptable to hapū**
(b) Same as (a) but land discharge to coastal, sand country soils. Additional treatment also required compared to fluvial soils as there is less uptake of nutrients by forestry on sand country, and leaching needs to be managed.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the moana and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	This option offers limited solutions to the cumulative impacts to the awa and moana, noting that the awa and moana will receive some discharge from sandy soils
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-2	Fails to address the loss over time, or build resilience of the awa and moana as some discharge to the wai will remain as seen with other discharges on sand country
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1.4**	**Fundamentally unacceptable to hapū**

Option 4: **Combined land and river discharge (L+R)** – Combined discharge to land and Manawatū River at Totara Road, with discharge to land in low or medium to low flow (43-54% of the time).

Variant	Values assessment	Score (-2 to +2)	Why
(d-1) Treated WW discharged to land when Manawatū River less than 80m^3/s (approx. 53% of the time), with discharge to River when >80m^3/s and highest 3% of days by WWTP flow. Land discharge will be inland, fluvial soils.	Whakapapa Atua, and Whakapapa Tupuna	-1	Provides limited avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	As the kai pupuri mouri for the lower reaches of the awa this option offers limited solutions to the cumulative impacts to the awa, noting that the awa will receive some discharge
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-1	Fails to adequately address the loss over time, or build resilience of the awa by allowing some discharge to the awa to remain
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1**	**Currently unacceptable to hapū**
(d-2) Treated WW discharged to land (fluvial) when Manawatū River less than 62m^3/s (approx. 43% of the time), with discharge to River when >62m^3/s and highest 3% of days by WWTP flow. Land discharge will be inland, fluvial soils.	Whakapapa Atua, and Whakapapa Tupuna	-1	Provides limited avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	As the kai pupuri mouri for the lower reaches of the awa this option offers limited solutions to the cumulative impacts to the awa, noting that the awa will receive some discharge
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-1	Fails to adequately address the loss over time, or build resilience of the awa by allowing some discharge to the awa to remain

Variant	Values assessment	Score (-2 to +2)	Why
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1**	**Currently unacceptable to hapū**
(e-1) Same as d-1 but land discharge to coastal, sand country soils.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the moana and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	This option offers limited solutions to the cumulative impacts to the awa and moana, noting that the awa and moana will receive some discharge from sandy soils
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Manawaroa	-2	Fails to address the loss over time, or build resilience of the awa and moana as some discharge to the wai will remain as seen with other discharges on sand country
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1.4**	**Fundamentally unacceptable to hapū**
(e-2) Same as d-2 but land discharge to coastal, sand country soils.	Whakapapa Atua, and Whakapapa Tupuna	-2	Undermines the mana of the moana and provides no avenue for te mana o te iwi
	Te Kai Pupuru Mouri	-1	This option offers limited solutions to the cumulative impacts to the awa and moana, noting that the awa and moana will receive some discharge from sandy soils
	Hapai O	-1	Unsatisfactory level of treatment to encourage the collection of kai

Variant	Values assessment	Score (-2 to +2)	Why
	Manawaroa	-2	Fails to address the loss over time, or build resilience of the awa and moana as some discharge to the wai will remain as seen with other discharges on sand country
	He ringa miti tai heke	-1	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-1.4**	**Fundamentally unacceptable to hapū**

<u>Option 5:</u> **Full discharge to ocean**

Variant	Values assessment	Score (-2 to +2)	Why
(a) Full discharge to ocean	Whakapapa Atua, and Whakapapa Tupuna	-2	This is a considerable impact to whenua, waahi tapu and the moana
	Te Kai Pupuru Mouri	-2	As the kai pupuri mouri for the whenua, waahi tapu and coastal region this plan offers no solutions to the cumulative effects. A number of hapu are also MACA Claimants.
	Hapai O	-2	Unsatisfactory level of treatment to encourage the collection of kai within already at risk food species
	Manawaroa	-2	Fails to provide for environmental resilience or addresses the loss through time, and nutrient deficiencies of waters
	He ringa miti tai heke	-2	Unsatisfactory level of treatment to encourage the collection of kai
	Total score	**-2**	**Fundamentally unacceptable to hapū**

Palmerston North Wastewater
Best Practicable Option (BPO) Review

Stakeholder & Community Engagement Assessment

August 2021

Prepared for Palmerston North City Council by:

JUST ADD LIME

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
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Report Details

Prepared by:	Claire Wannamaker	30/07/2021
Checked by:	Melaina Voss/ Julie Boucher	4/08/2021
Reviewed by:	Julie Boucher/ Simpson Grierson	4/08/2021
Approved & Issued by:	Melaina Voss	5/08/2021

Executive Summary

This report has been prepared to assist Palmerston North City Council (PNCC) to identify preferred options as part of the final Wastewater Best Practicable Option (BPO) assessment. The report assesses community and stakeholder feedback using a methodology and scoring process consistent with that used for the other BPO assessments.

Engagement was carried out in line with the requirements of the LGA Resource Management Act processes and involved two rounds of public engagement – the first in June and July 2020 and the second in April and May 2021. Both rounds included a survey and round two invited written feedback.

Feedback has been analysed for each of the 11 shortlisted options and a score of 1 (least preferred) to 5 (most preferred) has been allocated. The basis for scoring is documented in the methodology section of this report.

Analysis of the feedback has identified a preference for option six (ocean), with less support for options 1(river) and 4 (land and river).

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APPENDICES

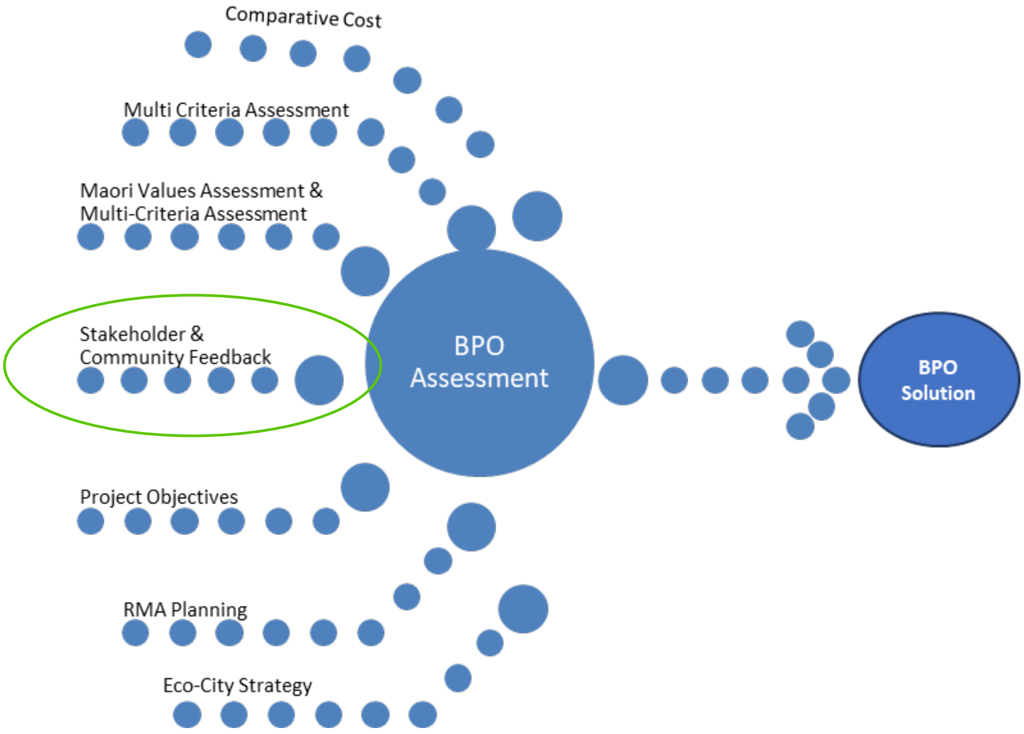
1 Introduction

1.1 Overview of Engagement and Feedback

This report documents the methodology and scoring of shortlist options for the stakeholder and community feedback element of Palmerston North City Council's Wastewater BPO assessment shown in Figure 1 below.

Engagement was carried out in line with the requirements of the LGA Resource Management Act. and involved engagement over two rounds with both the wider Palmerston North community and stakeholders.

Figure 1: Wastewater BPO assessment process



A full report on feedback received, demographics of respondents and options preferences can be found in the appendices to this report. A summary of the written submissions and analysis of stakeholders by industry and organisation type is also included in the report.

1.1.1 Assumptions and limitations

Assumptions and limitations recorded in the Engagement Feedback Summary Report apply to this report and assessment, with the addition of the following:

- BPO options included in the engagement process differed between the two rounds of engagement. Round one asked for feedback on five shortlist options, while round two sought feedback on three options. Although the full range of shortlist options were included in the round two engagement material no feedback was received on these. To enable comparison between the two rounds of engagement, the assessment methodology has sought to link feedback on the three options round two to the corresponding options in round one. For example, survey two option 1 (River with enhanced treatment) corresponds to survey one shortlist option 1 (R2).

- This assessment considers shortlist options as presented and does not address suggested changes or redesign of existing options submitted in the feedback.
- The feedback provided may not be representative of the Palmerston North population.
- Option 5 – discharge to groundwater – was found to be unfeasible and was removed from the shortlist after survey round one. Feedback related to this option has not been included in this assessment. Scores for survey round 1 have been standardised with the removal of 12% support for option 5 in survey round 1.
- Written submissions formed part of round two engagement and have been included in the scoring and weighting assessment.
- Neither survey asked participants if they directly opposed any option(s). Although participants were able to rank an option as "least preferred" in survey one, this does not imply opposition. Opposition to options is not a factor in assessment scoring.
- It is assumed that the additional information provided in response to requests from submitters between the two rounds of engagement has resulted in more informed participant engagement during the second survey. For this reason, scores for survey one have been given a lower weighting(30%) and survey two higher (70%).

1.2 Shortlist Options

The following table lists the shortlist options as identified in round one and two. Further details of the shortlist options are provided in the Shortlist Options Summary Report, May 2021.

Table 1 Options Description

Option No.	Option Summary Description
1	R2(b) River discharge with Enhanced Treatment
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow
4	L+R (a) 97% of the time to Land (inland)
5	L+R (b) 97% of the time to Land (coastal)
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)
7	L+R (d-2) to Land <62m^3/s / 43% of the time to Land (inland)
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L
9	L+R (e-2) to Land <62m^3/s / 43% of the time to Land (coastal) TN = 35 mg/L
10	O+L / Ocean with Land (coastal)
11	Ocean discharge

2 Engagement

Engagement was carried out in line with the requirements of the LGA Resource Management Act. This involved engagement in two rounds with the Palmerston North community and stakeholders to gain feedback.

Opportunities to participate in both engagement rounds, complete both surveys and make written submissions were promoted to the public through community print and social media, council and related communication channels and community events.

Round 1: June – July 2020

- Feedback was collected through online and paper surveys.
- Feedback consisted of 1108 survey responses.

Round 2: April – May 2021

- Feedback was collected through online and paper surveys, written submissions and comments via social media
- Feedback consisted of 250 survey responses and 20 written submissions received during April and May 2021.
- Twenty written submissions were received during the 2021 consultation period including feedback forms, letters, and long form reports with appendices.

The following technical factsheets were developed to inform stakeholders and the community of the shortlist options and the development and assessment process:

2O19- 2020

- Our wastewater networks
- Wastewater treatment – best practice and innovation
- Palmerston North’s existing wastewater scheme
- Resource Management Act and the consent process
- Understanding the effects on the Manawatū River
- Best practicable options review: project background
- Best practicable options review: vision, objectives and timeline.

2020 - 2021

- Wastewater BPO Problem statement
- Wastewater systems and sustainability
- Wastewater BPO Shortlist options summary
- Wastewater BPO Shortlist feedback
- River health
- Ocean and coastal health
- Contaminants
- Treatment assessments.

In addition, brochures, posters and social media adverts were created and used to inform and educate the public about the shortlist options and promote both engagement rounds.

3 Methodology for this Assessment

3.1 Classification Process

This section documents the levels of support among engagement participants for shortlist options during both round one and round two engagement, and the rationale for assigning a score for each. A combined overall score has been assigned based on the combined survey responses and written submissions. Table 2 summarises the shortlist options and the descriptions and names used in each engagement round. It is understood that PNCC assessed Option 5 (discharge to groundwater) not to be feasible, and so was removed from consideration after round one of the engagement.

Table 2: Survey 1 and 2 shortlist options

Option number	Shortlist option	Description	Survey 1 name	Survey 2 name
1	Option 1: R2	R2(b) River discharge with enhanced treatment	Option 1	River with enhanced treatment
2		R2(b-2) 75% ADWF to land / river discharge with enhanced treatment	Option 1	River with enhanced treatment
3	Option 2: Dual R + L	Dual R+L(b) 75% of the time application to land / two river discharge points	Option 2	Not applicable
4	Option 3: L+R (a) & (b)	L+R(a) 97% of the time to land (inland)	Option 3	Not applicable
5		L+R(b) 97% of the time to land (coastal)	Option 3	Not applicable
6	Option 4: L + R (d) & (e)	L+R(d-1) to land <80m3/s / 53% of the time to land (inland)	Option 4	Land 55% / River 45%
7		L+R(d-2) to land <62m3/s / 43% of the time to land (inland)	Option 4	Land 55% / River 45%
8		L+R(e-1) to land <80m3/s / 53% of the time to land (coastal)	Option 4	Land 55% / River 45%
9		L+R(e-2) to land <62m3/s / 43% of the time to land (coastal)	Option 4	Land 55% / River 45%
10	Option 6: Ocean	O+L ocean with land (assume coastal)	Option 6	Ocean
11		Ocean discharge only / ocean	Option 6	Ocean

The following steps were followed in completing the assessment and scoring:

1. Report findings for the two surveys in the Engagement Feedback Report were reviewed and the percentage of respondents who preferred each option collated. Written submissions which were part of engagement round two were combined with survey results for round two.
2. Scoring criteria was adapted from that used for the other BPO comparative assessments with support level scores 1 - 5 defined to align with other comparative assessments i.e. Level 1 was defined as indicating a low level of support (<20%) and level 5 reflecting high levels of support (>50%). Specific definitions for each scoring level are shown in Table 3 below.
3. The response preferences as a percentage of total responses for each option in each engagement round were entered into Table 4, the assessment table.
4. Weightings were applied with more weight given to round two of engagement based on the assumption that participants had acquired greater understanding of the options and so were able to provide more informed feedback. Round one results were assigned a 30% weighting and round two results were assigned a 70% weighting.
5. Weighted preferences expressed as a percentage were combined to provide an overall preference percentage for the two engagement rounds.
6. For each option, a support level score was assigned based on the weighted percentage of preferences.

3.2 Scoring

Table 3 outlines the levels of support ranging from 1 to 5 and the classification criterion for each level.

Table 3: Public support scoring criterion

Description	Level
Little or no support based on feedback from the public (<20%) of feedback identified as most preferred)	1
Feedback doesn't provide a clear indication of support (20 – 30%) feedback identified as most preferred)	2
Feedback indicates some support (30 - 40%)	3
Moderate level of support based on feedback from the public (40 -50%)	4
High level of support based on feedback from the public (>50% of feedback identified as most preferred)	5

4 Analysis

Table 4 shows the original percentage scores of support for each option from survey one and survey two, and the weighted scores for each survey. As described in the methodology, both weighted scores were combined and the support level was assigned from Table 3.

Table 4: Assessment table

	Unweighted option preference %		Weighted option preference %		Combined weighted preferences (%) and Support level scores	
Shortlist Option	**Round 1***	**Round 2**	**Round 1 (30%)**	**Round 2 (70%)**	**Combined % (rounded)**	**Support level Score**
1	32	28	10	20	29	2
2	19	0	6	0	6	1
3	32	0	10	0	10	1
4	9	25	3	18	20	2
6	8	47	2	33	35	3

*Percentage scores from Round 1 have been standardised on the basis that Option 5 was not considered in Round 2. Therefore the original score was divided by .88 to standardise percentages after the removal of 12% for Option 5, which was found to be unfeasible and is not included in this assessment.

5 Assessment & Scoring

Table 5 summarises the shortlist option and descriptions as described in engagement round one. The final combined weighted preferences by percentage, along with the applicable support level score are shown in the far right column.

Table 5: Detailed option description and scoring

Option number	Shortlist Option	Description	Weighted score
1	Option 1: R2	R2(b) River discharge with enhanced treatment	2 29%
2		R2 (b-2) 75% ADWF to land / river discharge with enhanced treatment	2 29%
3	Option 2: Dual R + L	Dual R+L (b) 75% of the time application to land / two river discharge points	1 6%
4	Option 3: L+R (a) & (b)	L+R(a) 97% of the time to land (inland)	1 10%
5		L+R(b) 97% of the time to land (coastal)	1 10%
6	Option 4: L + R (d) & (e)	L+R(d-1) to land <80m3/s / 53% of the time to land (inland)	2 20%
7		L+R(d-2) to land <62m3/s / 43% of the time to land (inland)	2 20%
8		L+R(e-1) to land <80m3/s / 53% of the time to land (coastal)	2 20%
9		L+R(e-2) to land <62m3/s / 43% of the time to land (coastal)	2 20%
10	Option 6: Ocean	O+L ocean with land (assume coastal)	3 35%
11		Ocean discharge only / ocean	3 35%

6 Recommendations

6.1 Options ranking

Table 7 below shows the ranked order of options based on the assessment and the support levels scoring. Where options were given the same score they have been given an equivalent rank order.

Table 6: Options ranking

Option Description		Ranking
1	R2(b) River discharge with Enhanced Treatment	3
2	R2(b) River discharge with Enhanced Treatment, 75% ADWF to land at low River flow	3
3	Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow	11
4	L+R (a) 97% of the time to Land (inland)	9
5	L+R (b) 97% of the time to Land (coastal)	10
6	L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)	5
7	L+R (d-2) to Land <62m³/s / 43% of the time to Land (inland)	5
8	L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35 mg/L	5
9	L+R (e-2) to Land <62m³/s / 43% of the time to Land (coastal) TN = 35 mg/L	5
10	O+L / Ocean with Land (coastal)	1
11	Ocean discharge	1

6.2 Summary

Overall there was not strong support for any one of the survey options:

- The ocean discharge option (Option 6) received the highest level of support at 35% (weighted score).
- Options proposing a combination of land and river (options 2, 3 and 4) discharge received the lowest overall support.
- Of the combination land and river options, option 4 which proposed 45 – 55% splits between land and river discharge received the most support.
- The river discharge option (option 1) received some support.
- The ocean discharge option (option 6) also received some support.

Appendix 1:

Engagement Feedback Summary Report

Palmerston North City Council

Wastewater BPO

Engagement Feedback Report

June 2021

Contents

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Appendices

1. Introduction

Palmerston North City Council is investigating options for a new wastewater system using a Best Practicable Option (BPO) process. A range of options were developed, and longlist and shortlist option processes involving technical investigations, multi-criteria analysis and iwi engagement have been completed. Two public consultation periods have been held as part of this process to determine preferred options and the values and priorities held by the Palmerston North community with regard to wastewater discharge. Both consultations offered a survey for the public to submit online, or on paper through engagement events. Public consultation was supported by factsheets, brochures, and multimedia resources. More information about the engagement and the engagement materials for this project can be found on the Nature Calls website https://www.pncc.govt.nz/naturecalls.

1.1. Purpose and structure of this report

The purpose of this report is to summarise feedback received during two consultation periods:

June – July 2020

- Feedback was collected through online and paper surveys.

April – May 2021

- Feedback was collected through online and paper surveys, written submissions and comments via comments.

The report first summarises the feedback received through surveys, presenting demographic information, preferred options and analysis and values for both surveys to provide a snapshot of each survey and enable comparisons of how demographics, preferences, and values have changed between the two consultation periods and associated options. Second, written submissions are summarised with demographic information, option preferences and values described where possible.

In addition, feedback received through the online engagement platform social pinpoint is included although this feedback option had very low uptake.

An overall summary is provided to conclude the report.

1.2. Limitations and assumptions

In the analysis of feedback and development of this report the following limitations have been identified.

- The demographics of two surveys are not directly comparable, as there were key differences including differences in questions about gender, tangata whenua identification, and home ownership between survey 1 and survey 2.
- Option preferences are not directly comparable – at the time of survey 1 there were six options being consulted on, at the time of survey 2 that number had been reduced to three.
- Rankings and preferences of values and options are not directly comparable between the two surveys. Survey 1 asked participants to rank values, Survey 2 asked them to rank options.
- For the purposes of this report, the written submissions have been summarised in a way that enables consideration alongside the surveys. This does not capture the range and complexity of information and feedback provided in the submissions nor recommendations made in them.
- The low number of written submissions means that the summary should not be considered representative of any demographic group or of the population of Palmerston North.

This report reflects the identity, preferences, values and views of individuals and organisations that participated in the two consultation periods. These may not reflect or be representative of the Palmerston North population.

2. Survey demographics

2.1. Age groups

Overall there was a significantly higher participation rate in survey 1 compared to survey 2 with over 4 times the number of respondents to survey 1.

Figure 1 shows survey 1 and survey 2 both yielded a high proportion of participants in the 61 years + age group, and low participation rates from the under 18 age group. While survey one had roughly even participation from the middle range age groups, survey two shows consistently increasing participation as age groups increase.

Figure 1: Survey respondents by age group

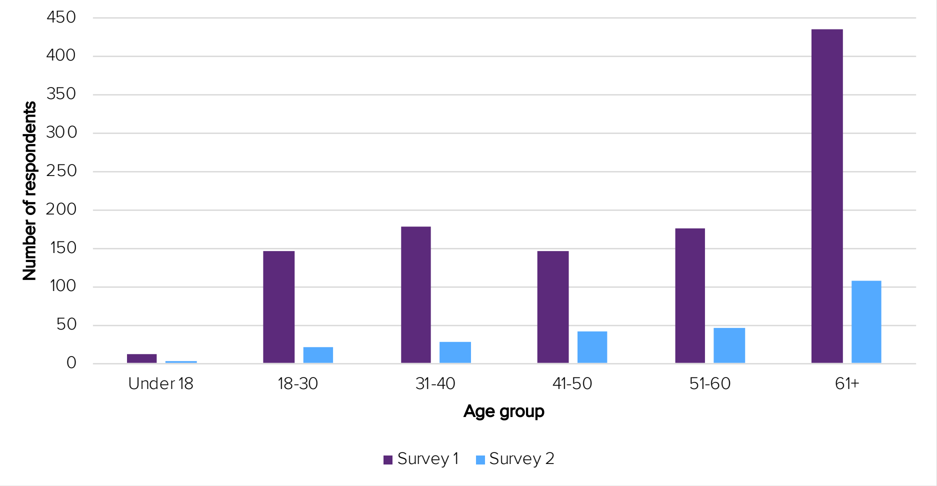
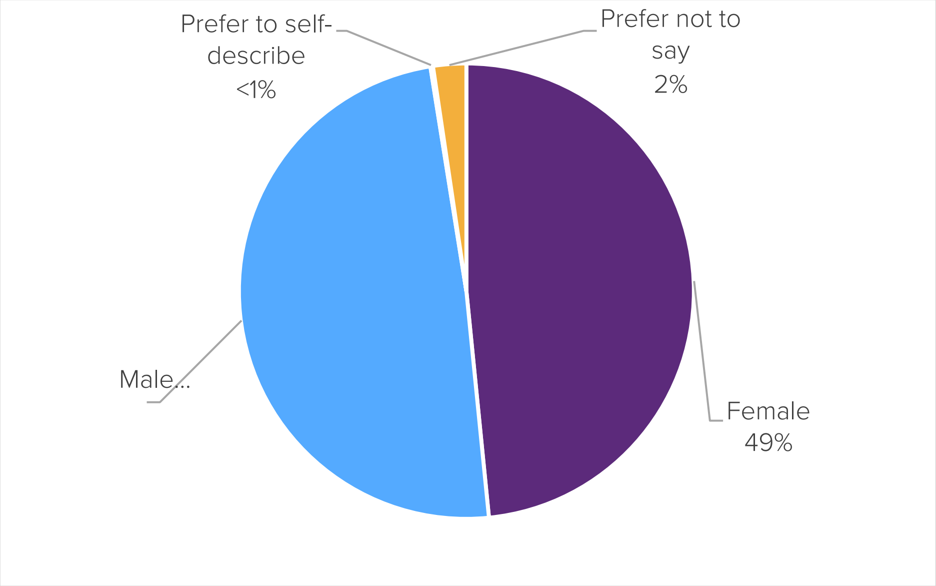


Figure 2: Gender



2.2. Gender

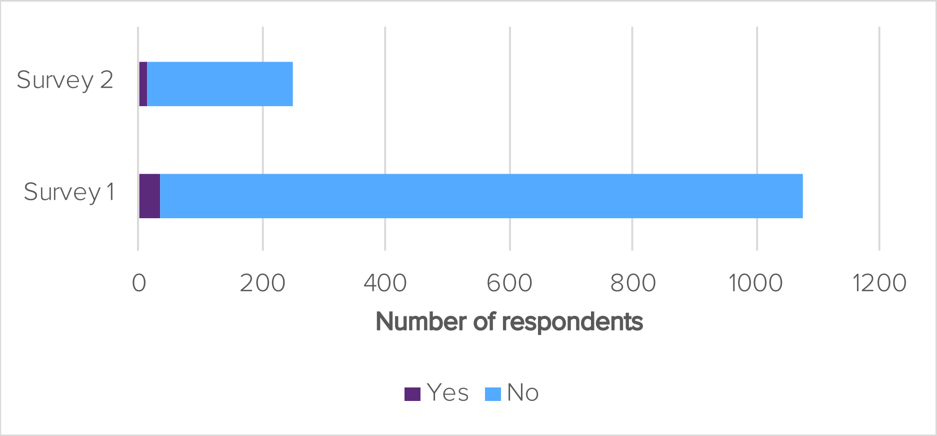
Gender identification was asked in survey 1, but not survey 2.

Participants in survey 1 were given options to self-describe or not state a gender, along with male and female options. Figure 2 shows that participation was split evenly between males and females with 2% opting not to state their gender.

2.3. Tangata whenua affiliation

Both surveys show a small percentage of participation by those who identify as tangata whenua with higher representation in survey 2.

Figure 3: Tangata whenua affiliation



2.4. Residential and business respondents

In order to understand whether respondents were business owners or not survey 1 asked participants to identify whether they were a business owner in Palmerston North. Survey 1 also asked people to identify as home owners. It can be expected that some respondents may have been both business owners and home owners. Survey 2 did not include a question about home ownership.

Figure 4: Business respondents

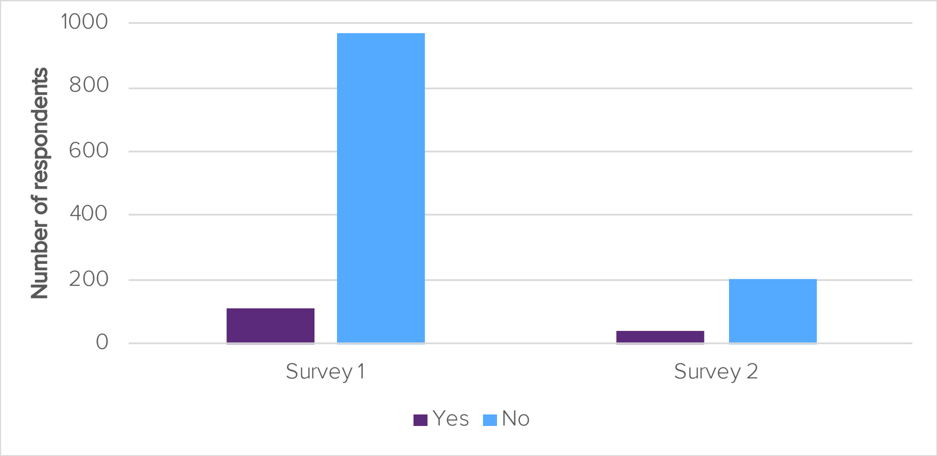
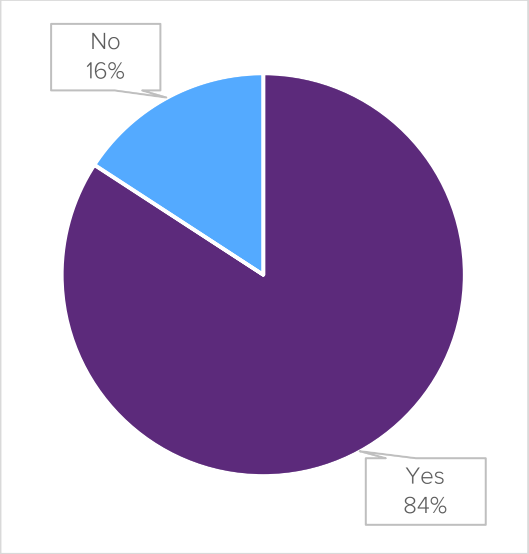


Figure 5: Home owner respondents survey 1



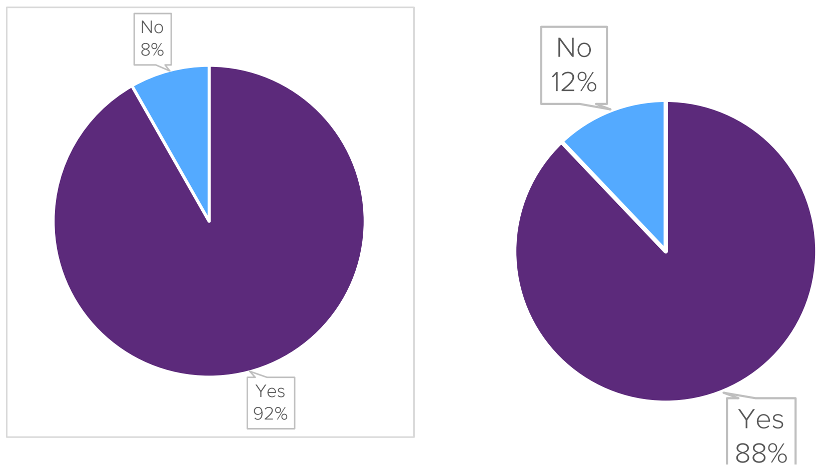
Both surveys show a similar proportion of business owners participating, with survey 2 having a higher rate of business owner participation compared with non-business owners.

2.5. Where people live

2.5.1. Place of residence

Survey 1 asked participants where they live and provided options of Palmerston North, Horowhenua, Manawatu and other. All answers for survey 1 except Palmerston North have been classified as “no” to enable comparison with survey 2 which asked participants if they live in Palmerston North and did not provide other options.

Figure 6: Respondents living in Palmerston North



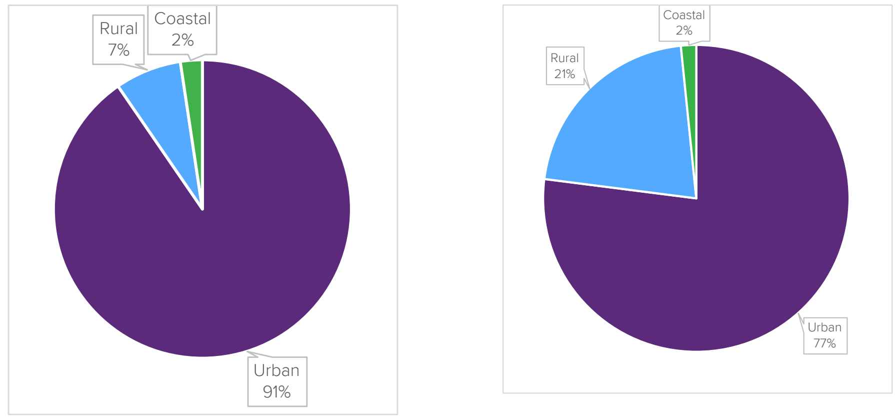
Survey 1

Survey 2

2.5.2. Environment of residence

Both surveys provided participants with options of urban, rural and coastal to describe the environment of their residence. While survey 1 respondents are overwhelmingly urban, a greater proportion of rural residents participated in survey 2. Representation of coastal residents is consistent at 2%.

Figure 7: Environment people live in



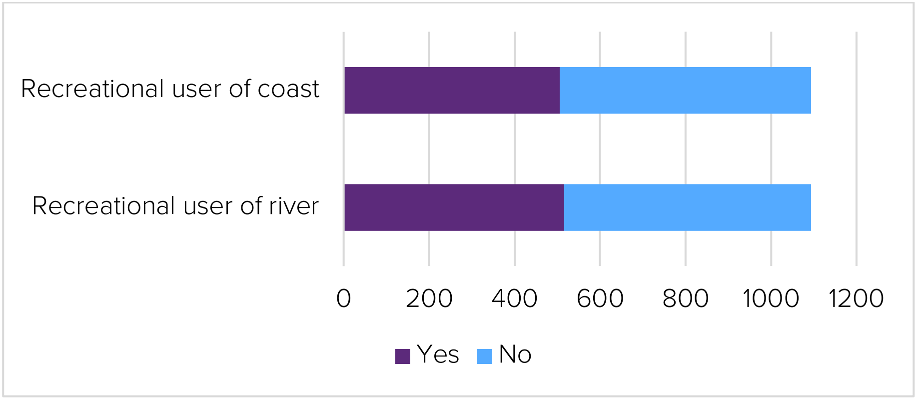
Survey 1

Survey 2

2.5.3. Recreational users of river and coast

Survey 1 asked respondents if they are regular recreational users of the Manawatū River or coast. Just under half of participants identified as regular users of the river and/or the coast.

Figure 8: Recreational users of river and coast - survey 1



3. Survey results – all options

This section presents the preferred options for survey 1 and survey 2. At the time of survey 1 there were six shortlist options, all included in the survey. By April 2021, the time of survey 2, this shortlist had been further reduced to three options. This section reports on the three survey 2 options, and the survey 1 options that correspond to those. The options from the shortlist in survey one that did not progress have not been included except in Figure 9 where a full summary of results for survey 1 options is provided.

Table 1: Options common between survey 1 and survey 2

Option	Survey 1 (June 2020)	Survey 2 (April – June 2021)
River Option	Option 1: River	Option 1: River
Land and River Option	Option 4: Land & River 45-55%	Option 2: Land & River 45-55%
Ocean Option	Option 6: Ocean	Option 3: Ocean

Figure 9: Options preference (all options) survey 1

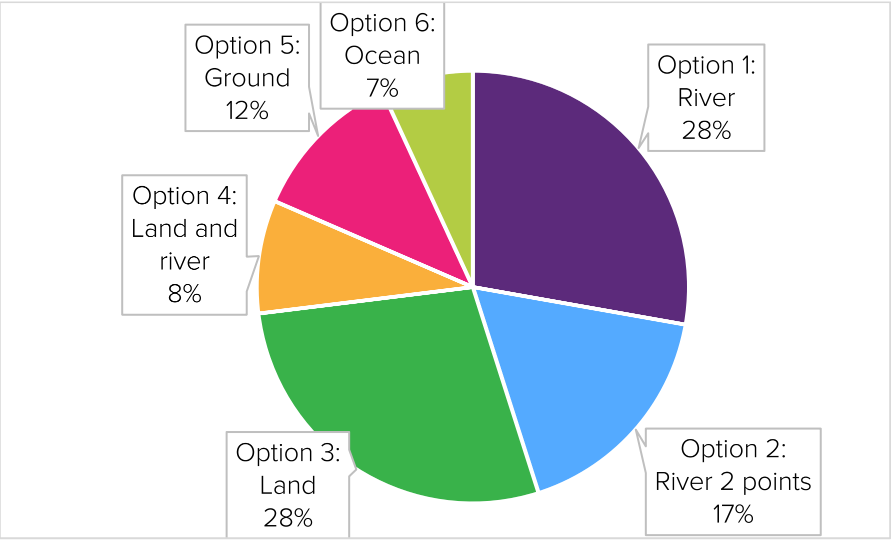
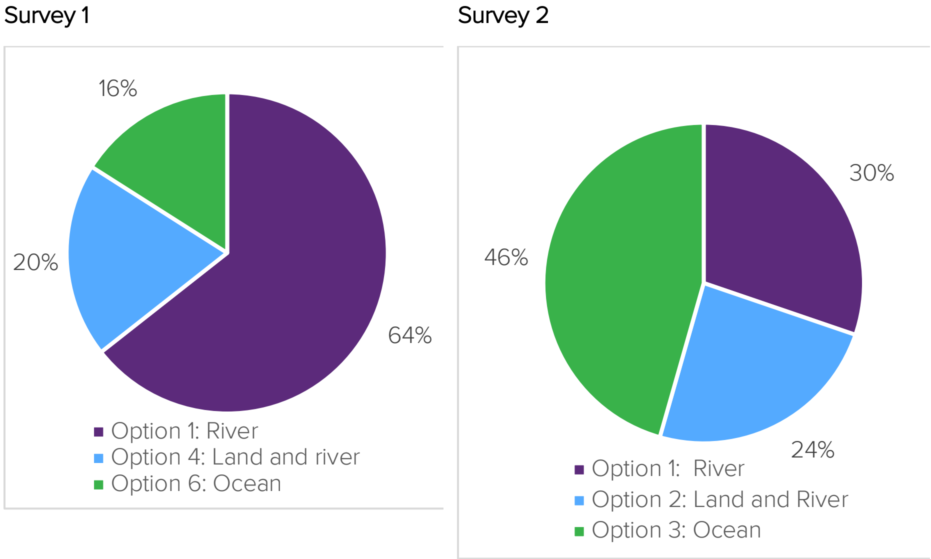


Figure 10: All respondents preferred option



Error! Not a valid bookmark self-reference. and **Error! Reference source not found.** show a significant change in support for river and ocean options while the popularity of land and river options has remained consistent. Support for discharge to the ocean has more than doubled, while support for discharge to the Manawatū River has more than halved.

Survey 1 asked respondents to rank the six options from most preferred to least preferred, and for the purposes of this report, the options ranked first and second have been counted as preferred options. Survey 2 asked participants to identify their one preferred option of the three being consulted on.

4. Survey results - river options

4.1. Preference by age and gender

Among those who prefer the discharge to river options, there is little change between the two survey periods in age group representation, which is consistent with overall survey participation for both surveys. One small change is a decrease in support from the 61+ age group and an increase from the 51 – 60 age group.

Figure 11: Preference by age group – river options

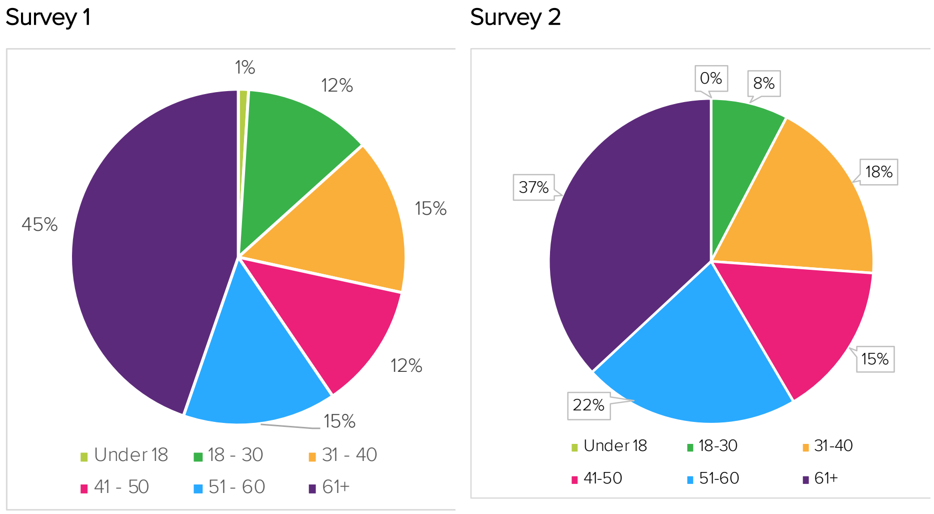
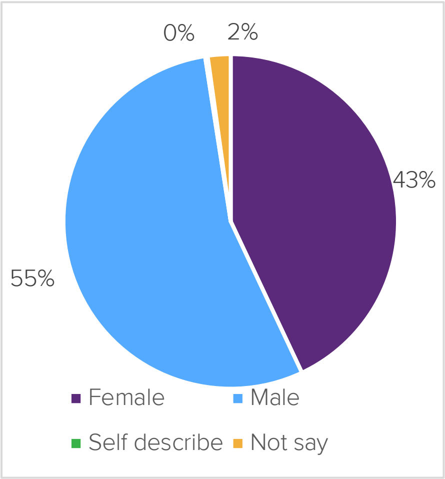


Figure 12: Preference by gender – river options

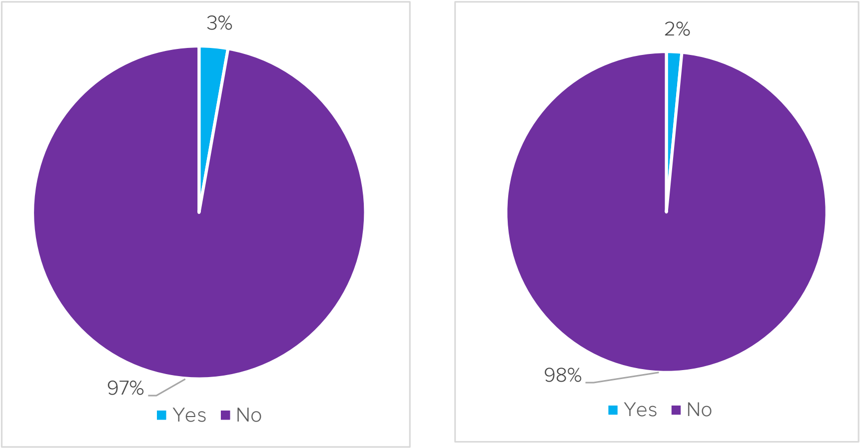


Survey 1 asked participants to identify their gender and the results for the river only option skew towards males compared with the gender representation of all participants.

4.2. Preference by tangata whenua

Support for discharge to river options has remained consistent from those who identify as Tangata Whenua.

Figure 13: Preference by tangata whenua – river options



Survey 1

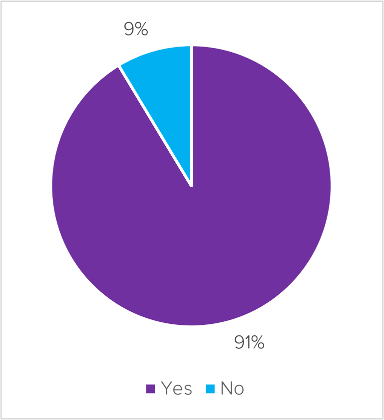
Survey 2

4.3. Preference by home and business owners

With 91% support from home owners, the rivers option has slightly higher support than the 84% baseline of respondents for all options.

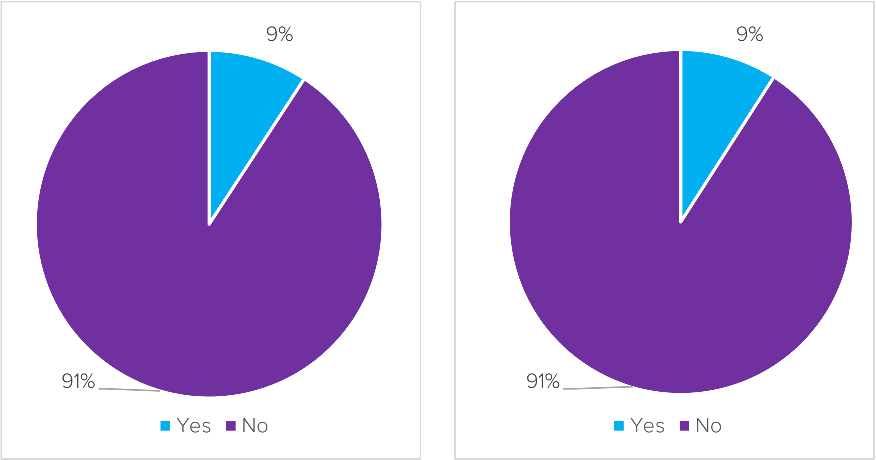
Survey 2 did not include a question about home ownership.

Figure 14: Preference by home owners – river options



Support from business owners for options proposing discharge to river has remained consistent.

Figure 15: Preference by business owners – river options



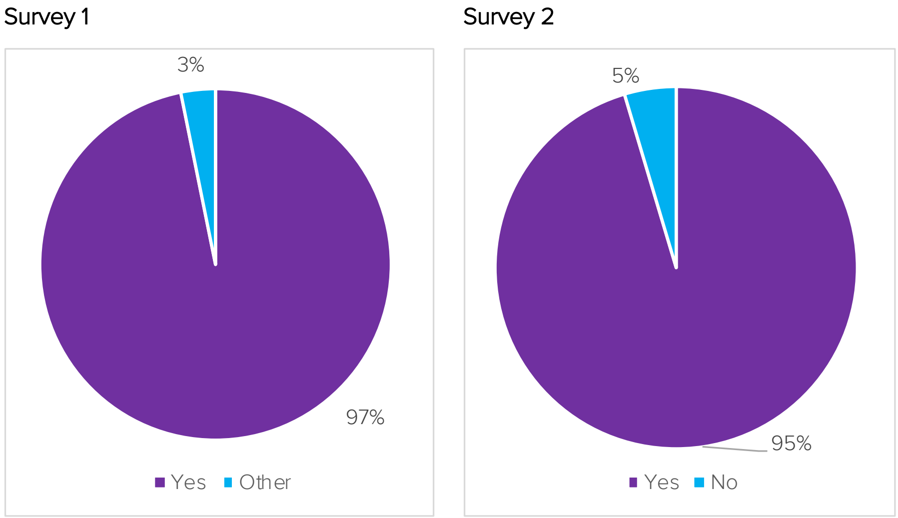
Survey 1

Survey 2

4.4. Preference by place of residence

92% and 88% participation by Palmerston North residents for survey 1 and survey 2 respectively indicates a higher rate of support from Palmerston North residents for river options.

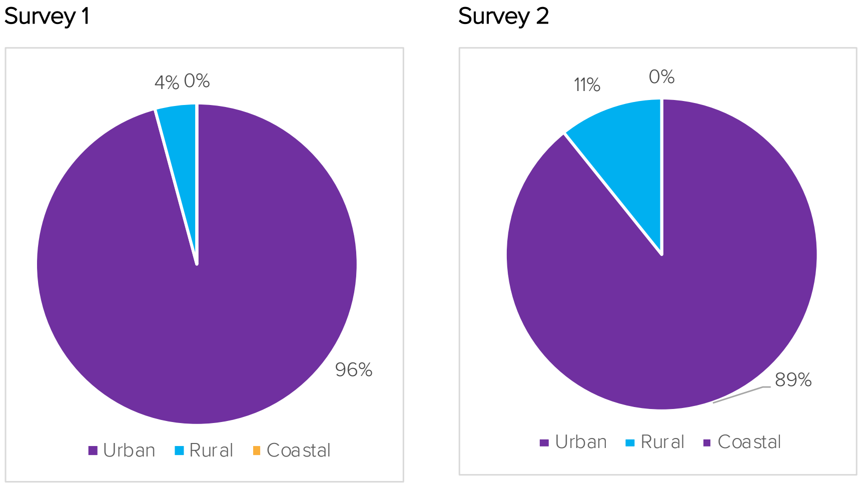
Figure 16: Preference by place of residence – river options



4.5. Preference by environment of residence

The level of support for discharge to river options has reduced among those who live in an urban environment and increased among those who live in a rural environment between the two survey periods. Even though the level of support from urban residents has decreased, it is higher than their proportional participation in both surveys, and even though the level of support from rural residents has increased, it is lower than their proportional participation in both surveys, indicating higher overall support from urban residents and lower support from rural residents. There was little to no support for the river options from coastal dwellers.

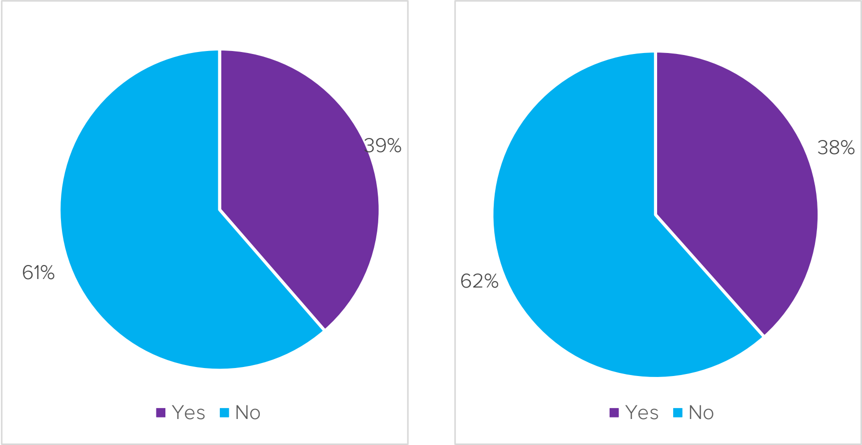
Figure 17: Preference by environment of residence – river options



4.6. Preference by recreational users of river and coast

Survey 1 asked respondents if they are regular recreational users of the Manawatū River and of the coast. Of the supporters for option 1 – discharge to river - 39% are regular river users and 38% are regular coast users.

Figure 18: Preference by recreational users – river options


Survey 1

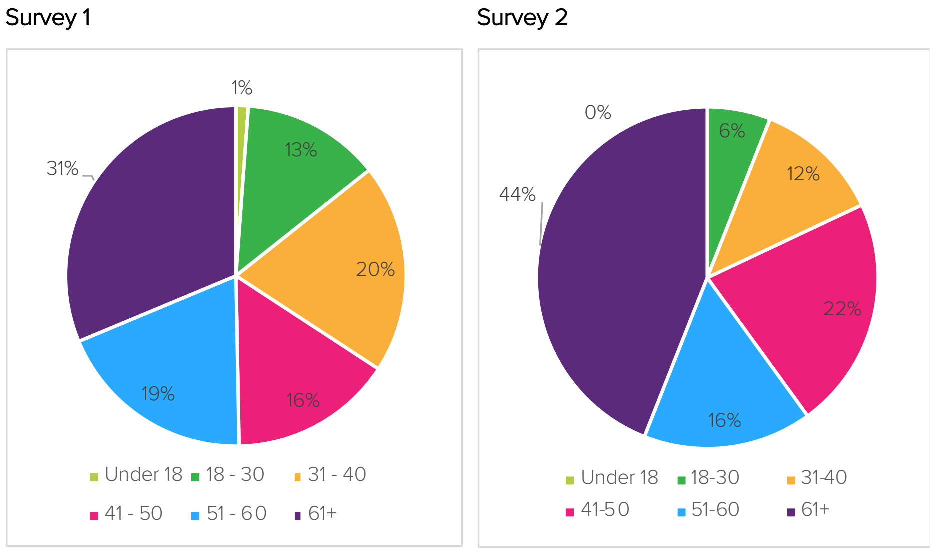
Survey 2

5. Survey results - land and river options

5.1. Preference by age and gender

Participants who support discharge to both land and river have consistent representation across age groups between the two surveys, with a slight increase in support from the 61+ and 41-50 year age group, and a slight decrease in support from age groups under 40 years.

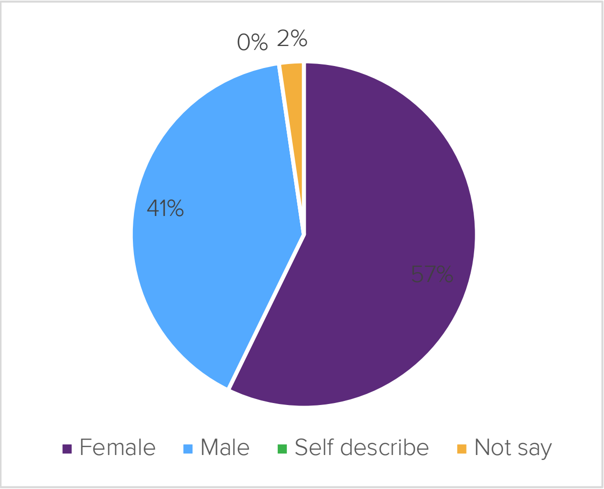
Figure 19: Preference by age group – land and river options


Survey 1

Survey 2

Survey 1 asked participants to identify their gender and the results for the land and river option skew towards females compared with the gender representation of all participants.

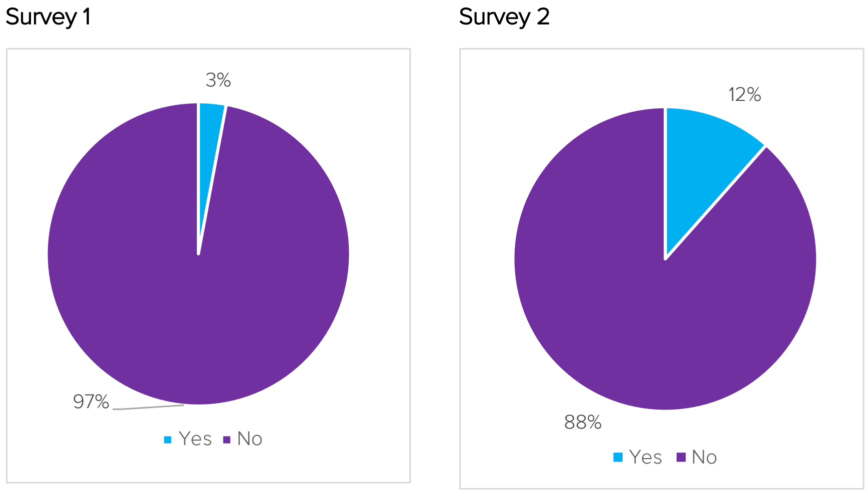
Figure 20: Preference by gender – land and river options



5.2. Preference by tangata whenua

Support for discharge to a balance of land and river has grown among those survey participants who identify as Tangata Whenua.

Figure 21: Preference by tangata whenua – land and river options

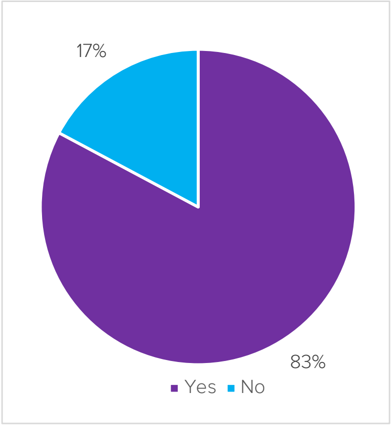


5.3. Preference by home and business owners

With 83% support from home owners, the land and river option a level of home owner support consistent with the survey 1 home owner participation rate of 84%.

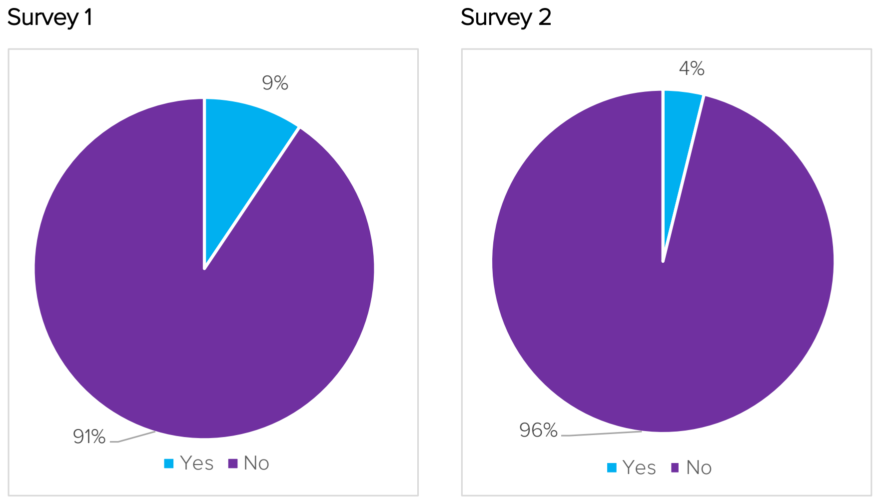
Survey 2 did not include a question about home ownership.

Figure 22: Preference by home owners – land and river options



Support from business owners for options proposing discharge to a balance of land and river has reduced slightly from survey 1 to survey 2.

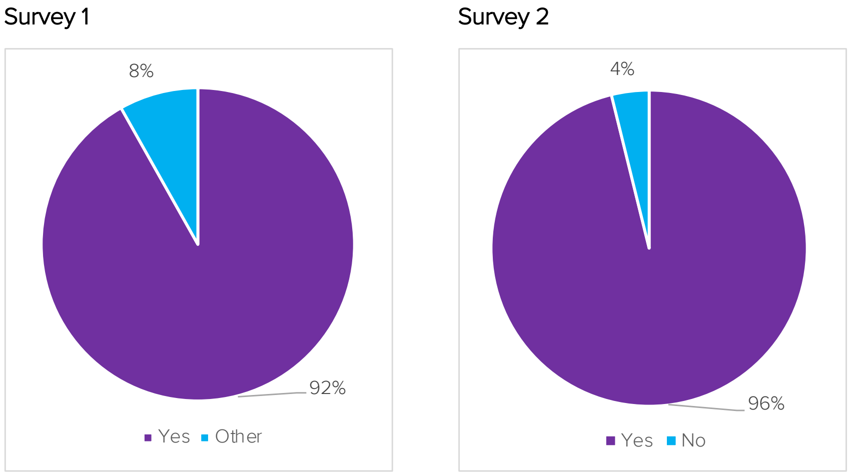
Figure 23: Preference by business owners – land and river options



5.4. Preference by place of residence

These results indicate support for a balance of discharge to land and river has grown among Palmerston North residents between the two survey periods.

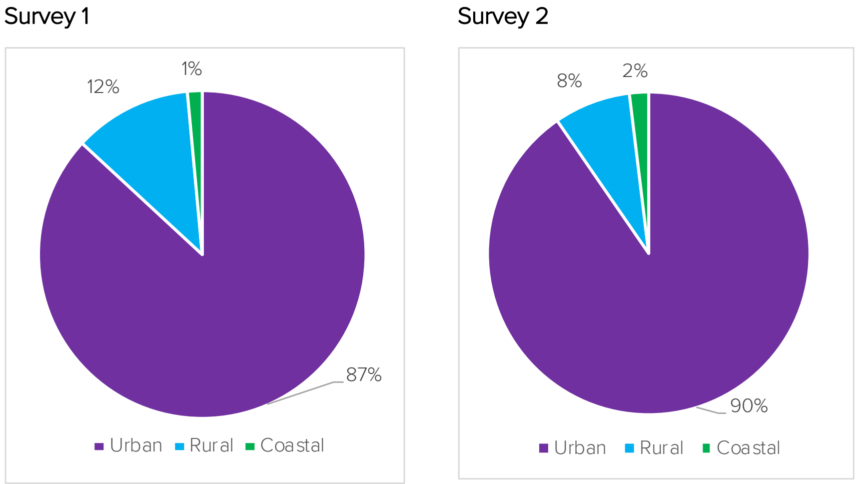
Figure 24: Preference buy place of residence – land and river options



5.5. Preference by environment of residence

Support for a combination of discharge to land and river options has significantly increased for urban dwellers given their participation rate in survey 2 (72%) was lower than survey one (91%). Although many more rural residents participated in survey 2 (21% compared with 7% for survey 1), their support level for land and river options has reduced between the two surveys.

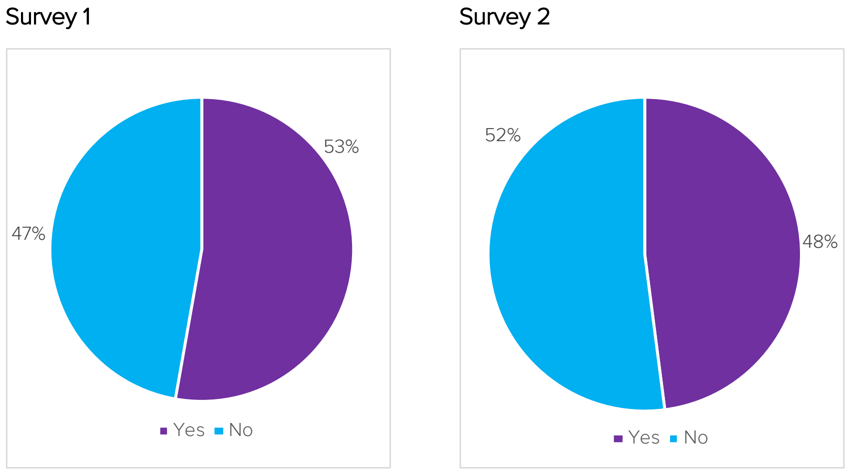
Figure 25: Preference by environment of residence – land and river options



5.6. Preference by recreational users of river and coast

Survey 1 asked respondents if they are regular recreational users of the Manawatū River and of the coast. Of the supporters for option 4 – discharge to land and river, 53% are regular river users and 48% are regular coast users.

Figure 26: Preference by recreational users – land and river options



6. Survey results - ocean options

6.1. Preference by age and gender

The 61+ age group shows a consistently high level of support for the ocean options, and support has grown within the 41-50 and 51-60 age groups and reduced in the 31-40 age group.

Figure 27: Preference by age group – ocean options

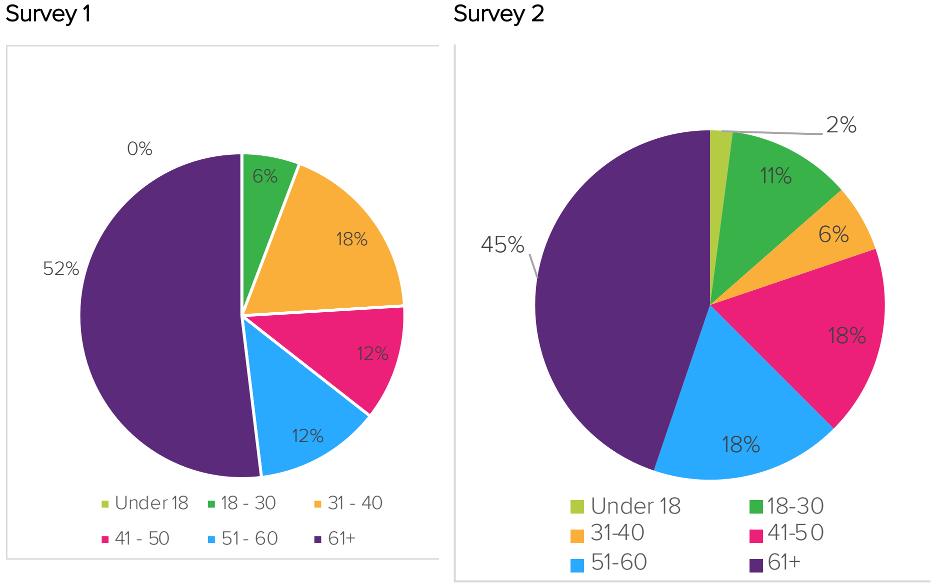
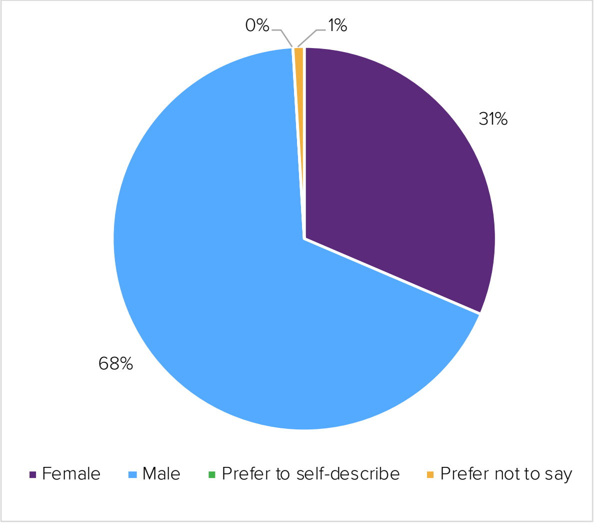


Figure 28: Preference by gender – ocean options

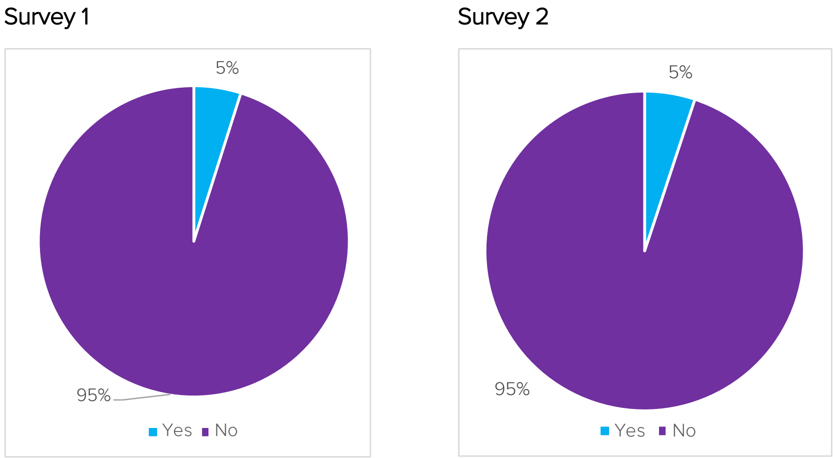


Survey 1 gender results for the ocean option indicate stronger support from males than any other gender group compared with overall gender representation in the survey.

6.2. Preference by tangata whenua

Support for discharge to the ocean has remained consistent at 5% from the survey respondents who identify as Tangata Whenua.

Figure 29: Preference by tangata whenua – ocean options

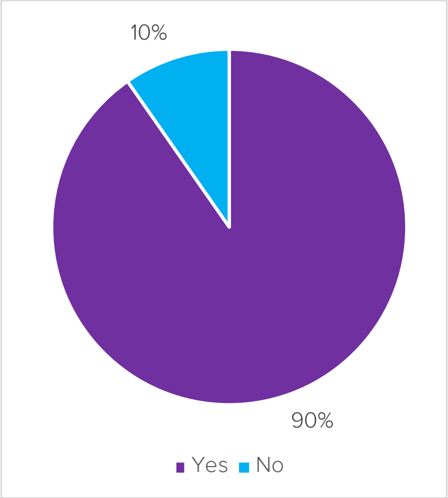


6.3. Preference by home and business owners

90% indicates a higher level of support than the survey participation rate of 83% for the discharge to Ocean option as presented in survey 1.

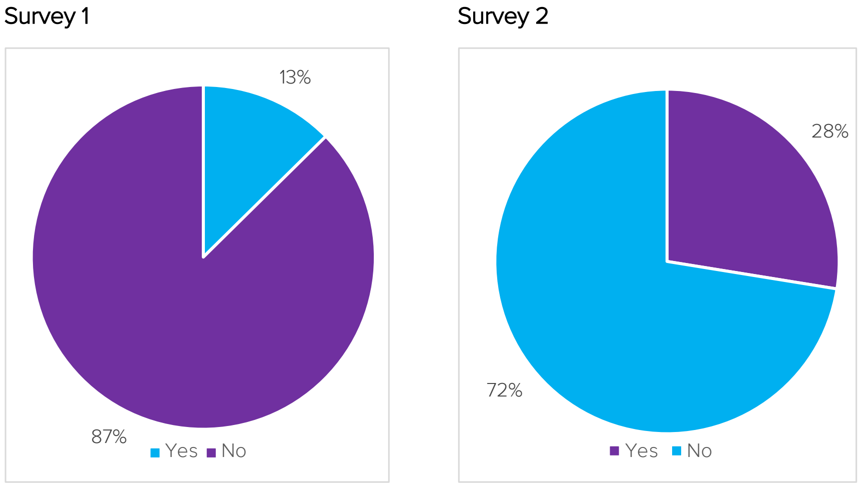
Survey 2 did not include a question about home ownership.

Figure 30: Preference by home owners – ocean options



There has been a significant increase in business owner support for discharge to ocean options between survey 1 and survey 2.

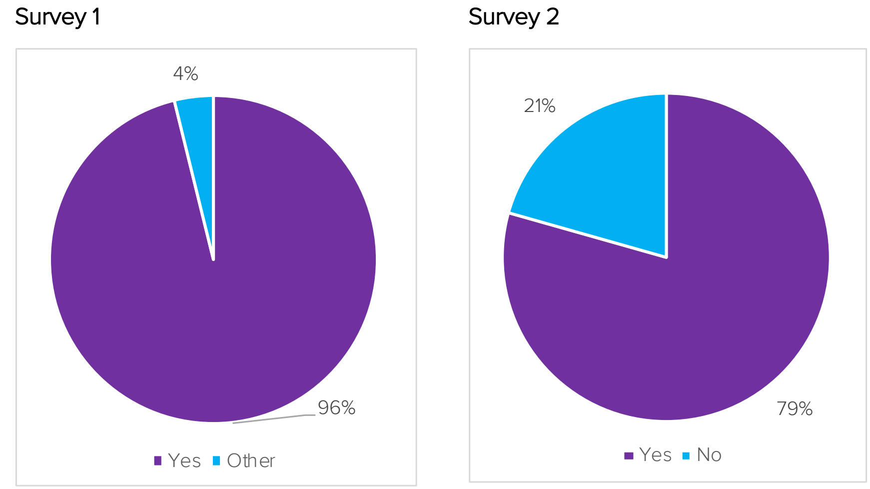
Figure 31: Preference by business owners – ocean options



6.4. Preference by place of residence

These results indicate that the residents of Palmerston North residents have reduced their level of support for discharge to ocean options between the two survey periods.

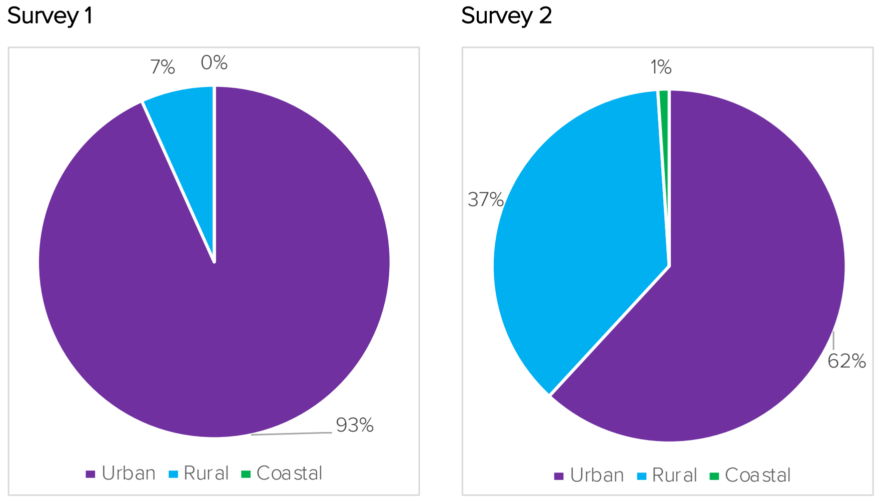
Figure 32: Preference buy place of residence – ocean options



6.5. Preference by environment of residence

Support for a options that propose discharge to the ocean has significantly decreased among urban dwellers and increased among rural dwellers between the two survey periods. Support from coastal residents has increased slightly.

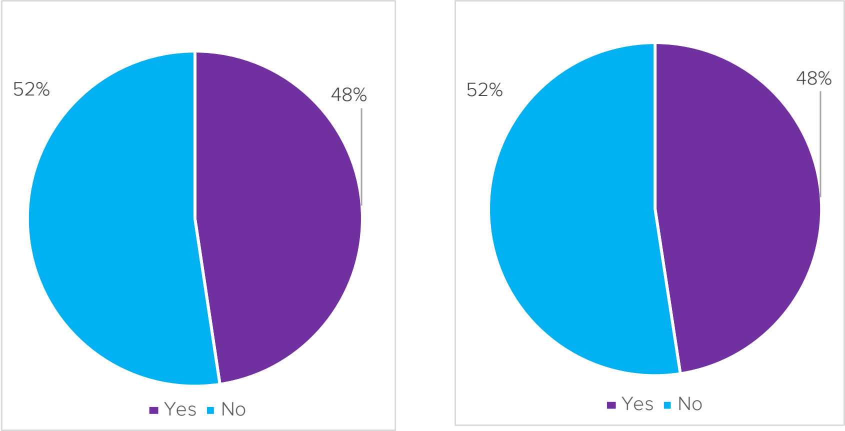
Figure 33: Preference by environment of residence – ocean options



6.6. Preference by recreational users of river and coast

Survey 1 asked respondents if they are regular recreational users of the Manawatū River and of the coast. Of the supporters for option 6 – discharge to the ocean, 48% are regular river users and 48% are regular coast users.

Figure 34: Preference by recreational users – ocean options


Survey 1

Survey 2

7. Survey results – values and outcomes

7.1. What people like about their preferred option

The two surveys provided different questions and possible responses for participants to indicate the values associated with and desired outcomes for their preferred option.

Survey 1 presented the question “Which option do you prefer and why?” and provided an open text field for responses. The content of the open text responses has been divided into groups for each option preferred and is presented in the following sections as word clouds. Word clouds are a visual tool to communicate the frequency words are used by font size. The bigger and bolder a word appears, the more often it has been used in answers. The words “outcome,” “option” and “water” have been removed from the word cloud to provide a clearer picture of feedback themes.

Survey 2 asked participants to rank the BPO outcomes from most important to least important. Participant rankings have been grouped by their preferred option and graphed to show how many people ranked each value first, second and third.

This section presents these findings for the river, land and river, and ocean options.

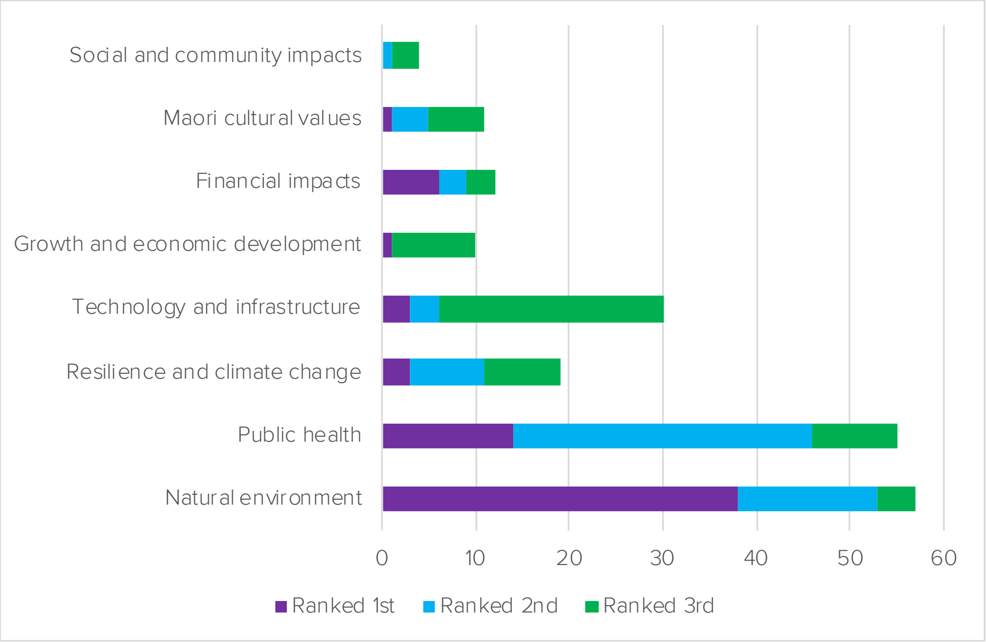
7.2. River Options

Figure 35 shows in a word cloud the reasons survey 1 participants who supported the river option gave for their choice.

Figure 35: Word Cloud Survey 1 Reasons for preferred river option

Error! Not a valid bookmark self-reference. shows how supporters of the river option ranked the eight BPO values presented in survey 2.

Figure 36: Survey 2 Value rankings by river option supporters



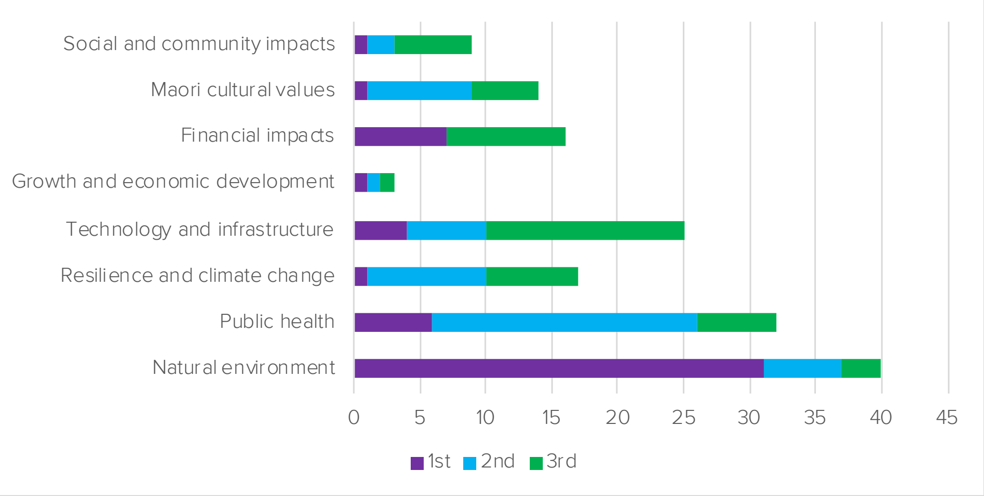
7.3. Land and River Options

Figure 37shows the reasons survey 1 participants who supported the land and river option gave for their choice.

Figure 37: Word Cloud Survey 1 Reasons for preferred land and river option

Figure 38 shows how supporters of the land and river option ranked the eight BPO values presented in survey 2.

Figure 38: Survey 2 value rankings by land and river option supporters



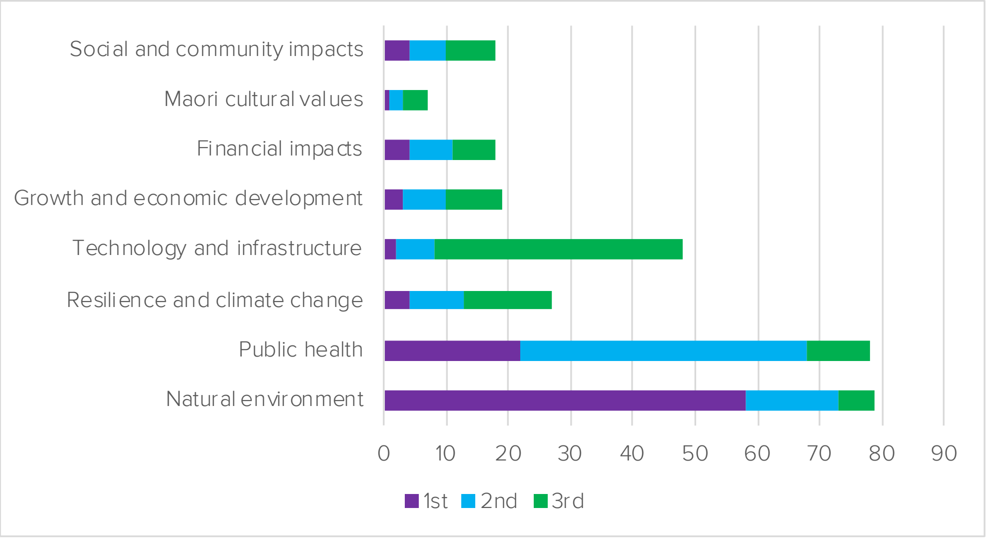
7.4. Ocean Options

Figure 39 shows the reasons survey 1 participants who supported the ocean option gave for their choice.

Figure 39: Word Cloud Survey 1 reasons for preferred ocean option

Figure 40 shows how supporters of the land and river option ranked the eight BPO values presented in survey 2.

Figure 40: Survey 2 value rankings by ocean option supporters



7.5. What outcomes matter most

Figure 41 presents a word cloud of the responses to the survey 1 question “what matters most to you?”

Figure 41: Word Cloud S1 all respondents - What matters most?

8. Summary of written submissions and other feedback

Twenty written submissions were received during the 2021 consultation period. Submissions took a variety of forms, including feedback forms, letters, and long form reports with appendices. Some submissions did not specify a preferred option but discussed the relative strengths and weaknesses from their perspective, and perceived implications for them or their constituents. Submissions include suggestions for alternative options, amendments to existing options or further investigation of existing options.

Some submitters voice concerns about the consultation process, saying they were not adequately consulted about perceived impacts on them, their properties and/or businesses.

The most substantial submission is a joint submission from the Food and Fibre Forum and Federated Farmers. Six other submissions state support for this one, including one by Federated Farmers separately.

The diverse nature and small number of the submissions precludes quantitative and qualitative analysis and this section will provide an overview of the submitters and preferred options and values where these were stated.

Where technical reports, recommendations and requests are made, Palmerston North City Council may consider the merits of these in the next phase of BPO technical investigations and engagement activities.

Written submissions are provided in Appendix A.

8.1. About submitters

20 written submissions were received, 14 from organisations and 6 from individuals.

The industry and interests represented by the organisations who submitted are shown in Figure 42, as well as two individuals who identified as farmers. The remaining four are shown as individuals.

Submissions were received from:

Farming:

- Food and Fibre Forum and Federated Farmers
- Federated Farmers
- Hopkins Farming Group
- Campbell Buchanan
- Peter Wells

Environmental:

- Environment Network Manawatū / Manawatū River Source to Sea
- Manawatu Forest and Bird
- Water and Environmental Care Association (WECA)
- The Water Protection Society
- Lower Manawatū Scheme
- Manawatū Drainage Scheme

Individuals:

- Dr Chris Teo- Sherrell
- BA and TG McErlean
- JFG O'Brien
- Mr Stacey Parlane

Council or Government:

- Manawatū District Council
- Horizons Regional Council
- Horowhenua District Council

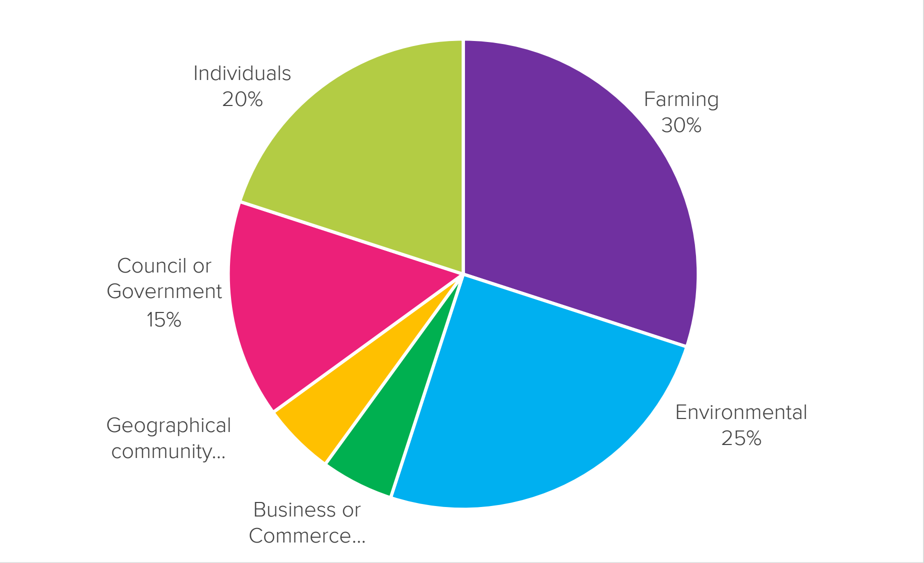
Business or Commerce:

- Manawatū Chamber of Commerce

Geographical community:

- Bainesse/Rangiotu Community Committee

Figure 42: Sector representation of submissions



8.2. Preferred options

Figure 43 shows the preferred options of written submitters where a preferred option was identified.

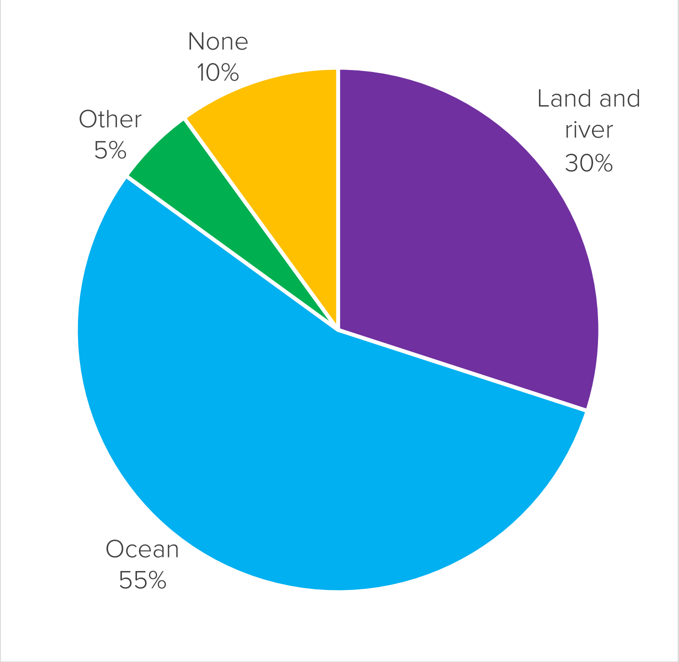
The ocean option is preferred by the Food and Fibre Forum, Federated Farmers and their supporters who state that options 1 and 2 not viable and that negative impacts to primary producers of discharge to land and/or river have not been considered sufficiently.

Support for the Land and River options is voiced by the Environmental groups who submitted and by the Manawatū and Horowhenua District Councils.

No preferred option was given by the Manawatū Chamber of Commerce or the Lower Manawatu Scheme.

The "other" preferred option proposes a higher percentage of discharge to land and more "front of pipe" measures to reduce quantities of wastewater.

Figure 43: Option preference from submitters



8.3. Values and outcomes

Of the five submissions specifically ranked BPO project outcomes, four rated public health the most important.

Four of those five submissions rated natural environment second.

The Food and Fibre Forum, Federated Farmers and supporters say they are unable to score the BPO values as they are based on an urban perspective and do not relate to them.

8.4. Social pinpoint

During April and May 2021, six pieces of feedback were received via online engagement platform, Social Pinpoint.

The six comments were received from four submitters, excluding two pieces of spam.

One comment supported land based discharge

The remainder voiced personal opinions upholding the importance of wise financial decisions, the environment and Te Ao Maori.

Another option was proposed by one submitter, to convert human waste to water and fertiliser.

.

9. Summary and conclusions

9.1. Preferred options

Discharge to ocean emerged as the preferred option for those who participated in the latest consultation period April to May 2021 with 46% support from survey participants and 55% support from written submissions.

The move towards ocean discharge corresponds with a move away from discharge to river, which had 64% support from participants in survey 1, reducing to 30% in survey 2.

In some demographics, there was strong support for a combination of land and river discharge however the overall results indicate a lower level of support for this option.

9.2. Supported values and outcomes

Public Health and natural environment emerged consistently as the leading values for participants in both surveys and the written submissions. Technology and infrastructure.

The outcomes that concerned participants most strongly were managing the costs, the need to minimise environmental impacts through effective treatment, impacts on land health and potential effects on farming and primary industries, and certainty around maintaining the long-term health of the Manawatū River.

These findings represent the views of people and organisations who participated in the consultation and may not reflect or be representative of the views of the whole Palmerston North population.

Appendix A

Submissions received

EnvironMent NETWORK manawatu

P.O. Box 1271
Level 2, 74 The Square
Palmerston North 4440
P 06 355 0126
E coordinator@enm.org.nz

www.enm.org.nz

NATURE CALLS (PNCC Wastewater Project) submission

Name: Environment Network Manawatū / Manawatū River Source to Sea

Address: 145 Cuba St., Palmerston North 4410

Email Address: coordinator@enm.org.nz

Values

Please rank the following items from 1 (most important) to 8 (least important)
(see 'How did we get here' page on Nature Calls website for explanations of these values).

2 Natural environment (Potential adverse environmental effects on the receiving environment (including Manawatū River), particularly in relation to water quality, soils, aquatic ecology and terrestrial ecology.)

1 Public health (Degree of public exposure to health risks in treated wastewater (including through land application or re-use options.)

3= Innovation and future proofing technology (Degree to which the option uses reliable and proven technology, can be staged, is able to be constructed, can be constructed within the appropriate timeframe, allows resource recovery/ beneficial re-use.)

8 Growth and economic development (Will the option support the population and economic growth the Council forecasts for Palmerston North?)

7 Financial (cost of option) (Comparative capital, operational, whole of life costs of the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.)

5= Maori cultural values (Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga.)

5= Social and community impacts (Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option.)

3= Resilience and future climate change impacts (Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.)

Rank Options

Based on your rankings above, which option do you believe will meet your set of priorities values?

No Option 1 - 100% discharge to the river with enhanced treatment

2 Option 2 - 55% discharge to land and 45% discharge to the river

No Option 3 - 100% discharge to the ocean with improved treatment

1 **Other option** - discharge to land of a greater proportion of the treated wastewater as well as 'front of pipe' measures to decrease creation of wastewater. At the very least the proportion should be that which can be achieved at a cost equal to that of the discharge to water options (i.e. an extra $430/year/rateable unit). We recognise that this is not likely to enable a total discharge to land but it should be more than 55%. **Before the BPO is selected, councilors (and the public) should be provided with the cost of discharging 65%, 75%, 85% and 95% to land.**

We support measures being taken to decrease the creation of wastewater in the first place. This should occur no matter which option is chosen. These measures include:

a) installation of water meters and charging all users by volume above a base volume, the base volume being paid for as part of the general rates. Water metering is a proven way to decrease water use and wastewater generation.

b) a reinvigorated Inflow and Infiltration prevention programme that:
   - involves regular inspection of properties and pipes in areas where flow in the city's wastewater pipes is higher than expected

    - continues the programme to replace old pipes.

c) encouragement and incentives for installing and using grey water tanks, dry toilet systems and other water saving devices in existing homes.

d) requiring the installation and use of grey water tanks and water saving devices in new free-standing homes and other appropriate buildings.

PNCC's treatment system should be designed to decrease contaminants sufficiently to meet any limits of the land and of the ability of plants grown on it to absorb nutrients and any aquatic limits that would pertain during periods when treated wastewater would have to be released into the river (at high flow only).

The land discharge area(s) should be used for biomass for energy production either by conversion to liquid or gaseous fuel or by direct burning to generate electricity and heat (the latter usable in associated greenhouses for food production or for other activities with high heat needs). This aspect introduces the prospect of co-funding the project with a commercial partner.

Finally, any excess wastewater as well as any water leaching into the shallow ground water would be intercepted by cut off drains and directed through wetlands designed for further treating the water and for biodiversity restoration with ultimate discharge of water from the wetlands to the river.

This system has multiple benefits including:

i. Economic : Not only does it mitigate any harm to the tourism potential of having a direct discharge to the river but it could in itself be a tourist attraction as a progressive, future-focused solution that deals with wastewater in the most beneficial, environmentally-positive way.

   It would also negate the possible negative effect of a discharge to river or ocean on future inshore fisheries/shellfish production operations.

And the bioenergy production side of the proposal would be a new economic activity for the region creating extra employment on top of that needed to manage the discharge area.

ii. Affecting a relatively small number of land owners and some of these would be able to be employed managing the land for its new purpose or in the biomass to energy operation.

iii. Making a significant contribution to restoring the biodiversity of the Lower Manawatu basin with the inclusion of large-scale wetlands (managed in a variety of ways). The area was previously largely covered in wetlands and associated vegetation so recreating some large wetlands appears very practical.

iv. Providing additional resilience if the system were located in more than one place and/or involved operating parallel systems that enable maintenance and different management to be carried out on parts of the system while the rest of the system functions as usual.

v. Decreasing the leaching of nutrients that is normally associated with the land if it is currently used for stock production since stock would no longer graze the land and nutrients would be removed from it with any biomass harvested.

vi. Possibly making a positive contribution to decreasing greenhouse gas emissions from the bioenergy produced, especially if liquid fuels were produced. However, this may be offset by emissions from any wetland area included.

vii. Decreasing the risk of the system failing to meet river water quality standards (either current ones or future ones). The ocean discharge also has this benefit but the discharge to river option does not. Treatment failure or the possibility that our understanding of river nutrient dynamics is incomplete are both ways in which the river discharge option may fail to meet expectations (as occurred for the current system). This is all the more likely with the longer dry periods and hence longer periods of low river flow that we are likely to experience in coming years, as climate change progresses, making the river more sensitive to nutrient enrichment.

viii. Better meeting broader society's expectations about water quality and the cultural preferences of local iwi and hapū who have always expressed a strong opposition to discharging human wastewater into the river.

Tell us more about your preferred option

Which value is most important to you and why?

Public health: The reason we collect human wastewater is to protect human health by taking it away from where people might come into contact with it. It is treated so as to decrease the health risk to people who come into contact with it in the receiving environment (the environment into which it is discharged) either directly, such as by swimming, or indirectly, such as by consuming food contaminated by growing in that environment. Clearly any option which fails on this criterion is an unacceptable option and would not be able to get a resource consent. Equally clearly, all options put forward will achieve the required level of protection of human health. So this can be taken as a given - it cannot be compromised.

After that, environmental protection is the most important value to us. We see ourselves as part of and dependent on the environment and also value other species for their own sake. Thus, we believe that we should protect them from any harm that our wastewater may cause. Less direct environmental protection comes from utilising both the nutrient content of wastewater as well as the water itself as a resource instead of viewing it only as a waste. By using it we can decrease reliance on material extraction (e.g. phosphate) and the associated energy use (e.g. synthetic nitrogen production and pumping of water from aquifers) helping to protect the global environment, not just our little bit of it.

What do you think is the most sustainable solution for Palmerston North and our region?

Minimising wastewater: In our view, the most sustainable solution must involve producing as little wastewater as possible and applying as much as possible of it to land.

We need to address the cause of the issue by changing the way we do things or the things we use so as to decrease the amounts of water we use and wastewater we create. This will help decrease the cost of treatment for whatever option is chosen. It is particularly important for any option involving discharge to land as the amount of wastewater is a major determinant of the amount of land needed. Although discharge to the river or ocean option would benefit from decreased wastewater flows, primarily from decreased treatment costs, those discharge options provide little or no other incentive to decrease wastewater, (The pumping cost is likely to be negligible in the case of the river discharge and a relatively minor cost for the ocean discharge.)

Public values: These are constantly changing and there is a progressive increase in the desire of the public for having less impact on the environment. These changes in public viewpoints will result in new standards being promulgated concerning the level of impact we should not exceed. This is likely to continue as younger generations, who have grown up with negative environmental impacts reaching lifestyle- and life-threatening levels, are more concerned about those impacts than previous generations. As they become the decision-makers of society they will demand and enforce higher standards. We should be selecting an option that recognises this and doesn't just meet the standards of today. We should exceed today's standards so that the readily anticipated higher standards of tomorrow don't require yet another revamp of our wastewater system.

Persistent pollutants: There is considerable uncertainty about the impacts of some of the chemicals we use. These include persistent organic pollutants but metals, including heavy metals, as well. Discharge to the river and the ocean both disperse contaminants in a way which makes them virtually impossible to recover or manage. In contrast, appropriate (in terms of quantity of water applied to avoid leaching) discharge to land will result in any persistent contaminants at least being contained within a known area. If any become problematic there is some chance of recovering them or at least of keeping them isolated by managing the land accordingly.

Beneficial use: Obtaining greater benefit from the use of resources is desirable especially when doing so can simultaneously decrease negative effects of the disposal of those resources. It is completely out of step with the City's EcoCity Strategy to be just throwing resources away such as by pouring wastewater into the river or ocean.

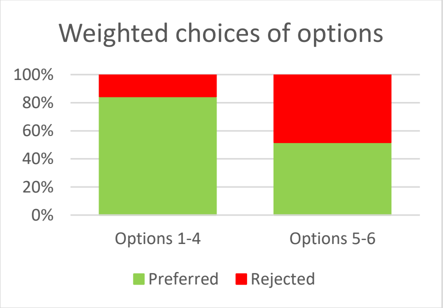
Economic potential: A solution which creates economic opportunity and decreases the risks to current or potential economic activity is more desirable than one which doesn't do these things. Discharging to water has potential to harm tourism and possible inshore fisheries/shellfish operations and has no potential for creating a tourist attraction. It also has no potential to create new economic activity in the way a land discharge scheme does.

A system which can contribute positively to biodiversity restoration is considered more sustainable than one which doesn't, especially given the almost complete destruction of wetland habitat, both swamp and swamp forest, in the lower Manawatu. Only the discharge to land option that we have proposed does so on any significant scale.

Which option has the right balance between environmental protection / impacts and community affordability?

Only options with substantial discharge to land have the right balance since full discharge to either river or sea is unacceptable to us. Discharge to the river or sea both enable continuation of the thinking that we can just throw it away without further effect on us and would provide little or no incentive for people to take measures to minimise the amount of wastewater they create.

Discharge to the ocean not only received little public support during the last consultation but it was also ranked least preferred option of nearly half of respondents. The discharge to river also had a considerable proportion of respondents saying it was their least preferred option. In contrast, those options involving substantive discharge to land was not only more favoured but also were the least preferred option of the fewest number of respondents. The following graph visualizes preferences expressed by submitters against the six options available in the previous round of consultations:



How to read the graph:

For the original public consultation, the following options were offered:

Option 1 = discharge to river at Totara Rd except when river flow is below 1/2 median when 75% of discharge will be diverted to 670ha of land.

Option 2 = discharge to river at 2 places, Totara Road and Opiki, and when river flow is below 1/2 median, at which time 75% of discharge will be diverted to 670ha of land.

Option 3 = 97 % discharge to land, at coast or inland

Option 4 = 45-55% discharge to land, at coast or inland

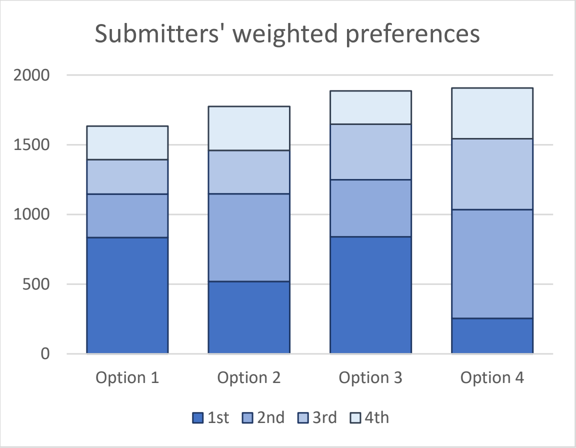
Option 5 = discharge to groundwater but to land during drier months

Option 6 = discharge to ocean but to land during drier months

Note: The original 6 options have been reduced to three preferred options in this consultation round. Those are highlighted in yellow.

Overall, submitters greatly (73%) prefer options 1-4 to Options 5-6 (27%). This strongly suggests that Options 5 and 6 should be discarded at this stage.

The next graph shows weighted preferences amongst the 4 options (= options 1 – 4 in the full list of six options above), preferred by submitters during the last consultation.



A submitter's first preference can be given more weight than their second preference, etc. When weighted for level of preference (see figure below), the most acceptable option is Option 3 (discharge to land), but overall there is little variation between Options 1-4 amongst submitters. There is more variation between the preferences for

Options 5-6. Groundwater discharge has subsequently been rejected by PNCC, on what appear to be reasonable grounds.

General Comment

- A lot of people in our network feel that they have not been heard in the first round of consultations, and that there is not much point to keep engaging.
- As per the last round, we are still feeling that we are making value calls in absence of understanding the bigger picture. While we understand that the team is trying to minimise effort by only doing more detailed work on the preferred option, the preferred option based on current level of understanding might ultimately not be the best option.
- The online feedback form is limiting in what can be submitted. We, therefore will send our full document via e-mail as well.
- We want to speak to our submission.

NATURE CALLS

HAVE YOUR SAY FEEDBACK FORM

Please drop your feedback form to our Customer Service Centre or the central library.
You can also fill this in online at **naturecalls.nz**

Or post it to: Nature Calls Submissions, Palmerston North City Council, Private Bag 11034, The Square, Palmerston North, 4442

You may add additional pages if you want to expand on any of your answers.
Your feedback from this form will be summarised in a report to Council.

Name Manawatū Branch of Forest & Bird

Address P.O. Box 961, Palmerston North, 4440

Email Address manawatu.branch@forestandbird.org.nz

Do you live in Palmerston North? *(please tick)*					☒ Yes	☐ No
Are you a business owner in Palmerston North? *(please tick)*					☐ Yes	☒ No
What age range are you in?	☐ under 18	☐ 18 - 30	☐ 31 - 40	☐ 41 - 50	☐ 51 - 60	☐ 61 +
Do you identify as tangata whenua in Palmerston North, Horowhenua, Manawatū? *(please tick)*					☐ Yes	☐ No
If yes, please identify your iwi/hapu/tribal affiliation	We don't hold this information about our members.					
What kind of area do you live in? *(please tick)*	mostly			☒ Urban	☐ Rural	☐ Coastal

Values discussion

Our MCA process considered scoring and weighting of criteria, which are representative of values. We want to know which values are more important, to you. Refer to the table on page 8 for the descriptions.

Please rank these items from 1 (most important) - 8 (least important)			
1	Natural Environment (ecology etc)	8	Financial (cost of option)
	Public Health		Maori Cultural Values
	Innovation and future proofing technology		Social and Community Impacts
	Growth and Economic Development		Resilience and Climate Change Impacts (future)

Based on your ranking above, which Option do you believe, will meet your set of prioritised values?	
Discharge option 1 - River with enhanced treatment	☐
Discharge option 2 - To land 55% of the time and river 45% of the time	☒
Discharge option 3 - To ocean with improved treatment	☐
Other option (please describe below)	☐

FEEDBACK CLOSES AT 5PM ON SUNDAY 9 MAY

Feedback forms are not returned, so please make a copy for yourself.

Tell us more about your preferred option

Tell us which value you selected as most important and why?

Forest & Bird is a voice for nature, protection of the natural environment is one of our top priorities. The Manawatu catchment is already experiencing nutrient levels that affect ecological health. We support the options that have the greatest potential to minimise the negative effects of wastewater discharge. There are no impediments except cost but the environment has been absorbing that cost for too long. It's time for us to step up and be a leader in environmental sustainability.

What do you think is the most sustainable solution for Palmy and our Region?

None of the options presented were 'sustainable'. Rather, it was a matter of choosing the 'least bad' option. We would only support Discharge option 2 if it came with the level of treatment associated with Discharge option 1. We do not support Discharge option 3 at all.

Which option has the right balance between environmental protection/impacts and community affordability?

The option with the best balance between environmental protection and impacts would be Discharge option 2 with the same level of treatment proposed for Discharge option 1. We would also have high monitoring and compliance expectations on the council.

Sustainability in your home

Please tick which measures you'd use to reduce your wastewater at home	
☐ Remove insinkerator	☐ Low energy appliances
☐ Greywater tank	☐ Urine separate toilets
☐ Water reducing showerheads and taps	☐ Water metering
☐ Composting toilet	☐ None of the above

NATURE CALLS SUBMISSION (PNCC Wastewater Project)

Name: Blue Forsyth and Geoff Keith

WECA (Water and Environmental Care Association Inc)

Values discussion

Please rank the following items from 1(most important) to 8 (least important)
(see 'How did we get here' page on Nature Calls website for explanations of these values).

1. Public health (Degree of public exposure to health risks in treated wastewater (including through land application or re-use options.)

2. Natural environment (Potential adverse environmental effects on the receiving environment (including Manawatū River), particularly in relation to water quality, soils, aquatic ecology and terrestrial ecology.)

3. Maori cultural values (Potential adverse effects on the mauri of natural resources, on kai moana, kai awa, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga.)

4. Innovation and future proofing technology (Degree to which the option uses reliable and proven technology, can be staged, is able to be constructed, can be constructed within the appropriate timeframe, allows resource recovery/ beneficial re-use.) For example: seriously consider eco-technological interventions from a life time of work to treat industrial and other waste in international contexts by John Todd.

5. Social and community impacts (Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option.)

6. Resilience and future climate change impacts (Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.)

7. Financial (cost of option) (Comparative capital, operational, whole of life costs of the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.)

8. Growth and economic development (Will the option support the population and economic growth the Council forecasts for Palmerston North?)

Rank Options

Based on your rankings above, which option do you believe will meet your set of priorities values?

Option 1 - 100% discharge to the river with enhanced treatment
Strongly rejected
Option 2 - 55% discharge to land and 45% discharge to the river
The best of the options presented but far from optimum (see Other option below)

Option 3 - 100% discharge to the ocean with improved treatment
Strongly rejected

Comment
Decisions that have long term impacts for communities and the environment must start from 'first principles'. This requires a genuine and concerted effort to decrease the creation of wastewater ***before*** dealing with the end of pipe results. This should occur no matter which option is chosen. These measures include:

1. Encouragement and incentives for installing and using grey water tanks, dry toilet systems and other water saving devices in existing homes.
2. Requiring the installation and use of grey water tanks and water saving devices in new free-standing homes and other appropriate buildings.
3. Installation of water meters and charging all users by volume above a base volume, the base volume being paid for as part of the general rates. Water metering is a proven way to decrease water use and wastewater generation.
4. A reinvigorated Inflow and Infiltration prevention programme that:
    a. works proactively with businesses to eliminate or minimize water use/trade waste (eg. Cleaner Production initiatives)
    b. involves regular inspection of properties and pipes in areas where flow in the city's wastewater pipes is higher than expected
    c. continues the programme to replace old pipes.
5. Educating the community about the cost (environmental, financial etc) and equity of a 'flush and forget' mentality.

Other option
The measures suggested above are long term aspirations and will not reduce the immediate flow of wastewater. For WECA, the preferred option in the meantime is discharge to land of the greater proportion of the treated wastewater. At the very least the proportion should be that which can be achieved at a cost equal to that of the discharge to water options (i.e. an extra $430/year/rateable unit). We recognise that this is not likely to enable a total discharge to land but it should be more than 55%. **Before the BPO is selected, councilors (and the public) should be provided with the cost of discharging 65%, 75%, 85% and 95% to land.**

PNCC's treatment system should be designed to decrease contaminants sufficiently to meet any limits of the land and of the ability of plants grown on it to absorb nutrients and any aquatic limits that would pertain during periods when treated wastewater would have to be released into the river (at high flow only).

The land discharge area(s) should be used for biomass for energy production either by conversion to liquid or gaseous fuel or by direct burning to generate electricity and heat (the latter usable in associated greenhouses for food production or for other activities with high heat needs). There is also great potential for other high value crops that would support much needed local industry (eg. Hemp for construction). These options present the prospect of co-funding of projects with commercial partners. Such arrangements would take time to scope and develop so ‘cut and carry’ harvesting operations could provide a short-term solution.

Finally, any excess wastewater as well as any water leaching into the shallow ground water would be intercepted by cut off drains and directed through wetlands designed for further treating the water and for biodiversity restoration with ultimate discharge of water from the wetlands to the river.

This system has multiple benefits including:

i. Economic : Not only does it mitigate any harm to the tourism potential of having a direct discharge to the river but it could in itself be a tourist attraction as a progressive, future-focused solution that deals with wastewater in the most beneficial, environmentally-positive way.
It would also negate the possible negative effect of a discharge to river or ocean on future inshore fisheries/shellfish production operations.
The crop production from discharge to land could be a new economic activity for the region creating extra employment and business oportunities.

ii. Affecting a relatively small number of landowners many of whom could be employed or contracted to manage the land for its new purpose or in the resultant downstream operation.

iii. Making a significant contribution to restoring the biodiversity of the Lower Manawatu basin with the inclusion of large-scale wetlands (managed in a variety of ways). The area was previously largely covered in wetlands and associated vegetation so recreating some large wetlands appears very practical.

iv. Providing additional resilience if the system was located in more than one place and/or involved operating parallel systems that enable maintenance and different management to be carried out on parts of the system while the rest of the system functions as usual.

v. Decreasing the leaching of nutrients that is normally associated with the land if it is currently used for stock production since stock would no longer graze the land and nutrients would be removed from it with any biomass harvested.

vi. Possibly making a positive contribution to decreasing greenhouse gas emissions from the bioenergy produced, especially if liquid fuels were produced. However, this may be offset by emissions from any wetland area included.

vii. Decreasing the risk of the system failing to meet river water quality standards (either current ones or future ones). The ocean discharge also has this benefit but the discharge to river option does not. Treatment failure or the possibility that our understanding of river nutrient dynamics is incomplete are both ways in which the river discharge option may fail to meet expectations (as occurred for the current system). This seems increasingly more likely, with longer dry periods resulting in longer periods of low river flows with the forecast impact of climate change, making the river more sensitive to nutrient enrichment. Drier conditions would also increase the viability and value of land discharge.

viii. Better meeting broader society's expectations about water quality and the cultural preferences of local iwi and hapū who have always expressed a strong opposition to discharging human wastewater into the river.

Tell us more about your preferred option

Which value is most important to you and why?

Public health
The reason we collect human wastewater is primarily to protect human health by reducing risk of exposure to the harmful pathogens, chemicals etc that it may contain. It is treated to decrease the health risk to people who come into contact with it in the receiving environment (the environment into which it is discharged) either directly, such as by swimming, or indirectly, such as by consuming food contaminated by growing in that environment. Clearly any option which fails on this criterion is an unacceptable option and sould not be able to get a resource consent. Equally clearly, all options put forward will achieve the required level of protection of human health. As such, public health cannot be compromised and is therefore top priority.

Environmental protection
WECA is an environmental group so improving environmental outcomes is most important to us. We are dependent on the environment for our future and have an obligation to protect and regenerate its services, not only for ourselves, but all other species threatened by our actions. Thus, we believe that we should protect them from any harm that our wastewater may cause and by so doing we will best protect ourselves, our health and our species future.
A less direct environmental protection will come from utilising both the nutrient content of wastewater and the water itself as a resource instead of treating it as a waste without value. By using it we can decrease reliance on material extraction (e.g. phosphate) and the associated energy use (e.g. synthetic nitrogen production and pumping of water from aquifers) helping to protect the global environment, not just our little bit of it.

What do you think is the most sustainable solution for Palmerston North and our region?

Reducing wastewater production
In our view, the most sustainable solution must involve reducing wastewater production to a minimum and then applying as much of the remainder as possible to land.

We need to address the cause of the issue by changing the way we do things or the things we use so as to decrease the amounts of water we use and therefore wastewater we create. This will help decrease the cost of treatment for whatever option is chosen. This is particularly important for any option involving discharge to land, as the amount of wastewater is a major determinant of the amount of land needed. Although discharge to the river or ocean option would benefit from decreased wastewater flows, primarily from decreased treatment costs, those discharge options provide little or no other incentive to decrease wastewater. (The pumping cost is likely to be negligible in the case of the river discharge and a relatively minor cost for the ocean discharge.)

Public values
These are constantly changing and there is a progressive increase in the desire of the public for having less impact on the environment. These changes in public viewpoints will result in new standards being promulgated concerning the level of impact we should not exceed. This is likely to continue as younger generations, who have grown up with negative environmental impacts reaching lifestyle- and life-threatening levels, are more concerned about those impacts than previous generations. As they become the decision-makers, they will demand and enforce higher standards. We should be selecting an option that recognises this and doesn't just meet the standards of today. We should exceed today's standards so that the readily anticipated higher standards of tomorrow don't require yet another revamp of our wastewater system.

Rank Options

Based on your rankings above, which option do you believe will meet your set of priorities values?

Option 1 - 100% discharge to the river with enhanced treatment
Strongly rejected
Option 2 - 55% discharge to land and 45% discharge to the river
The best of the options presented but far from optimum (see Other option below)

Option 3 - 100% discharge to the ocean with improved treatment
Strongly rejected

Comment
Decisions that have long term impacts for communities and the environment must start from 'first principles'. This requires a genuine and concerted effort to decrease the creation of wastewater ***before*** dealing with the end of pipe results. This should occur no matter which option is chosen. These measures include:

1. Encouragement and incentives for installing and using grey water tanks, dry toilet systems and other water saving devices in existing homes.
2. Requiring the installation and use of grey water tanks and water saving devices in new free-standing homes and other appropriate buildings.
3. Installation of water meters and charging all users by volume above a base volume, the base volume being paid for as part of the general rates. Water metering is a proven way to decrease water use and wastewater generation.
4. A reinvigorated Inflow and Infiltration prevention programme that:
    a. works proactively with businesses to eliminate or minimize water use/trade waste (eg. Cleaner Production initiatives)
    b. involves regular inspection of properties and pipes in areas where flow in the city's wastewater pipes is higher than expected
    c. continues the programme to replace old pipes.
5. Educating the community about the cost (environmental, financial etc) and equity of a 'flush and forget' mentality.

Other option
The measures suggested above are long term aspirations and will not reduce the immediate flow of wastewater. For WECA, the preferred option in the meantime is discharge to land of the greater proportion of the treated wastewater. At the very least the proportion should be that which can be achieved at a cost equal to that of the discharge to water options (i.e. an extra $430/year/rateable unit). We recognise that this is not likely to enable a total discharge to land but it should be more than 55%. **Before the BPO is selected, councilors (and the public) should be provided with the cost of discharging 65%, 75%, 85% and 95% to land.**

PNCC's treatment system should be designed to decrease contaminants sufficiently to meet any limits of the land and of the ability of plants grown on it to absorb nutrients and any aquatic limits that would pertain during periods when treated wastewater would have to be released into the river (at high flow only).

The land discharge area(s) should be used for biomass for energy production either by conversion to liquid or gaseous fuel or by direct burning to generate electricity and heat (the latter usable in associated greenhouses for food production or for other activities with high heat needs). There is also great potential for other high value crops that would support much needed local industry (eg. Hemp for construction). These options present

Persistent pollutants
There is considerable uncertainty about the impacts of some of the chemicals we use. These include persistent organic pollutants but metals, including heavy metals, as well. Discharge to the river and the ocean both disperse contaminants in a way which makes them virtually impossible to recover or manage. In contrast, appropriate (in terms of quantity of water applied to avoid leaching) discharge to land will result in any persistent contaminants at least being contained within a known area. If any become problematic there is some chance of recovering them or at least of keeping them isolated by managing the land accordingly.

Beneficial use
Obtaining greater benefit from the use of resources is desirable especially when doing so can simultaneously decrease negative effects of the disposal of those resources. It is completely out of step with the City's EcoCity Strategy to be just throwing resources away such as by pouring wastewater into the river or ocean.

Economic potential
A solution which creates economic opportunity and decreases the risks to current or potential economic activity is more desirable than one which doesn't do these things. Discharging to water has potential to harm tourism and possible inshore fisheries/shellfish operations and has no potential for creating a tourist attraction. It also has no potential to create new economic activity in the way a land discharge scheme does.

A system which can contribute positively to biodiversity restoration is considered more sustainable than one which doesn't, especially given the almost complete destruction of wetland habitat, both swamp and swamp forest, in the lower Manawatu. Only the discharge to land option that we have proposed does so on any significant scale.

Which option has the right balance between environmental protection / impacts and community affordability?

Only options with substantial discharge to land have the right balance since full discharge to either river or sea is unacceptable to us. Discharge to the river or sea both enable continuation of the thinking that we can just throw it away without further effect on us and would provide little or no incentive for people to take measures to minimise the amount of wastewater they create.

Sustainability in your home

Please tick which measures you would use to reduce your wastewater at home.

___ Remove insinkerator
___ Greywater tank
___ Water reducing showerheads and taps
___ Composting toilet
___ Lower energy appliances
___ Urine separating toilets
___ Water metering
___ None of the above

WECA and its members are broadly supportive of all the above measures.

Geoff Keith and Blue Forsyth

NATURE CALLS (PNCC Wastewater Project)
submission

Name: The Water Protection Society Incorporated

Address: c/- 129 Raukawa Road, RD 10, Palmerston North 4470

Email Address: wps@inspire.net.nz

Do you live in Palmerston North?
Most members do but some are beyond the city boundary.

Are you a business owner in Palmerston North?
Not as an organisation but some members may be.

What age range are you in? <18 18-30 31-40 41-50 51-60 >60
A range of ages 18 years and older.

Do you identify as tangata whenua in Palmerston North, Horowhenua or Manawatu?
Some members may do so.

If yes, please identify your iwi / hapu / tribal affiliation.

What kind of area do you live in? Urban Rural Coastal
Some members live in each of these kinds of area.

Values

Please rank the following items from 1(most important) to 8 (least important)
(see 'How did we get here' page on Nature Calls website for explanations of these values).

2 Natural environment (Potential adverse environmental effects on the receiving environment (including Manawatū River), particularly in relation to water quality, soils, aquatic ecology and terrestrial ecology.)

1 Public health (Degree of public exposure to health risks in treated wastewater (including through land application or re-use options.)

3= Innovation and future proofing technology (Degree to which the option uses reliable and proven technology, can be staged, is able to be constructed, can be constructed within the appropriate timeframe, allows resource recovery/ beneficial re-use.)

8 Growth and economic development (Will the option support the population and economic growth the Council forecasts for Palmerston North?)

7 Financial (cost of option) (Comparative capital, operational, whole of life costs of the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.)

5= Maori cultural values (Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga.)

5= Social and community impacts (Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option.)

3= Resilience and future climate change impacts (Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.)

1 is the primary purpose of wastewater collection and treatment.
2 must be achieved while carrying out 1.
3= these amount to saying any proposed system can be built and will work now and into the future

Rank Options

Based on your rankings above, which option do you believe will meet your set of priorities values?

No Option 1 - 100% discharge to the river with enhanced treatment

2 Option 2 - 55% discharge to land and 45% discharge to the river

No Option 3 - 100% discharge to the ocean with improved treatment

1 Other option - **discharge a higher (than 55%) proportion of the treated wastewater to land and implement more 'front of pipe' measures to decrease the amount of wastewater that is created in the first place.**

At the very least the proportion disposed of on land should be that which can be achieved at a cost equal to that of the two options which discharge the treated wastewater to water whether that be the river or the ocean (i.e. whatever could be achieved for an extra $430/year/rateable unit).

We recognise that this is not likely to enable a total discharge to land but it should be more than 55%. Before the BPO is selected, councilors (and the public) should be provided with the cost of discharging 65%, 75%, 85% and 95% of the treated wastewater to land.

This option would incorporate measures being taken to decrease the creation of wastewater in the first place. This should occur no matter which option is chosen. These measures include:

a) installation of water meters and charging all users by volume above a base volume, the base volume being paid for as part of the general rates so that reasonable use is provided for. Water metering is a proven way to decrease water use and wastewater generation.

b) a reinvigorated Inflow and Infiltration prevention programme that:
    - involves regular inspection of properties and pipes in areas where flow in the city's wastewater pipes is higher than expected
    - continues the programme to replace old pipes

c) *encouragement and incentives* for installing and using grey water tanks, dry toilet systems and other water saving devices in existing homes

d) *requiring* the installation and use of grey water tanks and water saving devices in new homes and other buildings.

This option would have a treatment system designed to decrease contaminants sufficiently to meet any limits of the land and plants grown on it to absorb nutrients and any aquatic limits that would pertain during periods when treated wastewater would have to be released into the river (at high flow only). It would also include a significant capacity to store wastewater.

The land discharge area(s) would be used for biomass for energy production either by conversion to liquid or gaseous fuel or by direct burning to generate electricity and heat (the latter usable in associated greenhouses for food production or for other activities with high heat needs). This aspect introduces the prospects of increasing economic activity and of co-funding the project with a commercial partner .

Finally, any excess wastewater as well as any water leaching into the shallow ground water would be intercepted by cut off drains and directed through wetlands designed for further treating the water before it is finally discharged to the river.

This system has multiple benefits including:

i. Economic : Not only does it mitigate any harm to the tourism potential of having a direct discharge to the river but it could in itself be a tourist attraction as a progressive, future-focused solution that deals with wastewater in the most beneficial, environmentally-positive way.

   It would also negate the possible negative effect of a discharge to river or ocean on future inshore fisheries/shellfish production operations.

   And the bioenergy production side of the proposal (with possible associated greenhouses) would be a new economic activity for the region creating extra employment on top of that needed to manage the discharge area.

   This would be a good example of moving towards a circular economy.

ii. Affecting a relatively small number of land owners and some of these would be able to be employed managing the land for its new purpose or in the biomass to energy or greenhouse operations.

iii. Making a significant contribution to restoring the biodiversity of the Lower Manawatu basin with the inclusion of large scale wetlands (managed in a variety of ways). The area was previously largely made up of wetlands and associated vegetation so recreating some large wetlands appears very practical and beneficial.

iv. Providing additional resilience if the system were located in more than one place and/or involved operating parallel systems that enable maintenance and management to be carried out on parts of the system while the rest of the system functions as usual.

v. Decreasing the leaching of nutrients that is normally associated with the land if it is currently used for stock production since stock would no longer graze the land and nutrients would be removed from it in any biomass harvested.

vi. Possibly a positive contribution to decreasing greenhouse gas emissions. This would accrue if liquid fuels were produced from the biomass and used to substitute for fossil-derived fuel. The decrease in ruminant animals on the land would also result in a decrease in these emissions. However, these may be offset to some extent by emissions from any wetland area included.

vii. Decreasing the risk of the system failing to meet river water quality standards (either current ones or future ones). The ocean discharge also has this benefit but the discharge to river option does not. Treatment failure or the possibility that our understanding of river nutrient dynamics is incomplete are both ways in which the river discharge option may fail to meet expectations (as occurred for the current system). This is all the more likely with the longer dry periods and hence longer periods of low river flow that we are likely to experience in coming years, as climate change progresses, making the river more sensitive to nutrient enrichment.

viii. Better meeting broader society's expectations about water quality and the cultural preferences of local iwi and hapu who have expressed a strong opposition to discharging human wastewater into the river.

Tell us more about your preferred option

Which value is most important to you and why?

Public health: The reason we collect human wastewater is to protect human health by taking it away from where people might come into contact with it. It is treated so as to decrease the health risk to people who come into contact with it in the environment into which it is discharged, either directly, such as by swimming, or indirectly, such as by consuming food obtained from that environment. Clearly any option which fails on this criteria is an unacceptable option and would not be able to get a resource consent. Equally clearly, all options put forward will achieve the required level of protection of human health. So this can be taken as a given - it cannot be compromised.

After that, environmental protection is the most important value to us. We see ourselves as part of and dependent on the environment and also value other species for their own sake. Thus, we believe that we should protect them from any harm that our wastewater may cause. Environmental protection comes from using both the nutrient content of wastewater as well as the water itself as resources instead of viewing them only as waste. By using them as resources, we can decrease reliance on material extraction (e.g. phosphate) and the associated energy use (e.g. synthetic nitrogen production and pumping of water from aquifers) helping to protect the global environment, not just our little bit of it.

What do you think is the most sustainable solution for Palmerston North and our region?

Minimising wastewater: In our view, the most sustainable solution must involve producing as little wastewater as possible and applying as much as possible of it to land.

We need to address the cause of the issue by changing the way we do things or the things we use so as to decrease the amounts of water we use and wastewater we create. This will help decrease the cost of treatment for whatever option is chosen. It is particularly important for any option involving discharge to land as the amount of wastewater is a major determinant of the amount of land needed. Although discharge to the river or ocean option would benefit from decreased wastewater flows too, primarily from decreased treatment costs, they provide relatively little or no other incentive to decrease wastewater (the pumping cost is likely to be negligible in the case of the river discharge and a relatively minor cost for the ocean discharge).

Public values: These are constantly changing and there is a progressive increase in the desire for having less impact on the environment. These changes in public view result in new standards being promulgated concerning the level of impact we should not exceed. This is likely to continue as younger generations, who have grown up with our negative impacts on the environment reaching lifestyle and life-threatening levels, being more concerned about those impacts than previous generations. As they become the decision makers of society it is likely they will demand higher standards. We should be selecting an option that recognises this and doesn't just meet the standards of today. We should exceed today's standards so that the readily anticipated higher standards of tomorrow don't require yet another revamp of our wastewater system.

Persistent pollutants: There is considerable uncertainty about the impacts of some of the chemicals we use. These include persistent organic pollutants but metals as well. Discharge to the river and the ocean both disperse contaminants in a way which makes them virtually impossible to recover or manage. In contrast, appropriate (in terms of quantity of water applied to avoid leaching) discharge to land will result in any persistent contaminants being contained within a known area. If any become problematic there is some chance of recovering them or at least of keeping them isolated and managing the land accordingly.

Beneficial use: Obtaining greater benefit from the use of resources is desirable especially when doing so can simultaneously decrease negative effects of the disposal of those resources. It is completely out of step with the City's EcoCity Strategy to be just throwing resources away such as by pouring wastewater into the river or ocean.

Economic potential: A solution which creates economic opportunity and decreases the risks to current or potential economic activity is more desirable than one which doesn't do these things. Discharging to water has potential to harm tourism and possible inshore fisheries/shellfish operations and has no potential for creating a tourist attraction. It also has no potential to create new economic activity in the way a land discharge scheme does.

A system which can contribute positively to biodiversity restoration is considered more sustainable than one which doesn't, especially given the almost complete destruction of wetland habitat in the lower Manawatu. Only the discharge to land option that we have proposed does so on any significant scale.

Which option has the right balance between environmental protection / impacts and community affordability?

Only options with substantial discharge to land have the right balance since full discharge to river or sea are unacceptable to us. Discharge to the river or sea both enable continuation of the thinking that we can just throw it away without further effect on us and would provide little or no incentive for people to take measures to minimise the amount of wastewater they create.

Discharge to the ocean not only received little public support during the last consultation but it was also ranked least preferred option of nearly half (44%) of respondents. The discharge to river also had a considerable proportion (23%) of respondents saying it was their least preferred option.

In contrast, those options involving substantive discharge to land were not only more favoured but also the fewest respondents ranked these as their least preferred option (7% for option 3, 97% discharge to land, and 1% for options 4, 45-55% discharge to land).

Sustainability in your home

Please tick which measures you would use to reduce your wastewater at home.

___ Remove insinkerator
___ Greywater tank
___ Water reducing showerheads and taps
___ Composting toilet
___ Lower energy appliances
___ Urine separating toilets
___ Water metering
___ None of the above

These are more appropriate for individuals to answer. Many of our members have advocated for these in the past.

Thank you.

Myles Stilwell
Secretary
Water Protection Society.

NATURE CALLS (PNCC Wastewater Project) submission

Name: Chris Teo-Sherrell

Address: 37 Oxford St, Palmerston North 4410

Email Address: carfreechris@inspire.net.nz

Do you live in Palmerston North?
Yes

Are you a business owner in Palmerston North?
No

What age range are you in? <18 18-30 31-40 41-50 51-60 >60
51-60

Do you identify as tangata whenua in Palmerston North, Horowhenua or Manawatu?
No

If yes, please identify your iwi / hapu / tribal affiliation.

What kind of area do you live in? Urban Rural Coastal
Urban

Values

Please rank the following items from 1(most important) to 8 (least important)
(see 'How did we get here' page on Nature Calls website for explanations of these values).

2 Natural environment (Potential adverse environmental effects on the receiving environment (including Manawatū River), particularly in relation to water quality, soils, aquatic ecology and terrestrial ecology.)

1 Public health (Degree of public exposure to health risks in treated wastewater (including through land application or re-use options.)

3= Innovation and future proofing technology (Degree to which the option uses reliable and proven technology, can be staged, is able to be constructed, can be constructed within the appropriate timeframe, allows resource recovery/ beneficial re-use.)

8 Growth and economic development (Will the option support the population and economic growth the Council forecasts for Palmerston North?)

7 Financial (cost of option) (Comparative capital, operational, whole of life costs of the option, assessment of this criterion includes consideration of land acquisition costs, capital gains and product net revenue.)

5= Maori cultural values (Potential adverse effects on the mauri of natural resources, on kai moana, and on the relationship of Māori, their cultures and traditions, with ancestral lands, water, sites, waahi tapu and other taonga.)

5= Social and community impacts (Significance of potential social effects based on the gravity, distributive equity, the need for land acquisition and degree of permanence of land use change, and public support for the option.)

3= Resilience and future climate change impacts (Degree to which the option is resilient to natural hazards and climate change and offers operational resilience.)

1 is the primary purpose of wastewater collection and treatment.
2 must be achieved while carrying out 1.
3= these amount to saying any proposed system can be built and will work now and into the future

Rank Options

Based on your rankings above, which option do you believe will meet your set of priorities values?

No Option 1 - 100% discharge to the river with enhanced treatment

2 Option 2 - 55% discharge to land and 45% discharge to the river

No Option 3 - 100% discharge to the ocean with improved treatment

1 Other option - **discharge a higher (than 55%) proportion of the treated wastewater to land and implement more 'front of pipe' measures to decrease the amount of wastewater that is created in the first place.**

At the very least the proportion disposed of on land should be that which can be achieved at a cost equal to that of the two options which discharge the treated wastewater to water whether that be the river or the ocean (i.e. whatever could be achieved for an extra $430/year/rateable unit).

I recognise that this is not likely to enable a total discharge to land but it should be more than 55%. Before the BPO is selected, councilors (and the public) should be provided with the cost of discharging 65%, 75%, 85% and 95% of the treated wastewater to land.

This option would incorporate measures being taken to decrease the creation of wastewater in the first place. This should occur no matter which option is chosen. These measures include:

a) installation of water meters and charging all users by volume above a base volume, the base volume being paid for as part of the general rates so that reasonable use is provided for. Water metering is a proven way to decrease water use and wastewater generation.

b) a reinvigorated Inflow and Infiltration prevention programme that:
   - involves regular inspection of properties and pipes in areas where flow in the city's wastewater pipes is higher than expected
   - continues the programme to replace old pipes

c) *encouragement and incentives* for installing and using grey water tanks, dry toilet systems and other water saving devices in existing homes

d) *requiring* the installation and use of grey water tanks and water saving devices in new homes and other buildings.

This option would have a treatment system designed to decrease contaminants sufficiently to meet any limits of the land and plants grown on it to absorb nutrients and any aquatic limits that would pertain during periods when treated wastewater would have to be released into the river (at high flow only). It would also include a significant capacity to store wastewater.

The land discharge area(s) would be used for biomass for energy production either by conversion to liquid or gaseous fuel or by direct burning to generate electricity and heat (the latter usable in associated greenhouses for food production or for other activities with high heat needs). This aspect introduces the prospects of increasing economic activity and of co-funding the project with a commercial partner .

Finally, any excess wastewater as well as any water leaching into the shallow ground water would be intercepted by cut off drains and directed through wetlands designed for further treating the water before it is finally discharged to the river.

This system has multiple benefits including:

i. Economic : Not only does it mitigate any harm to the tourism potential of having a direct discharge to the river but it could in itself be a tourist attraction as a progressive, future-focused solution that deals with wastewater in the most beneficial, environmentally-positive way.

   It would also negate the possible negative effect of a discharge to river or ocean on future inshore fisheries/shellfish production operations.

   And the bioenergy production side of the proposal (with possible associated greenhouses) would be a new economic activity for the region creating extra employment on top of that needed to manage the discharge area.

   This would be a good example of moving towards a circular economy.

ii. Affecting a relatively small number of land owners and some of these would be able to be employed managing the land for its new purpose or in the biomass to energy or greenhouse operations.

iii. Making a significant contribution to restoring the biodiversity of the Lower Manawatu basin with the inclusion of large scale wetlands (managed in a variety of ways). The area was previously largely made up of wetlands and associated vegetation so recreating some large wetlands appears very practical and beneficial.

iv. Providing additional resilience if the system were located in more than one place and/or involved operating parallel systems that enable maintenance and management to be carried out on parts of the system while the rest of the system functions as usual.

v. Decreasing the leaching of nutrients that is normally associated with the land if it is currently used for stock production since stock would no longer graze the land and nutrients would be removed from it in any biomass harvested.

vi. Possibly a positive contribution to decreasing greenhouse gas emissions. This would accrue if liquid fuels were produced from the biomass and used to substitute for fossil-derived fuel. The decrease in ruminant animals on the land would also result in a decrease in these emissions. However, these may be offset to some extent by emissions from any wetland area included.

vii. Decreasing the risk of the system failing to meet river water quality standards (either current ones or future ones). The ocean discharge also has this benefit but the discharge to river option does not. Treatment failure or the possibility that our understanding of river nutrient dynamics is incomplete are both ways in which the river discharge option may fail to meet expectations (as occurred for the current system). This is all the more likely with the longer dry periods and hence longer periods of low river flow that we are likely to experience in coming years, as climate change progresses, making the river more sensitive to nutrient enrichment.

viii. Better meeting broader society's expectations about water quality and the cultural preferences of local iwi and hapu who have expressed a strong opposition to discharging human wastewater into the river.

Tell us more about your preferred option

Which value is most important to you and why?

Public health: The reason we collect human wastewater is to protect human health by taking it away from where people might come into contact with it. It is treated so as to decrease the health risk to people who come into contact with it in the environment into which it is discharged, either directly, such as by swimming, or indirectly, such as by consuming food obtained from that environment. Clearly any option which fails on this criteria is an unacceptable option and would not be able to get a resource consent. Equally clearly, all options put forward will achieve the required level of protection of human health. So this can be taken as a given - it cannot be compromised.

After that, environmental protection is the most important value to me. I see myself as part of and dependent on the environment and also value other species for their own sake. Thus, I believe that we should protect them from any harm that our wastewater may cause. Environmental protection comes from using both the nutrient content of wastewater as well as the water itself as resources instead of viewing them only as waste. By using them as resources, we can decrease reliance on material extraction (e.g. phosphate) and the associated energy use (e.g. synthetic nitrogen production and pumping of water from aquifers) helping to protect the global environment, not just our little bit of it.

What do you think is the most sustainable solution for Palmerston North and our region?

Minimising wastewater: In my view, the most sustainable solution must involve producing as little wastewater as possible and applying as much as possible of it to land.

We need to address the cause of the issue by changing the way we do things or the things we use so as to decrease the amounts of water we use and wastewater we create. This will help decrease the cost of treatment for whatever option is chosen. It is particularly important for any option involving discharge to land as the amount of wastewater is a major determinant of the amount of land needed. Although discharge to the river or ocean option would benefit from decreased wastewater flows too, primarily from decreased treatment costs, they provide relatively little or no other incentive to decrease wastewater (the pumping cost is likely to be negligible in the case of the river discharge and a relatively minor cost for the ocean discharge).

Public values: These are constantly changing and there is a progressive increase in the desire for having less impact on the environment. These changes in public view result in new standards being promulgated concerning the level of impact we should not exceed. This is likely to continue as younger generations, who have grown up with our negative impacts on the environment reaching lifestyle and life-threatening levels, being more concerned about those impacts than previous generations. As they become the decision makers of society it is likely they will demand higher standards. We should be selecting an option that recognises this and doesn't just meet the standards of today. We should exceed today's standards so that the readily anticipated higher standards of tomorrow don't require yet another revamp of our wastewater system.

Persistent pollutants: There is considerable uncertainty about the impacts of some of the chemicals we use. These include persistent organic pollutants but metals as well. Discharge to the river and the ocean both disperse contaminants in a way which makes them virtually impossible to recover or manage. In contrast, appropriate (in terms of quantity of water applied to avoid leaching) discharge to land will result in any persistent contaminants being contained within a known area. If any become problematic there is some chance of recovering them or at least of keeping them isolated and managing the land accordingly.

Beneficial use: Obtaining greater benefit from the use of resources is desirable especially when doing so can simultaneously decrease negative effects of the disposal of those resources. It is completely out of step with the City's EcoCity Strategy to be just throwing resources away such as by pouring wastewater into the river or ocean.

Economic potential: A solution which creates economic opportunity and decreases the risks to current or potential economic activity is more desirable than one which doesn't do these things. Discharging to water has potential to harm tourism and possible inshore fisheries/shellfish operations and has no potential for creating a tourist attraction. It also has no potential to create new economic activity in the way a land discharge scheme does.

A system which can contribute positively to biodiversity restoration is considered more sustainable than one which doesn't, especially given the almost complete destruction of wetland habitat in the lower Manawatu. Only the discharge to land option that we have proposed does so on any significant scale.

Which option has the right balance between environmental protection / impacts and community affordability?

Only options with substantial discharge to land have the right balance since full discharge to river or sea are unacceptable to us. Discharge to the river or sea both enable continuation of the thinking that we can just throw it away without further effect on us and would provide little or no incentive for people to take measures to minimise the amount of wastewater they create.

Discharge to the ocean not only received little public support during the last consultation but it was also ranked least preferred option of nearly half (44%) of respondents. The discharge to river also had a considerable proportion (23%) of respondents saying it was their least preferred option.

In contrast, those options involving substantive discharge to land were not only more favoured but also the fewest respondents ranked these as their least preferred option (7% for option 3, 97% discharge to land, and 1% for options 4, 45-55% discharge to land).

Sustainability in your home

Please tick which measures you would use to reduce your wastewater at home.

___ Remove insinkerator - don't have one, use a compost and worm bin instead
_√_ Greywater tank
_√_ Water reducing showerheads and taps
_√_ Composting toilet
_√_ Lower energy appliances
_√_ Urine separating toilets
_√_ Water metering
___ None of the above

Thank you.

Dr. Chris Teo-Sherrell
9/5/2021

Palmerston North City

Nature Calles – Wastewater Discharge

Submission to Palmerston North City Council (PNCC)

From

Manawatu Chamber of Commerce (MCoC)

Manawatu Chamber of Commerce
Unit 9a, Northcote Office Park
86, Grey Street
Palmerston North
4410

8 May 2021

Mobile: 021 0533071 Email: amanda@manawatuchamber.co.nz

Contact People: Amanda Linsley, CEO, Manawatu Chamber of Commerce

Blair Alabaster, Chairperson, Manawatu Chamber of Commerce

Manawatu Chamber of Commerce Board Members: Ed Teece, Paul O'Brien, Steve Davey, Lisa Matena, Matthew Jeanes, Caren Bailey, Cam Hadfield, Adrian Doyle, Rahui Corbett and Alex Boustridge.

1. The Manawatu Chamber of Commerce ("MCoC") is a 440+ Business Member organisation, that represents a significant proportion of the City and Region's GDP.

2. This submission is presented to Council by the MCoC Board after consultation with our Advisory Board and on behalf of our Members.

Nature Calls – Waste Water Discharge

3. MCoC thank PNCC for the opportunity to consult on this matter.

4. MCoC acknowledge that the treatment of our wastewater is the biggest environmental and financial decision that the city needs to make in the coming years. The decision will affect the treatment of our wastewater for up to 35 years.

5. MCoC understand that whilst this consultation is ongoing, the likelihood is with the changing legislation (Three Waters Bill) at a national level, by 2025 the Council will likely no longer be responsible for the delivery of the three waters and services to users. However, Council is still

required to continue with the Nature Calls project until these changes are implemented. We understand that Resource Consent is required to be lodged with Horizons Regional Council prior to June 2022. We are concerned that this consultation and the outcome (and cost) thereof will ultimately have to be revisited given the changing legislation as above.

6. MCoC note that from a business perspective, the costs involved, regardless of which option is chosen, could be quite significant given that these businesses will also have to pay 'per pan'.

7. MCoC have received differing views from our Membership with regards to the three (3) discharge options that have been put forward for consultation. However, we understand from the previous consultation that the discharge to ocean was the least supported option.

8. MCoC are unable to put forward a collective or clear majority view point with regards to the preferred option as a result of the differing views from our Membership.

9. MCoC believe that whatever option is chosen the treatment should have the highest treatments available in New Zealand for that option.

10. MCoC urge PNCC to continue consultation with all stakeholders across the wider Region, especially with those communities who would be most affected.

11. MCoC would like to see some direction from Council to businesses as to how they could reduce their wastewater and improve sustainability.

Summary

There are a lot of unknowns at present with regards to legislation and where responsibility for the Three (3) Waters will ultimately lie. At this stage MCoC are unable to put forward a collective preferred option, due to the differing views of the MCoC membership.

Yours sincerely

Signed on behalf of the Manawatu Chamber of Commerce Board
by;

Amanda Linsley
CEO
Manawatu Chamber of Commerce

Palmerston North City Council

'Nature Calls'

Submission 2021

Organisation: Bainesse/Rangiotu Community Committee

We do wish to speak to Council in person about our feedback.

Evidence from around the country is that Long Term land based discharge is not working. Eg. Feilding (continual bogging), Rotorua (trees substandard).

We support option 3 – with the highest level of treatment **AT ALL TIMES** and then discharge 5km out to sea. Being 5km out will be far enough away from the tidal wash and currents along the coastline.

The standard **must be built to last 50 years.**

Alan Horsfall (chairman)
RD7
Palmerston North
email: a.j.horsfall@xtra.co.nz

Thank you on behalf of our community,

Bainesse/Rangiotu Community Committee

6 May 2021

Grant Smith
Mayor
Palmerston North City Council
Private Bag 11034
Manawatū Mail Centre
Palmerston North 4442

Emailed to: naturecalls@pncc.govt.nz

Dear Grant

Submission from the Manawatū District Council (MDC) to the Short List of Options for the Palmerston North City Council's (PNCC's) Wastewater Treatment Plant

Thank you for the opportunity to provide feedback on the short list of options for the "Nature Calls" project looking at the future management of wastewater in Palmerston North.

In our submission to PNCC's 10 Year Plan 2018-2028, MDC noted its support for any upgrades to the Wastewater Treatment Plant that improve the state of the Manawatū River, in accordance with the Palmerston North City Council's responsibilities under the Manawatū River Leaders' Accord. MDC reiterates our support for options that remove wastewater discharges from the Manawatū River. MDC offered to share its learnings in relation to the re-consenting of the Manawatū Wastewater Treatment Plant in Feilding with PNCC. This offer is ongoing.

We understand that PNCC is seeking feedback on which of the three shortlisted options best meet submitters prioritised values; is the most sustainable solution for Palmy and the region; and strikes the right balance between environmental protection/impacts and community affordability. As a local authority that has a purpose to promote the social, economic, environmental and cultural well-being of communities in the present and for the future, this submission does not attempt to assign priority to these different values. However, general feedback is given that may assist the elected members of PNCC in their decision-making.

MDC obtained a new consent for the Manawatū Wastewater Treatment Plant in Feilding in November 2016. The consent granted to MDC for the discharge of treated wastewater to the Ōroua River is only for a period of 10 years and includes requirements around land discharges to reduce discharges to water. MDC's discharge consent is very restrictive has a very low level of compliance tolerance for nitrogen levels which means that the discharge of treated wastewater from the Manawatū Wastewater Treatment Plant into the Ōroua River is sometimes restricted when flow rates in the river are higher than the consented low flow levels. MDC encourages PNCC to ensure that the compliance limits for nitrogen and phosphorus be based on robust science. The trigger for the low flow cut-off needs to be based on scientific analysis of the sensitivity of the receiving environment and set at a level that is appropriate for avoiding ecological harm. PNCC must then commit to not discharging to the Manawatū River during low flows which may require a land area in between that proposed for option 1 and option 2. This commitment will underpin the ecological, cultural and aesthetic values of the Manawatū River.

MDC questions why, under Option 1, only 75% of treated wastewater would be discharged to land during low flows. The Manawatū Wastewater Treatment Plant in Feilding achieves 100% discharge of treated wastewater to land during low flows (defined as the half median flows or 3.49 m^3/sec) in the Ōroua River.

MDC supports the proposal in Options 1 and 2 to further treat the wastewater by passing it through a wetland and/or land passage before it enters the Manawatū River. While Option 1 is likely to be cultural unacceptable to iwi and hapū in the Manawatū District, given the reliance on river discharge, MDC recognises that this further treatment is in recognition of these cultural concerns. The treatment by way of wetland or land passage is also necessary to meet the requirements of Horizons One Plan. MDC acknowledges that the goal for iwi is to avoid all discharges of wastewater to the Awa. However, we recognise that this is not likely to be feasible or realistic when balancing all factors, including affordability.

Option 2 is likely to be the most culturally acceptable in terms of impacts on the mauri of the Manawatū River. However, given the amount of land that must be acquired under this option, it is possible that it may include land that is culturally significant to Māori. MDC notes PNCC's concern about the area of land required for the irrigation of treated wastewater under Option 2. This is a valid concern given PNCC's obligations under the National Policy Statement for Highly Productive Land.

The land that receives irrigated treated wastewater from the Manawatū Wastewater Treatment Plant in Feilding is currently operated as a pasture based cut and carry operation, in accordance with the conditions of the discharge permit. This land produces a significant amount of dry matter that supports food production elsewhere. MDC's permit also allows for the land application area to be grazed by young cattle and/or sheep. MDC therefore considers its irrigation operations for the Manawatū Wastewater Treatment Plant in Feilding as a "resource recovery" operation rather than being just wastewater disposal or an unproductive use of land. PNCC will need to consider the productive potential of the land that is to be acquired under this option and whether the proposed use is, on balance, the best use for this land. The comments made above in relation to setting compliance limits for nitrogen and phosphorus and the low flow limits are also relevant to Option 2.

As noted in the commentary on Option 3, this option is not culturally acceptable to the iwi and hapū in the Manawatū and Horowhenua.

Any technical questions on our submission may be directed to MDC's General Manager – Infrastructure, Hamish Waugh (email: Hamish.Waugh@mdc.govt.nz).

We would like to speak to our submission.

Yours sincerely

HWorboys

Helen Worboys
Mayor
On behalf of the Manawatū District Council

Palmerston North City Council
NATURE CALLS

Joint Submission from the Food and Fibre Forum and Federated Farmers of New Zealand

Food and Fibre Forum Members

- *Peter Wells (Chair)*
- *Braeden Whitelock*
- *Paul Olsen*
- *James Stewart*

Federated Farmers of New Zealand

- *Coralee Matena - Regional Policy*
- *cmatena@fedfarm.org.nz*

FEDERATED FARMERS OF NEW ZEALAND

CONTENTS

SUBMISSION

1. This submission is a joint submission from the Food and Fibre Forum and the Manawatu Rangitikei Province of Federated Farmers, hereafter jointly referred to as ‘farmers’.

2. Unless otherwise referenced, the detail used to populate this submission has been taken from the following reports:

    i. Horizons Regional Council State of the Environment Report 2020
    ii. New Zealand Wastewater Sector Report October 2020 – prepared for the Ministry for Environment by BECA, GHD, Boffa Maskell New Zealand
    iii. October 2018 Boffa Miskell Report – Cost of upgrading Wastewater to meet NPS
    iv. Ministry for Environment – Three Waters Reform Presentation – April 2021
    v. Bradley, J. Maori cultural considerations in developing and operating wastewater systems – case history experiences.

te awa, te tangata, te whenua

3. We appreciate this opportunity to feedback to the Palmerston North City Council (Council) Nature Calls project. We thank Council for their willingness to work with farmers as the project develops, both prior to this consultation but also for the remainder of the project.

4. Nature Calls has the potential to adversely impact the awa individually (recognising that it is an entity), mana whenua and also the communities with an affirmation with the awa because of where they/their families reside. We recognise that the majority of those impacted by this proposal will reside outside of Council boundaries.

5. As Council Governance is elected from its ratepayer base, we are concerned that Council may aim to represent only the interests of City ratepayers in order to minimise any long term adverse voting impacts from decisions made. We caution Council against taking a narrow view on effects, noting that it does not align with Council’s obligations under, te tiriti, the Resource Management Act, or wider Government and Regional Council regulations.

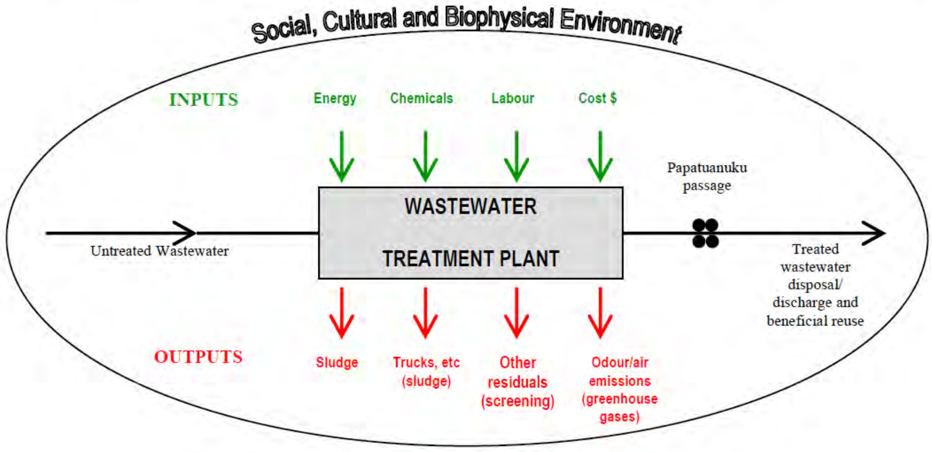
6. Sustainable management is important to the regions farmers and we are proud of the commitment that the primary production industry has made to the responsible management of its resources. Our rural landowners, farmers and horticulturalists take great pride in their work, the stewardship of the land, and their economic contribution locally and nationally. Farmers also appreciate the generational interdependence on the awa and the whenua, and the importance of protecting these assets in the long term.

Te Ao Māori

7. We understand that the Te Ao Māori position on human waste that it should not discharge directly to water, no matter how well it is treated. As shown in Figure 1, Applications to provide for this in other Districts require the waste to pass via Papatuanuku (earth mother) in a rock channel, riparian strip or pond before discharge to surface or marine waters.

8. We also appreciate the importance of mana whenua governance of the awa, noting that this has been formally recognised by the Manawatu River Leaders Forum.

Figure 1: The Generic Integrated and Holistic Approach to Wastewater Management



New Zealand regulation

9. Wastewater management in New Zealand is multi level, with various national and regional legislation considerations.

Resource Management Act

10. The purpose of the Resource Management Act 1991 (RMA) is "…*to promote the sustainable management of natural and physical resources*" where sustainable management means: "…*managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety*…"

11. The RMA is effects based and as such, "the assessment of new and existing water and wastewater infrastructure on the natural and physical environment needs to focus on the various types of effects that are encompassed in the meaning of effect as set out in this legislation. This approach clearly puts the focus on the effects of the water / wastewater infrastructure and service on the natural and built environment, including people and communities, rather than on the technology and infrastructure itself".

12. Section 104 of the RMA sets out the matters for a consent authority to consider in relation to an application for resource consent. This includes consideration of the actual or potential effects on the environment, relevant provisions of policy documents and any other matter considered relevant.

National Policy Statement Freshwater Management (NPSFM)

13. The NPSFM sets out objectives and policies of freshwater management and provides direction to regional councils as to how to manage freshwater. This includes each council developing objectives and values for each defined freshwater management unit, through consultation with local iwi and the community. From these objectives, water quality and quantity measures will implemented in order to meet identified bottom lines.

14. In 2018, Boffa Miskell undertook an analysis of the costs by District to bring Wastewater Treatment Plants up to the standard required in the 2017 NPS. The assessment indicated that 24 wastewater treatment plants in the Manawatu required upgrades in order to meet the water quality standards in the NPSFM.

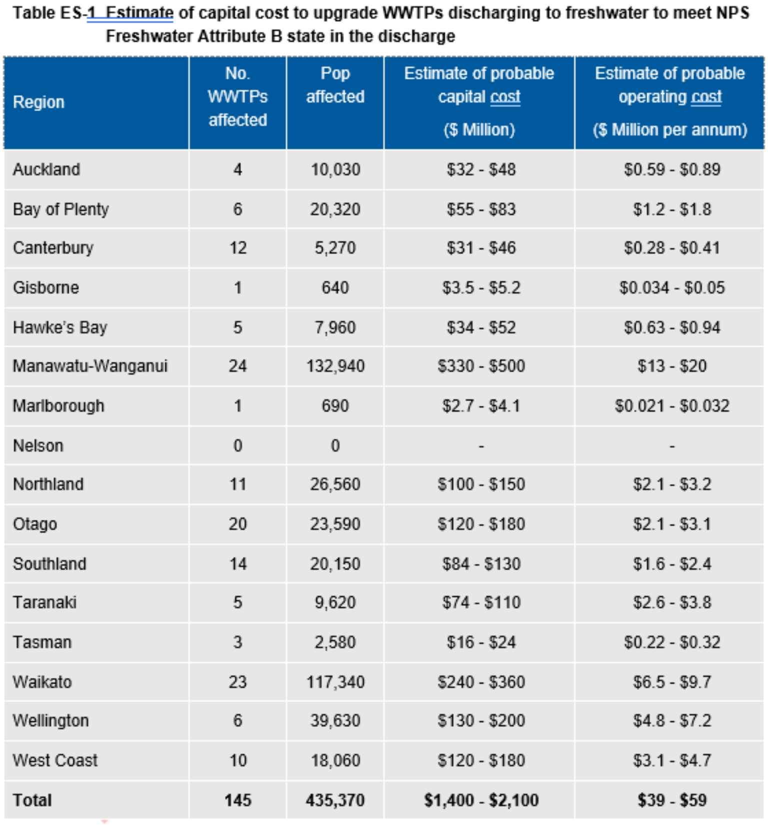


Table ES-1 Estimate of capital cost to upgrade WWTPs discharging to freshwater to meet NPS Freshwater Attribute B state in the discharge

Region	No. WWTPs affected	Pop affected	Estimate of probable capital cost ($ Million)	Estimate of probable operating cost ($ Million per annum)
Auckland	4	10,030	$32 - $48	$0.59 - $0.89
Bay of Plenty	6	20,320	$55 - $83	$1.2 - $1.8
Canterbury	12	5,270	$31 - $46	$0.28 - $0.41
Gisborne	1	640	$3.5 - $5.2	$0.034 - $0.05
Hawke's Bay	5	7,960	$34 - $52	$0.63 - $0.94
Manawatu-Wanganui	24	132,940	$330 - $500	$13 - $20
Marlborough	1	690	$2.7 - $4.1	$0.021 - $0.032
Nelson	0	0	-	-
Northland	11	26,560	$100 - $150	$2.1 - $3.2
Otago	20	23,590	$120 - $180	$2.1 - $3.1
Southland	14	20,150	$84 - $130	$1.6 - $2.4
Taranaki	5	9,620	$74 - $110	$2.6 - $3.8
Tasman	3	2,580	$16 - $24	$0.22 - $0.32
Waikato	23	117,340	$240 - $360	$6.5 - $9.7
Wellington	6	39,630	$130 - $200	$4.8 - $7.2
West Coast	10	18,060	$120 - $180	$3.1 - $4.7
Total	**145**	**435,370**	**$1,400 - $2,100**	**$39 - $59**

National Environmental Standards for Freshwater Regulations 2020

15. The Essential Freshwater package, including the Freshwater NES, that came into force in September 2020 introduced strong new policies and regulations to protect natural wetlands on a national scale. The core intent of the wetland policies is to provide strong protection for natural inland wetlands, there is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.

16. The Horizons Wetland Inventory maps known inland wetlands. Attachment 2 shows where these wetlands are with regard to the Nature Calls project.

Three waters

17. In July 2019, Cabinet agreed to the Three Waters Regulatory reform. The intent of the reform is to consolidate/cluster water services nationally with a goal of sharing resources leading to the possible regional treatment of the three waters. A key pillar of the reform programme, is the protection and restoration of water quality in New Zealand's lakes, rivers and beaches.

Regional regulations

Horizons One Plan provisions for Territorial Authorities

18. Policy 3-4 of the One Plan requires Territorial Authorities to pay particular attention to the benefits of the retention of Class 1 and 11 Versatile soils for use as production land in their assessment of how best to achieve sustainable management. Production land as referred to under Objective 3-4 and defined in the RMA 1991, means any land and auxillary buildings used for the production (but not processing) of primary products (including agricultural, pastoral, horticultural, and forestry products).

19. Cumulative nitrogen leaching maximums in the Horizons One Plan, designed to protect surface water quality, set stringent standards for nitrogen loss. Landowners in targeted catchments are tasked with making substantial changes to farming practices in order to comply with required maximums. Horizons Plan Change 2 confirmed that land receiving human waste discharges were not exempt from these requirements.

Ground water

20. In the Horizons region, groundwater is widely utilised, with around 8,700 bores located throughout the Whanganui, Rangitīkei, and Manawatū catchments. Horizons groundwater quality monitoring from 2012 to 2017 shows nitrate concentrations are generally below the drinking water standard, with some elevated levels in Horowhenua and Tararua. Trends for nitrate concentration are generally indeterminate or improving, with one bore north east of Levin showing a declining trend.

Location and extent of aquifers

21. Monitoring of groundwater levels is important to check for changes over time, and to ensure this important resource is appropriately managed. The map adjacent shows the location of aquifers relevant to the Nature Calls project.

Contaminants of Emerging Concern

22. Contaminants of Emerging Concern (CECs) are chemicals and other substances that have recently been discovered in natural water bodies and can lead to potentially adverse ecological and human health impacts and are not currently regulated for. CECs are not necessarily new chemicals and can include endocrine disrupting chemicals (e.g oestrogens), microplastics and PFAS and PFOS.

23. PFAS recently become a focus following the discovery of PFAS in soil and water on and around the New Zealand Defence Force Base Ohakea, near Bulls. Widely used since the 1950s in commercial and industrial products such as non-stick cookware and food packaging, PFAS resist heat, stains, grease and water, making them very effective for smothering petroleum fires. However, because of these properties they are difficult to break down and have a tendency to accumulate in people, animals and in the environment. These foams have been widely used in specialised firefighting foams at airports and training bases throughout New Zealand.

24. The long-term effects of PFAS exposure are not well-known. Of particular concern, several Australia studies regarding PFOS and PFAS removal found that conventional treatment processes have limited success in removing PFAS, thus PFAS can be present in treated discharges and biosolids. This is of particular concern for Options 1 and 2, given that the output from the treatment plant will be discharge to the river or to land.

Antimicrobial Resistance

25. Internationally, concern has increased regarding the presence of many chemicals at low concentrations within the water environment. With so many different substances in use, many chemicals reach surface waters via urban wastewater treatment plants applying traditional treatment methods. Research has shown that many of the chemicals in waste waters now arise from use in our homes and leaching from products or are directly added in the case of cleaning products and excreted pharmaceuticals. Concern is growing over the presence of mixtures of chemicals in the environment — the so-called ‘cocktail effect’ — that may be impacting aquatic life.

26. There is concern internationally that use and excretion of antimicrobials, such as antibiotics, in human and veterinary medicine has resulted in the evolution of resistant bacteria, viruses and microbes. which can cause disease and are now resisting medicinal treatment. In response the World Health Organisation is investigating whether urban waste water treatment plants could be transferring AMR genes to the environment, to reach humans.

Soil

27. In New Zealand, highly versatile soils are known as Land Use Capability (LUC) Class 1 and 2 soils. These are the best quality soils, considered to be prime land for horticulture and agriculture. Horizons is one of four regions, including Canterbury, Taranaki and Waikato, where LUC Class 1 and 2 soils predominantly occur. Attachment 3 shows the soil classes in the lower Horizons region.

NPS High Productive Soils

28. The NPS High Productive Soils has been consulted, however we are yet to see the outcome of the consultation. As proposed, Objective 2 aims to maintain the availability of highly productive land for primary production for future generations. Council supported the draft NPS when consulted, noting that it would "*bring some much needed recognition for the importance of protecting high class versatile soils for productive purposes. Given the recent urban growth pressures that New Zealand is facing, a NPS High Productive Land provides some much needed counter balance to the NPS Urban Development to ensure that valuable finite soil resources are adequately protected*".

Climate

29. Horizons climate modelling forecasts:
    - The regions temperatures are likely to increase 0.7 to 1.1 by 2040 and up to 3.1 percent by 2090.
    - Summer flows in the Manawatu River are projected to decrease 14% by 2092 and the number of high flow events are likely to increase.
    - Annual average precipitation is predicated to increase 15 to 20% in the north of the region and decrease 20% in the south by 2090.
    - Further modelling suggests a greater pace of works will be required to offset the impact of climate change on sedimentation of rivers in the long term

Value of primary production to the region

30. The agriculture sector is incredibly important to the Manawatu-Whanganui regional economy. In 2018 the agriculture, forestry and fishing sector directly contributed $1.02b and 11,970 jobs to the Manawatu-Whanganui economy. This is 11.3% of total Gross Domestic Product (GDP) and 10.5% of all jobs. Information from DairyNZ indicate that if as proposed 1700 ha was taken out of dairy production that would equate to $13.6m less income flowing through the region per year.

31. The Central Economic Development Agency (CEDA) launched the Manawatu Agritech Strategy in late 2019 to recognise and promote Manawatu's leadership in agritech and agrifood on a global platform. The strategy recognises the significance of the agrihub that the Manawatu is built upon, notably the existing educational, science and research facilities and the significance of the pastoral landscape that it sits within.

NATURE CALLS – THE OPTIONS

32. We understand that while three options have been put forward for feedback, the wider set of options consulted by Council remain under consideration. We note that the three consulted are the top three in terms of scoring the highest across a range of criteria and values.

33. Given the potential and varying impact of the options on rural landowners, farmers have been frustrated with the lack of detail Council have shared to date about what each option will look like. We consider it is hard to understand the full impact (costs and benefits) of each option without the detail. Despite this, the options analysis below

draws upon the key and common concerns raised by farmers/rural ratepayers, about the shortfalls or otherwise of each option. The discussion below is supported by the cost benefit analysis shown in Table 1.

Option 1 – Discharge to River

Majority of treated wastewater is discharged to the Manawatu River via a wetland and/or land passage, with significantly improved removal of contaminants including phosphorus and nitrogen.

34. We understand that Option 1 largely aligns with Council's current practices, or the status quo. The majority of treated wastewater will be discharged to the river, albeit with improved treatment. However we also note that when the river is at low levels, about 75% of treated wastewater will be applied to land. Council have estimated that around 670ha of land will be required for this application.

35. Farmers do not consider Option 1 to be a viable option for the following reasons.

Events

36. The Wastewater Sector Report notes that untreated or inadequately treated wastewater discharged from failed wastewater management in response to various 'events' contains elevated levels of contaminants such as nitrate and phosphorus as well as pathogens, viruses and protozoa that can cause harm to humans and the surrounding environment. Reference to the conclusions of a study on the performance of New Zealand wastewater networks concluded that given the multiple ways in which a network can overflow, and the openness of the system, complete elimination of wastewater overflows from networks is likely an unrealistic expectation". We are therefore concerned that Option 1 be subject to the same events as today, resulting in multiple events to the detriment of te awa, mana whenua and those downstream.

37. We understand that Council have attempted to provide for the Papatuanuku passage by including a wetland which wastewater will pass through before reaching the river. We are however concerned that in the likelihood of an 'event' the wetland will likely be bypassed resulting in direct discharge to the river. We note that this does not uphold the Maori world view of how wastewater should be provided for, nor does it protect mahinga kai.

Use of existing infrastructure

38. We understand that Council are intending to utilise their current wastewater plant, while making significant improvements. Farmers are concerned that Council may be inadvertently limiting the projects possibilities, as the location and size of the current plant is problematic. Farmers are concerned that upgrading will result in another short term solution, as pressures on growth will impact the longer term viability of the plant. Farmers are also concerned that a wastewater treatment plant adjacent to the City, continues to silo the treatment of the City's waste, and therefore does not align with the future direction of the Government with regard to the three waters.

Climate change considerations

39. Horizons projections with regard to climate change, place further uncertainty on the ability of Option 1 cope with future needs. For example, we understand that climate

change will mean rainfall will be more frequent. In urban areas — where rainwater drains into the stormwater, it will mean greater surface water flooding and overflow at urban waste water treatment plants, with untreated sewage flowing into the river.

Economic impact on neighbours and those downstream.

40. Farmers are concerned that Council's intention to continue to discharge to the river, will in time negatively impact their businesses. New Zealand primary producers routinely face pressure from international markets to comply with ever increasing food safety standards, but also private standards based on matters such as environmental footprint or ethics.

41. The World Trade Organization Committees for Sanitary and Phytosanitary (food safety and health) and Technical Barriers to Trade (non-health/safety technical measures) are burdened by complaints put forward from countries about unfair protectionist measures enforced by some markets. Commercial risks of product contaminated with human waste (perceived or actual) are a very real risk to farmers.

42. We understand that in response to concerns, farmers are well placed to ensure that liability notifications are in place before Council progress. Council will also have to consider the purchase of all implicated land, ie land receiving discharge but also land adjacent to the river and also within the spillways.

Impact on high productive soils, wetlands

43. Noting the information set out earlier, it is likely that the land Council will seek for discharge to land will either be highly productive soil or contain a wetland as detailed by Horizons inventory and therefore subject to the NES regulations. The fiscal and environmental impacts of the loss of land or loss of wetland are likely to be significant.

Option 2 – Land based discharge

Hybrid discharge between land (55%) and the Manawatu River (45%)

44. Many of the rationale outlined for Option 1, regarding farmer opposition/concerns, are applicable for this Option also. We have refrained from restating these matters here, however the duplication is reflected in Table 1.

45. Farmers also have concerns that the size of land required for this option is unreasonable and unworkable. We understand that there are local wastewater discharge to land operations that operate on a much smaller scale with varying levels of success. This includes a significantly smaller operation in Shannon that is currently operating efficiently however has required adjustments in management made possible by having an experienced farmer on site to appreciate the flow on consequences to the land of the decisions made.

46. Conversely, we understand that a larger scale discharge to land operation in a neighbouring District, is not enjoying the same level of success. We understand that issues include (*not an exhaustive list):*

- aerosols and odour concerns and closely aligned with this, concerns with actual vs reported/measured spray drift;
- occupational health and safety implications for staff on neighbouring properties;

- overflow of wastewater onto neighbouring properties and subsequent disadvantages to the neighbouring farmer (withholding period for implicated stock);
- Discharging direct to a neighbouring stream and groundwater contamination;
- Elevated water table leading to pugging issues;
- Inability to cope with weather events;
- Underestimation of the size of the land parcel required;
- Concern with cut bales – traceability/use/need or demand for these; and
- Impact on land values.

47. These lessons are very real to the current proposals, given that the land that could be sought for discharge to land is previously drained swamp land. Farmers report that the water table on their farms is already high, and therefore do not consider the land appropriate to take the level of discharge required.

Option 3 – Discharge to Sea (Growth)

Treated wastewater is discharged to the ocean

48. Given the risks associated with discharge to the river or application to land, farmers consider that there is real benefit in investigating the viability of Option 3, however with a slight refocus. Farmers consider that a practical revision of Option 3 could be something like that illustrated in Attachment 1.

49. This option looks to re direct the wastewater away from the river to a treatment facility located at a more appropriate site. Storage ponds are located on the current site and also at the proposed facility. The intention is that no wastewater is discharged to the river. The option also provides for the ability for the site to coordinate drinking water and stormwater facilities, for the Council and also surrounding Districts.

50. As set out below, we consider an alternative approach would provide benefits on a community, regional and national scale. Benefits include:

    a. No discharge to river, no impact on groundwater, safe drinking water.

    b. No liability risks from landowners/Council. No loss of productive soils.

    c. Ability to leverage funding from Central Government and also share costs with neighbouring Districts.

    d. Ability to re-design the treatment facility, to take on board national and international lessons and provide for a facility that is future enabling/adaptive

    e. Co-Governance with iwi – an ability to redesign this project with iwi co-governance. Rather than try to make a culturally inappropriate solution fit, redesign the approach with iwi guidance/direction/leadership.

Leveraging *of the Three Waters Reform*

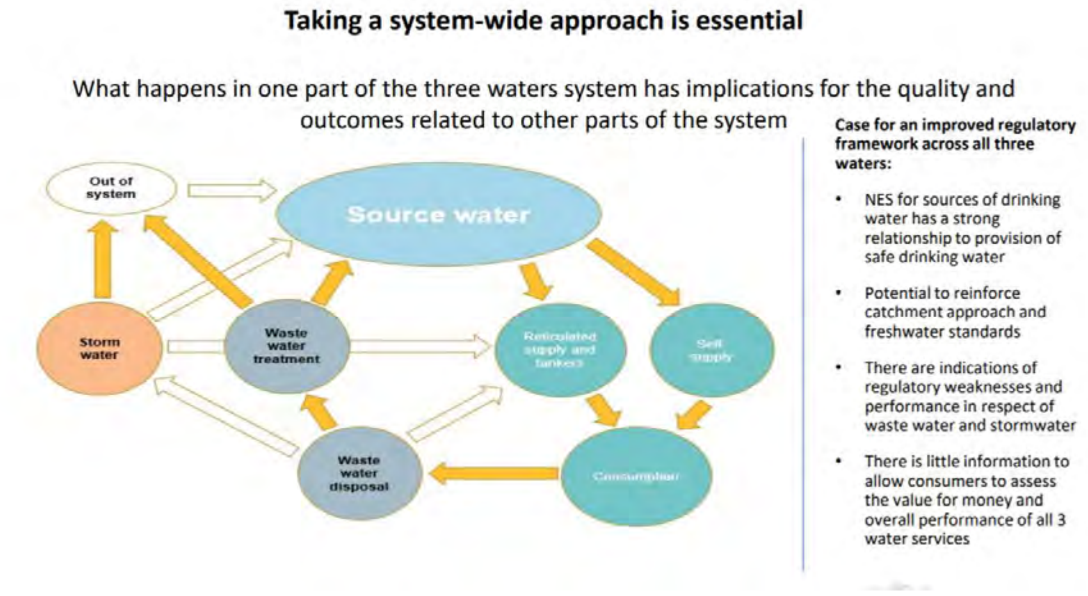
51. The Governments proposed Three Waters Reform, aims to cluster services for waste, storm and drinking water, to leverage resources across Territorial Authorities. The

alternative option proposed, aligns with the intent of the three water reform, and will enable neighbouring Districts to utilise the infrastructure developed.

52. In their 2021 draft Long Term Plan's, Rangitikei District Council and Manawatu District Council signal the need for wastewater spending as a result of failing current infrastructure and/or growth within their Districts. Council is in a position where it could redevelop Option 3 to provide a more centrally located facility designed to accommodate the needs of surrounding districts for the three waters.

53. We understand that the Hawkes Bay region is progressing options to regionalise their three waters infrastructure. We also understand that their early buy in to the programme has been rewarded by Central Government with elevated levels of investment compared to those Councils who have not. We consider Council to be in a position where it could proactively work with surrounding District Council's to explore this opportunity in the short term, so to make use of any possible Government investment available.

54. The following diagram has been shared by Government to identify the benefits of a system wide approach to the three waters.



Taking a system-wide approach is essential

What happens in one part of the three waters system has implications for the quality and outcomes related to other parts of the system

Case for an improved regulatory framework across all three waters:

- NES for sources of drinking water has a strong relationship to provision of safe drinking water
- Potential to reinforce catchment approach and freshwater standards
- There are indications of regulatory weaknesses and performance in respect of waste water and stormwater
- There is little information to allow consumers to assess the value for money and overall performance of all 3 water services

Protection of soil resource

55. Option 3 provides for the protection of high productive soils. This aligns with Section 7 of the RMA, ensuring finite stock of land of high productive value is maintained for future generations.

Ability to comply with NPSFM

56. The 2018 Boffa Miskell Wastewater assessment indicated that 24 waste water treatment plants in the Manawatu will require upgrade in order to meet the water quality standards in the NPSFM. The ability for this project to remedy the failings of other plants is of significant benefit to this Council and neighbouring Councils.

Technologically adaptive solution

57. The New Zealand Wastewater Sector Report identifies potentials benefits for new wastewater projects. The proposed regional solution gives Council the opportunity to further explore the possible benefits of a technologically adaptive solution, for example:

    a. Biogas production – Biogas from anaerobic digestion process is used for hot water heating or power generation via co-generation engines.

    b. Biosolids drying - Christchurch City Council previously disposed of wastewater treatment plant biosolids by spreading them on forestry land and rehabilitating a closed landfill. A new strategy for biosolids management was required – and a thermal belt drying plant was developed. The Biosolids Drying Facility now provides valuable sources of nutrients and humus for land rehabilitation.

    c. An alternative treatment option could also leverage of international successes. In the Netherlands, the Amersfoort urban wastewater treatment plant receives domestic and light industrial effluent. The treatment process comprises physical treatment, and carbon, nitrogen and phosphorus removal. It uses innovative technologies to recover phosphorus and nitrogen from sludge for commercial nutrient use, producing a fertiliser as well as biogas. It is 100% energy self-sufficient and exports energy to power 600 city dwellings.

    d. The Wulpen urban wastewater treatment plant in Belgium includes more stringent treatments to remove phosphorus and disinfect the effluent. The treated water is of superior quality — similar to that of drinking water — is free of micropollutants and pathogens, and is used to recharge the acquifier.

Gaps – detail still required from Council

58. Given the significant gaps in the analysis provided, farmers seek information from Council to address the following:

    a. How has the MCA (multicriteria analysis) accounted for the full costs to human health (bathing, recreation, water abstraction, fishing), cultural costs and biodiversity (habitat destruction, degrading habitat, build up of pollutants in ecosystem)?

    b. How has the MCA accounted for the full costs to human health (bathing, recreation, water abstraction, fishing), social costs (loss of livelihoods, impact/dislocation on community/families), the economy (loss of revenue from productive land), and biodiversity (habitat destruction, degrading habitat, build up of pollutants in ecosystem)?

    c. How has the MCA accounted for the full costs (and benefits of avoided local impact) of human health (bathing, recreation, water abstraction, fishing), avoided social costs, the avoided economic impact, and relative biodiversity impact (avoided river and land pollution vs marine environment)?

Recommendations

59. The Food and Fibre Forum and Federated Farmers recommend that Council:

    a. Consider the negative impacts of Options 1 and 2 as identified by farmers;

    b. Recognise the potential benefits of a redesigned Option 3 to the Council, neighbouring Districts and nationally;

    c. Recognise the potential benefits from a redesigned Option 3 as a regional scale approach to managing the three waters;

    d. Commit to exploring Option 3 growth – Kotahi tangata, Kotahi otinga, to tatou heke mai;

    e. Continue to work with farmers as the Nature Calls project is progressed.

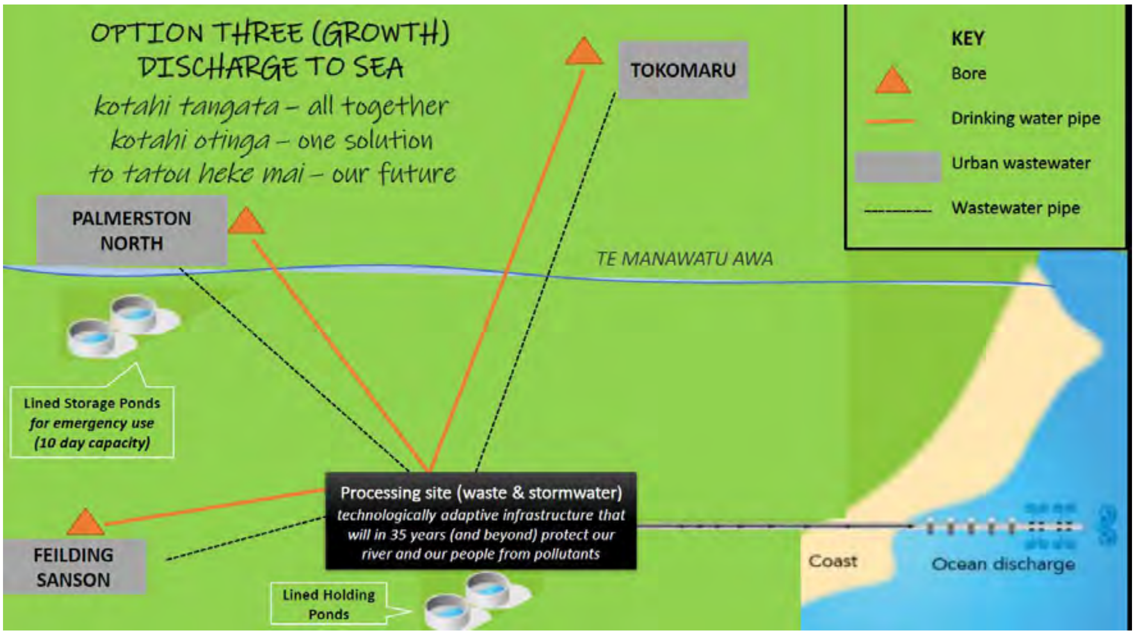
Table 1 – Options: Cost- benefit analysis

Weighting criteria

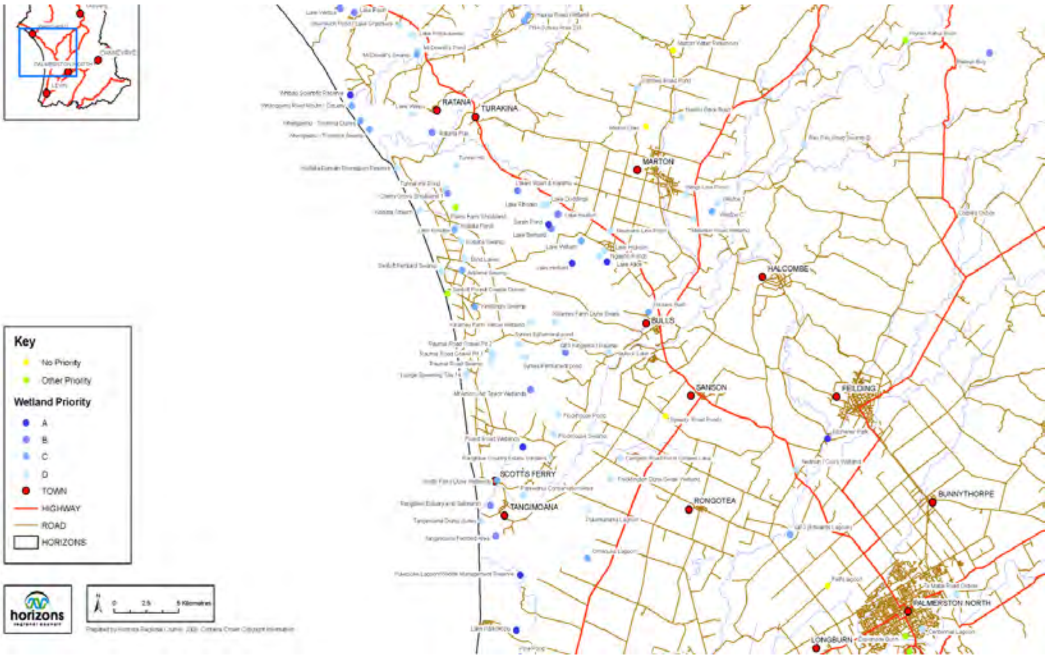
Negative impact	-10
Neutral impact	0
Positive impact	10

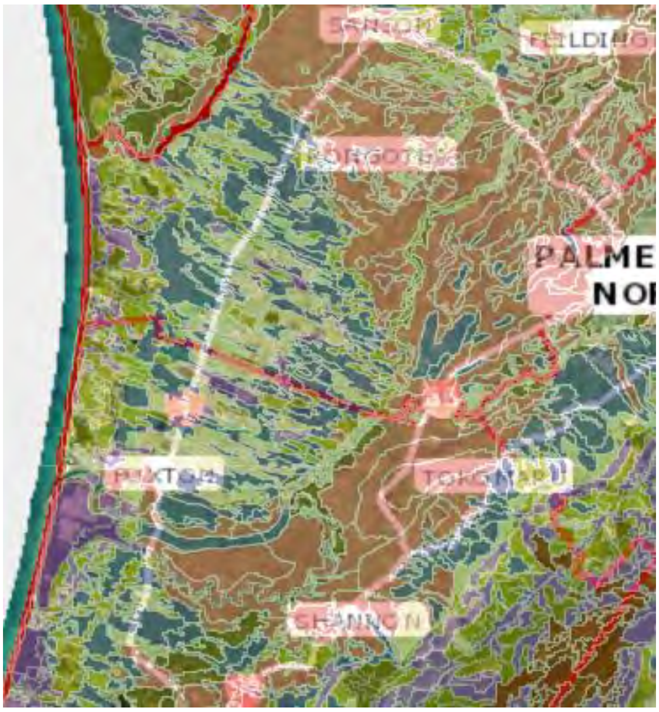
	River	**Land**	**Sea**	**Sea (Growth)**
Cost to PNCC	-10 PNCC have not factored in the cost of buying land off landowners (spillway land also)		0 Assume costs as previously forecasted	10 Potential to leverage from the Governments three waters fund
Cost to wider districts/ ability to provide for future regional approach	-10 Option will not be able to cope with growth/expansion at scale proposed.			10 Upgraded/centralised treatment plant could be developed from outset to provide for regional service
Cost to national/economy/trade	-10 Farm land lost for effluent discharge and also land adjacent to river or in spillway no longer able to be farmed		0 Status quo	10 Ability for new treatment plant to provide for three waters on a regional scale
Impact on productive land	-10 Farm land lost for effluent discharge and also land adjacent to river or in spillway no longer able to be farmed		0 Status quo retained	0 Status quo retained
Impact on te ao maori	-10 Lack of ability to provide for ‘events’. Untreated waste to river		-10 No papatuanuku passage	10 Ability for new treatment plant to provide for co-governance with iwi and input into culturally appropriate design
Alignment with Govt three waters	-10 Does not provide for three waters or wider regional approach			10 Treatment plant developed to provide for PNCC three waters but also neighbouring districts
Impact on sensitive catchments/wetlands	-10 Options both require discharge to land		0 Discharge to sea bypasses catchments	0
Public health considerations (drinking water)– ecoli, AMR	-10 Potential for groundwater loss, drinking water contamination		0 No impact on groundwater	0 No impact on groundwater
Liability issues	-10 Council risk from liability – future loss to landowners		0 No impact on landowner	0 Identify suitable site for treatment to avoid liability issues.
TOTAL	**- 90**		**-20**	**50**

Attachment 1 – Alternative Proposal



Attachment 2 - Horizons Regional Council Wetlands Inventory

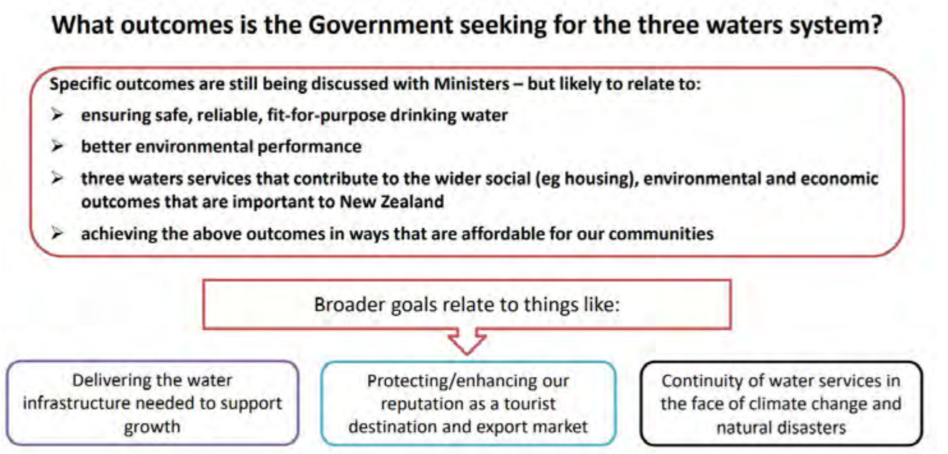




Attachment 3 – Soil classes

Soil classes - key

Attachment 4 – Three Waters Background



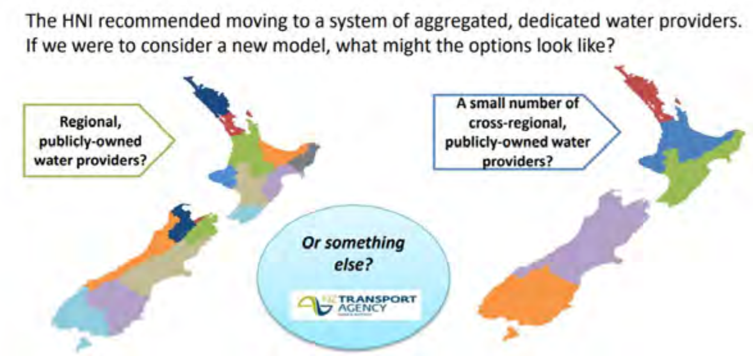
What outcomes is the Government seeking for the three waters system?

Specific outcomes are still being discussed with Ministers – but likely to relate to:

- **ensuring safe, reliable, fit-for-purpose drinking water**
- **better environmental performance**
- **three waters services that contribute to the wider social (eg housing), environmental and economic outcomes that are important to New Zealand**
- **achieving the above outcomes in ways that are affordable for our communities**

Broader goals relate to things like:

- Delivering the water infrastructure needed to support growth
- Protecting/enhancing our reputation as a tourist destination and export market
- Continuity of water services in the face of climate change and natural disasters

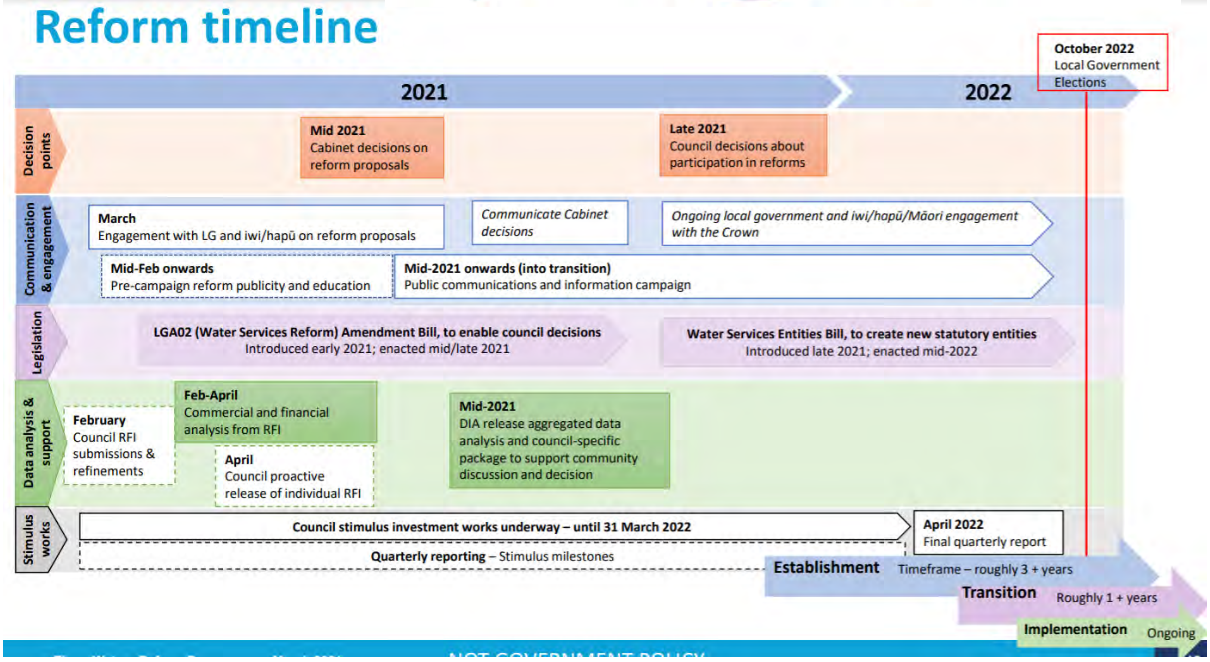


The HNI recommended moving to a system of aggregated, dedicated water providers. If we were to consider a new model, what might the options look like?

Regional, publicly-owned water providers?

A small number of cross-regional, publicly-owned water providers?

Or something else?



Reform timeline

October 2022
Local Government Elections

2021 **2022**

Decision points

Mid 2021
Cabinet decisions on reform proposals

Late 2021
Council decisions about participation in reforms

Communication & engagement

March
Engagement with LG and iwi/hapū on reform proposals

Communicate Cabinet decisions

Ongoing local government and iwi/hapū/Māori engagement with the Crown

Mid-Feb onwards
Pre-campaign reform publicity and education

Mid-2021 onwards (into transition)
Public communications and information campaign

Legislation

LGA02 (Water Services Reform) Amendment Bill, to enable council decisions
Introduced early 2021; enacted mid/late 2021

Water Services Entities Bill, to create new statutory entities
Introduced late 2021; enacted mid-2022

Data analysis & support

February
Council RFI submissions & refinements

Feb-April
Commercial and financial analysis from RFI

April
Council proactive release of individual RFI

Mid-2021
DIA release aggregated data analysis and council-specific package to support community discussion and decision

Stimulus works

Council stimulus investment works underway – until 31 March 2022

April 2022
Final quarterly report

Quarterly reporting – Stimulus milestones

Establishment Timeframe – roughly 3 + years

Transition Roughly 1 + years

Implementation Ongoing

Federated Farmers of New Zealand

Submission to the Palmerston North City Council on the Draft Long Term Plan 2021

14 May 2021

0800 327 646 FED FARM .ORG.NZ

SUBMISSION ON PNCC DRAFT LONG TERM PLAN 2021

To:	Palmerston North City Council submissions@pncc.govt.nz
Name of submitter:	Federated Farmers of New Zealand Murray Holdaway Manawatu/ Rangitikei Province President Paul Olsen Manawatu/ Rangitikei Province Vice President James Stewart Manawatu/ Rangitikei Province Executive
Contact person:	Coralee Matena Senior Regional Policy Advisor - Federated Farmers of New Zealand PO Box 945, Palmerston North, 4340 cmatena@fedfarm.org.nz

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1. The Manawatu-Rangitikei of Federated Farmers (Federated Farmers) welcome the opportunity to comment on the Palmerston North City Council Long Term Plan 2021. We acknowledge any submissions made by individual members of Federated Farmers.

2. We wish to be heard in support of this submission. Our preferred hearing time is on the morning of the 27th of May.

3. Federated Farmers also put forward a joint submission with the Food and Fibre Forum on the Nature Calls project. We would like our hearing time to be scheduled alongside the Forum's allocated hearing time.

SUBMISSION

2021 – Council position and impact on LTP

4. Federated Farmers appreciates that for Regional and District Councils alike, the 2021 LTP is heavily directed by external factors. Increasing costs to implement Central Government regulatory changes, coupled with the ongoing impact of COVID19 are untimely challenges for Councils. We appreciate that for many Councils, the pressure to invest in new and upgraded infrastructure while also maintaining existing infrastructure, is forcing tough conversations to be

had about nice to have services compared to core services. For our members, this conversation is long overdue.

5. We note the introductory comments from the Mayor with regard to the complexity of the current environment, the unknown future and the need to make tough decisions over the 10 years of the Plan. We also note the comments made in the Independent Audit Report with regard to the inconsistencies in the information proposed in the Long Term Plan compared to the Council's financial strategy. We note in particular the recommendation from the auditor that "*the Council needs to reduce levels of service, removing or deferring planned projects and increasing rates further*". We would support Council taking a hard line on nice to have projects in the short term and instead focus on key projects like the wastewater project and earthquake strengthening.

Rates – General comments

6. Rates are among the top ten operational expenses of a farming business. They are a source of considerable financial pressure for all farmers. Federated Farmers makes submissions on Annual and LTP's to ensure Council's exercise fiscal prudence, and consider affordability, fairness and equity issues when recovering rates (to the extent this is possible in land and capital value taxation systems).

7. Rates are a charge for services, and they are supposed to reflect the access to, and benefit derived by ratepayers from council services. This is a key principle, reinforced in 2019 by the Productivity Commission and a key provision in s.101 of the Local Government Act 2002 that sets out funding principles for local authorities. In practice though, Federated Farmers considers that the 'benefit principle' is often eroded by factoring in other considerations like 'affordability' or 'ability to pay', albeit without evidence about the real financial situations of individual ratepayers.

8. We therefore support the current rating differentials for wastewater and drinking water, which more fairly require those who are benefiting or utilising the activity to provide the required rating contributions.

Nature calls

9. Federated Farmers also supports developments to wastewater treatment as we have a number of members who have farms in proximity to the river, and therefore the condition of the river has a direct impact on them socially and economically. Federated Farmers has worked with the Food and Fibre Forum to put forward a joint submission to Council on the Nature Calls project. The submission is attached to this submission.

10. We consider Council to be well placed to reconsider the direction of the Nature Calls project, with a view to aligning with neighbouring Districts to create a regionalised solution for wastewater, and potentially also storm water and drinking water. We consider that this would enable Council to leverage funding from Central Government, while also developing a culturally inclusive (co-governed with iwi) future proofed three waters facility.

Manawatu/Rangitikei Federated Farmers thanks Palmerston North City Council for considering our submission.

FEDERATED
FARMERS
OF NEW ZEALAND

NATURE CALLS FEEDBACK FORM

Email to naturecalls@pncc.govt.nz – Feedback closes Sunday 9 May 2021

Submitter details	
Name:	**Lower Manawatu Scheme** **Peter Wells, LMS Chairman**
Address:	
Email Address: peterwells@lansdale.co.nz	
I wish to speak to this submission on behalf of this organization	

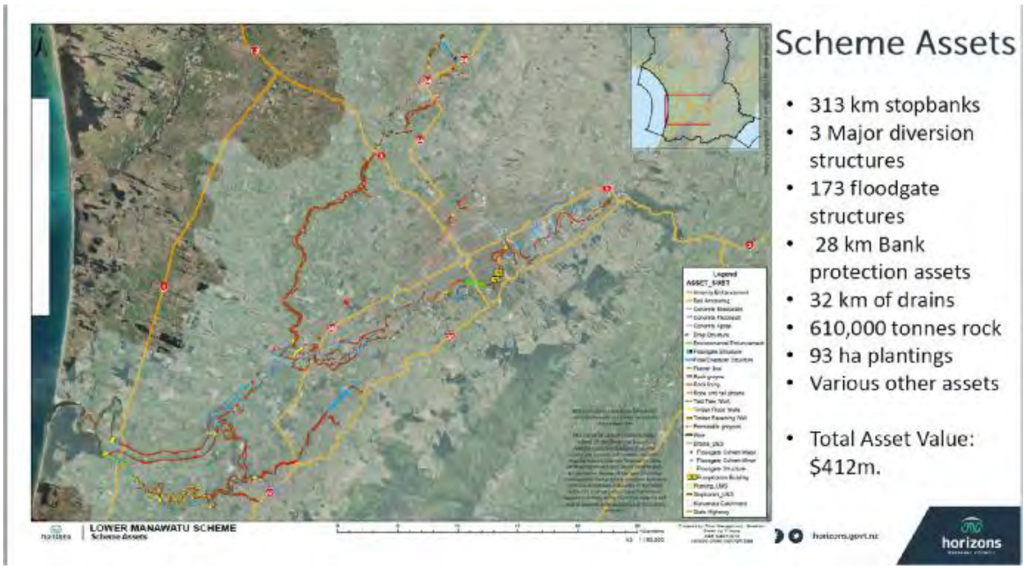
The Lower Manawatu Scheme (LMS) provides 100-year flood protection as a minimum for landowners in its geographic area. The Scheme has 412m in assets encompassing areas associated with the Manawatu River from the Manawatu Gorge to Foxton Beach. Option 1 & 2 under the PNCC Nature Calls Waster Proposal could have a significant impact on the workings of the scheme and its revenue used to finance the scheme.
Note: several other drainage schemes that would be affected by Nature Calls Proposal 1 & 2 won't have been consulted or even aware that their schemes and properties could be affected.

- The scheme has a significant investment in the area covered by the Nature Calls proposals and despite a submission dated July 13th, 2020, there has been limited consultation that we are aware of between ourselves or affected landowners by PNCC
- The LMS owns a significant area of the spillway and accretion that it leases to farmers. We are concerned that the continued discharge of treated waster water into the river could affect farmers' ability to sell their produce and meet their compliance obligations. Most farm compliance programs preclude the selling of any product that comes into contact with human wastewater. (Fonterra for example)
- We are also aware of farmers who own accretion and spillway land that could be affected
- If the accretion or spillway can't be grazed this could have an impact on river flows and result in additional siltation, putting at risk the 100-year flood protection requirement of the scheme.
- If farmers cannot derive their normal income from these areas we suggest it may be necessary to purchase these areas as part of the scheme.
- The proposal to irrigate wastewater to 1700 hs of farmland in the LMS catchment will affect water flow from drainage systems into the Manawatu River. This could include contaminants and nutrient loading from on-farm drainage systems
- There are known issues from the transfer of disease from birds to pastoral animals. We believe research needs to be put into this issue if wetland birdlife increases.

Summary

There are significant issues from the Nature Calls proposal which we believe require more consultation and data before councilors can make an informed decision on options 1 and 2. And whilst we are the river/drainage largest scheme in the area we are aware of other drainage schemes that will be affected who won't be aware of proposals or have been consulted.

Appendix 1



Scheme Assets

- 313 km stopbanks
- 3 Major diversion structures
- 173 floodgate structures
- 28 km Bank protection assets
- 32 km of drains
- 610,000 tonnes rock
- 93 ha plantings
- Various other assets

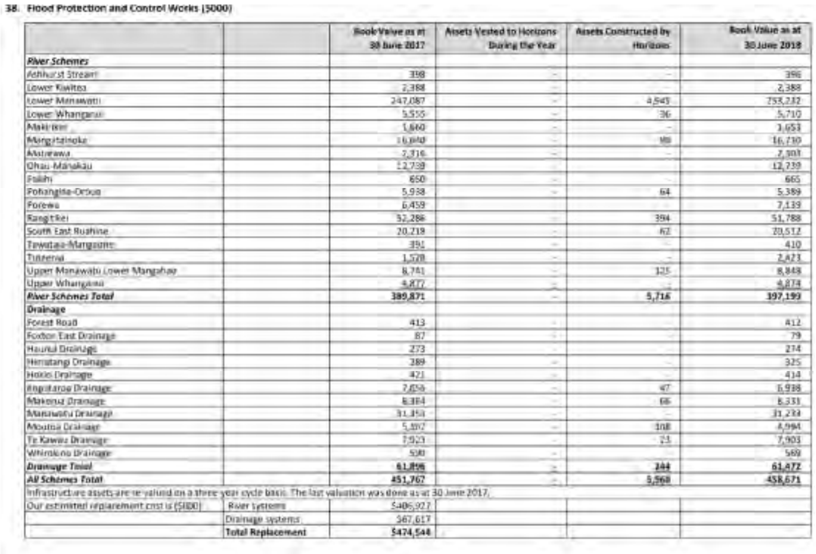
- Total Asset Value: $412m.

horizons.govt.nz

horizons

Appendix 2.

Most of the drainage schemes (not river) listed below will be affected by the Natures Calls Proposals 1 & 2



38. Flood Protection and Control Works ($000)

		Book Value as at 30 June 2017	Assets Vested to Horizons During the Year	Assets Constructed by Horizons	Book Value as at 30 June 2018
River Schemes					
Ashhurst Stream		398	–	–	396
Lower Kiwitea		2,388	–	–	2,388
Lower Manawatu		247,087	–	4,945	253,232
Lower Whanganui		5,555	–	36	5,710
Makirikiri		1,660	–	–	1,653
Mangatainoka		16,640	–	90	16,730
Matarawa		2,316	–	–	2,303
Ohau-Manakau		12,739	–		12,739
Pakihi		650	–	–	665
Pohangina-Oroua		5,938	–	64	5,389
Porewa		6,459		–	7,139
Rangitikei		52,286	–	394	51,788
South East Ruahine		20,218	–	62	20,512
Tawataia-Mangaone		391	–	–	410
Tutaenui		1,528	–	–	2,423
Upper Manawatu Lower Mangahao		8,741	–	125	8,848
Upper Whanganui		4,877	–	–	4,874
River Schemes Total		**389,871**	–	**5,716**	**397,199**
Drainage					
Forest Road		413	–	–	412
Foxton East Drainage		87	–	–	79
Haunui Drainage		273	–	–	274
Himatangi Drainage		389	–	–	325
Hokio Drainage		421	–	–	414
Koputaroa Drainage		7,056	–	47	6,938
Makerua Drainage		6,384	–	66	6,331
Manawatu Drainage		31,359	–	–	31,233
Moutoa Drainage		5,107	–	108	4,994
Te Kawau Drainage		7,923	–	23	7,903
Whirokino Drainage		590	–	–	569
Drainage Total		**61,896**	–	**244**	**61,472**
All Schemes Total		**451,767**	–	**5,960**	**458,671**
Infrastructure assets are re-valued on a three year cycle basis. The last valuation was done as at 30 June 2017.					
Our estimated replacement cost is ($000)	River systems	$406,927			
	Drainage systems	$67,617			
	Total Replacement	**$474,544**			

Appendix 3

13 July 2020

PRD0535
IM/JB

To: Palmerston North City Council

Comments on: Nature Calls

Comments by: **Horizons Lower Manawatu Scheme**

Address for Service: **Area Engineer Central**
Horizons Regional Council
Private Bag 11025
Manawatu Mail Centre
Palmerston North 4442
Email: ian.mcmahon@horizons.govt.nz

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1. The Horizons Regional Council - Lower Manawatu Scheme appreciates this opportunity to comment on the Palmerston North City Council (PNCC) project 'Nature Calls'.

2. As owners of land adjacent to the Manawatū River, the Horizons Lower Manawatu Scheme would like to be consulted on an 'effected party' basis.

3. The Horizons Regional Council Resource Management Plan requires each landowner to individually be responsible for the sustainable management of their businesses. We expect to see urban activities managed in a commensurate way. This project must also achieve the sustainable management principles as set out in the Resource Management Act.

4. Consultation process - Horizons Lower Manawatu Scheme is concerned that Council are not intending to consult with the public, and in particular rural landowners, in further detail on the option the project will progress. We consider that the detail provided on each option has not enabled a robust assessment of the merits or otherwise of each option. We therefore ask that Council include a further round of formal public consultation with all parties on the specifics of the option Council will progress.

5. Information consultation – We consider that Council have not drawn on the wealth of experience and knowledge that sits within the wider community. We therefore consider that it is important that going forward, Council factors in opportunities to informally share information with the primary sector and also seek feedback or input on specific matters. We therefore ask that Council

   a. Establish a primary sector reference group with the aim of regularly meeting with the group to provide face to face updates/seek information, and also share information via email as the project develops. The importance of the agricultural sector to the city, region and nationally cannot be forgotten as the project is refined. It is therefore vital that Council ground truths the direction it will take to ensure that it does not have any adverse impacts on agriculture, and rather, progresses opportunities to better work with or enable the sector.

   b. Identify impacted groups to provide active and regularly updates – We are concerned that Council have not identified groups with an direct interest in the project, in particular those with a discrete mandate that will be impeded by the project. There are for example a number of River Scheme User/Management Groups that should be regularly consulted with as the project is developed.

6. Exploration of Option 6 – We consider that while Option 6 could have the greatest cost implications to Council in terms of infrastructure, it could also provide considerable benefits to Council and the wider region. Without exploring the option in any great depth, it is not possible to fully explore or understand the potential gains from discharging direct to sea. We therefore request that Council fully explore this Option, to ensure that it is not bypassing what could be a significant win for all. This includes for example:
   - Removing discharge to the river
   - Redirecting the discharge to areas that could benefit (for example for irrigation).

7. Concerns with discharge to Land – We have a number of concerns about any option that proposes discharge to land including:

   a. A lack of understanding about the land required – what land and how much.

   b. Risks – We are concerned that Council has not considered the risks of discharging to land (and also river). This includes both known risks, but also potential future risks as identified (for example the impact of class 'A' drugs in waste, hormones, communicable diseases etc).

The Horizons Lower Manawatu Scheme look forward to working together with PNCC to ensure the success of this vital project.

Yours sincerely,

Ian McMahon
AREA ENGINEER CENTRAL

Copied to Michelle.allan@pncc.govt.nz

Enclosures Nil

Submission for Nature Calls Feedback

Manawatu Drainage Scheme

Richard Green, Committee Member
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0211028852

The Manawatu Drainage Scheme provides 100-year flood protection for landowners in its geographic area. The Scheme has 31 million in assets and covers 16,400ha. Option 1 & 2 under the PNCC Nature Calls Waster Proposal could have a significant impact on the drainage scheme workings and its revenue used to finance the scheme.

The standard feedback form does not meet the concerns we have.

Our committee is tasked with liaising with the Horizons Regional Council to facilitate efficient and safe drainage systems within the Kairanga area.

- We are concerned by proposals to dispose of city wastewater onto large areas of flat low-lying soils with clay and blue pug bases.
- Most farm systems include subterranean pipe systems to transport water to internally owned drains that transfer water to Horizons drains, that are protected by spillways, and then to the main river systems, which are also protected by spillways.
- The local landowners incorporated an expensive drainage pumping system located at Rangioutu to dispense water into the Oroua River.
- Our concern is that the intrusion of large volumes of extra water into the current high capital cost drainage system structures will overload the current design causing major production losses to the wider region.
- The volumes of water proposed would raise water tables affecting current land uses not only on the site being used to apply the wastewater but also in the wider region due to the nature of the topography.
- Also, water not fully treated that could contain elements, salts, chemicals, and toxins could contaminate the whole region in the regular flood events that prevail in this area, including major river stopbank breeching.
- The integrity of the drainage and flood systems is critical to the local economy.
- Some of the scheme income is derived from leasing land, and proposals 1 & 2 could impact this income,
- The consultation process by PNCC has neglected to consult with affected landowners and groups like ourselves in the areas in the proposals

We would only support option 3, discharge to the ocean, as the only viable option of the 3 options presented.

MANAWATU DRAINAGE SCHEME

Scheme Facts

- Scheme Assets.
  - 75 floodgated culverts
  - 276 km of drainage channels
  - 1 Pump station
  - 34 km Stopbanks
- Total Asset Value: $31,681,465.
- Scheme Area 16,400ha.
- Majority of the catchment flows out into the Manawatū River at the Burkes Floodgates.
- Predominantly servicing dairy, horticultural land and an increasing number of lifestyle blocks.

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Palmerston North Wastewater Best Practicable Option (BPO) Review

Project Objectives Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Melaina Voss

Report Details

Prepared by:	Jim Bradley/Melaina Voss/Paula Hunter/ BPO Technical Team	21/07/2021
Checked by:	Jim Bradley/Melaina Voss	25/06/2021
Reviewed by:	Client / Simpson Grierson	4/08/2021
Approved & Issued by:	Roger Hulme	5/08/2021

Executive Summary

This report has been prepared to assist the Council in identifying the Best Practicable Option (BPO) for wastewater management. This assessment forms one of seven assessments being carried out, to inform the final BPO selection.

In 2017, the Council adopted a Project Vision and 11 Project Objectives. These Objectives have been used to inform assessment criteria throughout the different options assessment phases, including the Traffic Light Assessment (2019) and Multi-Criteria Assessment process (2020).

This assessment has been undertaken with the involvement of technical experts, who have advised the Council on options development and assessments throughout the project.

Each of the 11 shortlisted options has been assessed against the 11 project objectives. The technical advisors recommend a scale of 1 to 5 is provided for comparing how well options are aligned to each of the Project Objectives (refer Table 2). The scores assigned and basis for the scoring is documented in Section 3 of this report (refer Table 2).

Technical advisors and Rangitāne o Manawatū have been involved in the assessment of all options against the Project Objectives. Rangitane o Manawatu have provided support to this assessment due to the relationship with the Strategy and mana whenua status over the city.

Overall, the options with the highest level of treatment and therefore lowest impact on the Manawatū River and ocean receiving environments (Options 1, 2, 10 and 11), are ranked in the top 4 when assessed against the level of alignment with the Project Objectives. Options with significant land area in the fluvial soil areas i.e. Options 4, 6, 7, 8 and 9 have ranked

Project Vision

> *"Management of the City's wastewater which enables growth, protects and enhances the environment, contributes to improving the health and mauri of the Manawatū River and provides a best practicable option solution."*

Project Objectives

1. *Protects public health and minimises public health risk*
2. *Minimise adverse environmental effects on air, land, and water*
3. *Is sustainable, enduring, and resilient*
4. *Contributes to improving the health and mauri of the Manawatū River*
5. *Takes an integrated approach to the management of the Manawatū Catchment including understanding cumulative effects*
6. *Enhances people's use and enjoyment of the Manawatū River*
7. *Is affordable and cost effective*
8. *Minimises whole of life carbon emissions and optimises resource recovery*
9. *Is innovative while being evidence based*
10. *Facilitates long term growth and economic development*
11. *Is developed with the active engagement of the community and key stakeholders*

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1 Introduction

1.1 Overview of Assessment Process

An assessment of the short list options against the Project Objectives has been undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the Project Objectives assessment integrates with the other assessments and processes involved in determining the BPO.

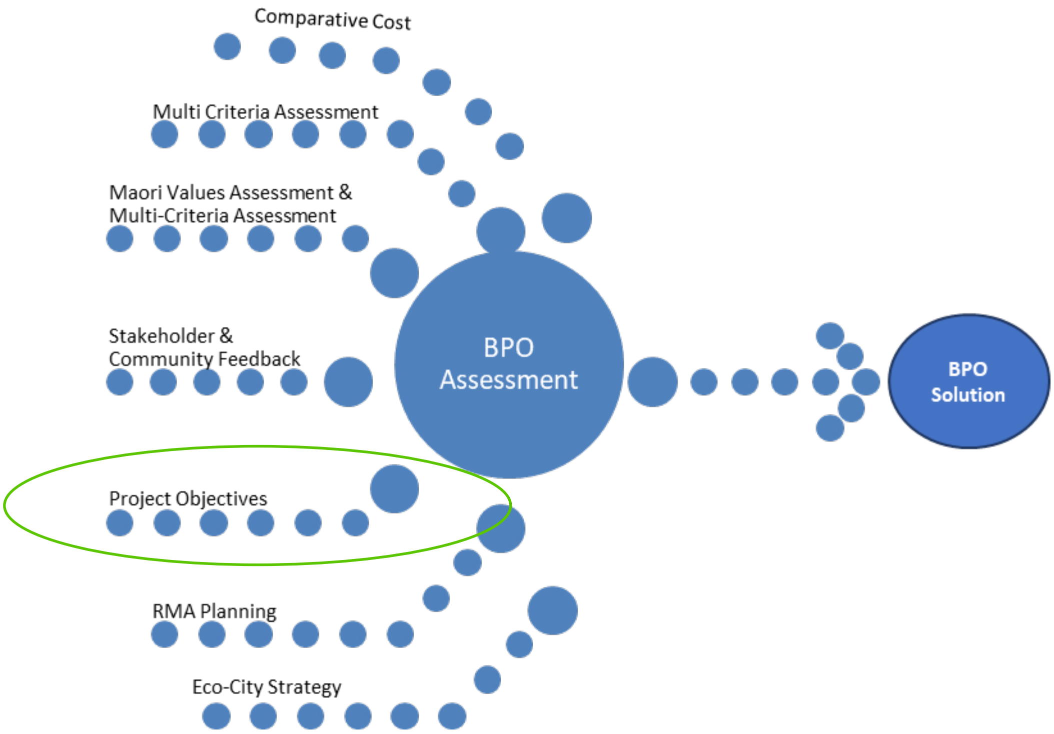


Figure 1 BPO Assessment Process

The Project Objectives assessment involves considering how each of the shortlisted options relative to one another aligns with each of the Project Objectives. This assessment draws on the technical work completed to determine the shortlist options and other assessment reports completed at the MCA stage of the project (refer Section 1.4 below). An outline of the methodology used to undertake this assessment is provided in Section 3 of this Report.

In carrying out this assessment, scoring provided within other assessments has been reviewed with the involvement of technical experts and Iwi to ensure there is consistency and alignment in the scoring.

1.2 Shortlist Options

The following table lists the shortlisted options assessed in this report. Technical details of each of the shortlist options are provided in the Shortlist Options Summary Report, July 2021.

Table 1 Options Description / Reference

Option No.	Option Summary Description
1	R2(b) River discharge with Enhanced Treatment
2	R2 (b-2) River discharge with Enhanced Treatment, 75% ADWF to Land at low River flow.
3	Dual R+L (b) Two river discharge points, with 75% ADWF to Land low River flow.
4	L+R (a) 97% of the time to Land (inland)
5	L+R (b) 97% of the time to Land (coastal)
6	L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)
7	L+R (d-2) to Land <62M^3/s / 43% of the time to Land (inland)
8	L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35 mg/L
9	L+R (e-2) to Land <62m^3/s / 43%of the time to Land (coastal) TN = 35 mg/L
10	O+L / Ocean with Land
11	Ocean discharge

1.3 Supporting Project Information

The following technical documents have been referred to, to inform this assessment:

- Wastewater BPO Shortlist Options Report August 2021
- Wastewater BPO Treatment Options Report, May 2021 and Addendum Report, May 2021
- Carbon Footprint Assessment Report, August 2021
- Stakeholder Engagement Feedback Report, July 2021
- Wastewater BPO MCA Process Report & Appendices, February 2021

2 Methodology for this Assessment

2.1 Classification Process

The first step in the assessment process was for the technical advisors to review each of the Objectives to determine if options could be comparatively scored against the Objective. This identified that 9 of the 11 Objectives could be comparatively scored. Two of the Objectives were excluded on the basis that there was no ability to differentiate between options. These objectives were:

> *5. Takes an integrated approach to the management of the Manawatū Catchment including understanding cumulative effects;* and
>
> *11. Is developed with the active engagement of the community and key stakeholders*

In some cases, the Objectives were further interrogated and divided into subcategories within the overall objective with scores given to each subcategory. For example, Objective 2, which seeks ‘*to minimise any adverse effects on air, land and water’ was divided into 3 subcategories on* the basis it allowed each option to be assessed on how well the effects were minimised for each receiving environment. The overall score was then determined to be an average of the subcategory scores.

2.2 Scoring of Objectives

The assessment includes a judgement on the extent to which the proposed treatment level and discharge environment, aligned with the Project Objectives.

Table 5 sets out the suggested 1 to 5 banding/scoring for the assessment of the degree of alignment of each option with the Project Objectives. Table 3 details the allocated scores applied to each shortlist option and objectives based on the definitions outlined in Table 2.

Table 2 Scoring Criteria

Level of alignment	**Score**
Strong alignment	5
Good alignment	4
General alignment	3
Weak alignment	2
Fails to align	1

3 Scoring

The following section assigns the relative scores for options against 9 of the 11 Project Objectives.

Table 3 Option Score for Alignment with Project Objectives

Objectives	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
1. Protects public health and minimises public health risk	Qualitative risk assessment has determined these scores on the basis of the scale of the public health impacts and the frequency of the public health exposure. The potential exposure routes include recreation, both primary and secondary contact, food gathering and consumption, drinking water (surface water, ground water and tank water) and inhalation from spray drift. Options 1 and 2, provide efficient pathogen removal through the multi-barrier treatment. Options 10 and 11 have effective dispersion and dispersion, in addition to natural disinfection. Land application options, particularly inland, can give rise to a risk of groundwater contamination.	4	4	3	2	2	2	2	3	3	4	5
2. Minimise adverse environmental effects on air, land, and water												
Air	Options 1 and 2 remove the aerated lagoons with a more highly controlled treatment process, which reduces the potential for adverse effects on air (odour). Discharges to the Ocean and River (receiving environments), have minimal adverse effects on air. Options with significant land application have the potential for odour generated associated with the application of wastewater over land during varying weather conditions and when stored in ponds.	5	4	3	2	2	2	2	2	2	4	5
Land	Options are assessed in relation to two key aspects, operational risks and potential long-term effects on the environment (land). While many adverse effects will be minimised through design, there is uncertainty as to the feasibility of operating large scale land irrigation systems. Options with 1,600ha of irrigation or more are more than three times the size of the largest current operational facility in New Zealand. The largest land area requirement for any of the options is 3,700ha (Option 4) Over time, potential long term adverse effects on the land are considered likely because of irrigation of treated wastewater discharging to land. Long term effects may also include limitations on future land use, once the discharge of treated wastewater has ceased. Options with significant areas of land have therefore scored lower, and particularly inland (fluvial soils) which have more diverse and higher value land use options	5	4	3	2	2	2	2	2	2	4	5
Water	The assessment includes surface water, groundwater and marine (coastal) waters. Proposed treatment levels for the options have been used to determine the scores along with the potential adverse effects identified by the technical specialists. Options 1 and 2 propose the highest levels of treatment, significantly reducing contaminants within the treated wastewater compared to other options discharging to the River. There is a moderate risk that targets in One Plan are not met during the low river flow period and a lower risk of this occurring for Option 2 on the basis that discharge at low river levels will be to land (reducing risks further). Options 8 and 9 include sites in close proximity to coastal lakes, which are sensitive to and potentially impacted by land-based discharge. Options 10 and 11 provide for the discharge of treated wastewater to the ocean. Environmental effects are minimised for these options on the basis that the appropriate treatment levels have been selected and the	3	4	3	3	3	3	3	3	3	3	5

Objectives	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
	sensitivity of the receiving environment is low given it is a harsh environment, and has significant assimilative capacity providing significant dilution. .											
	Average Score	4	4	3	2	2	2	2	2	2	4	5
3. Is sustainable, enduring, and resilient	This assessment considers the ability of an option to achieve the standards and outcomes required in the face of significant natural hazards and climate change. The scoring also considers the sustainability and durability of infrastructure assets for the life of the consent (35 years). Options with significant conveyance and/or large land areas have scored lower due to their greater vulnerability to climate change and natural hazards i.e. sea level rise and earthquakes. Climate change is predicted to result in higher sea levels and more wave-generated coastal erosion along with more frequent heavy rain events. Options with large land areas will be sensitive to heavier rainfall due to reductions in the available water holding capacity, requiring a combination of additional storage and/or additional land to facilitate irrigation for the same or increased wastewater flows. Options with long conveyance pipelines will be vulnerable to climate change and natural disasters. Long conveyance is also more vulnerable to increased growth (beyond projected), resulting in the design capacity being exceeded and potential infrastructure failure. In relation to the operation of ocean outfall (options 10 and 11), risks from outfall failure due to seismic events are considered low, however do need consideration. This will be accounted for through design in conjunction with wave and current effects associated with storm surge. Enhanced treatment (Options 1 and 2) includes more complex and costly mechanical and electrical equipment which require on-going renewal and maintenance investment. Options with significant assets which are subject wear and tear are assessed to have low durability. Therefore, these options scored relatively well by comparison to options with higher risks associated with large areas of land and or pipeline.	4	3	3	2	2	2	2	2	2	3	4
4. Contributes to improving the health and mauri of the Manawatū River	The focus of this assessment is the mauri of the Manawatū River. Options 5, 10 and 11 have scored the highest on the basis the treated wastewater discharge will be removed completely from the Manawatū River. Options including large coastal land application areas will not impact on the Manawatū River. Option 4 is scored lower than Option 5, because of the potential risk of irrigated wastewater infiltrating to the River.	2	3	2	4	5	3	3	4	4	5	5
5. Takes an integrated approach to the management of the Manawatū Catchment including understanding cumulative effects	This Objective is focused on potential cumulative effects for the entire catchment which in turn depends on actions undertaken by others outside the influence of Palmerston North City Council. On the basis of this external uncertainty and the fact that the final discharge location for a number of the options is unknown, it is considered inappropriate to score the options against this objective at this stage of the Project.	-	-	-	-	-	-	-	-	-	-	-
6. Enhances people's use and enjoyment of the Manawatū River	Recreational water quality standards can be met for all options including those with a river discharge. There are however differences between options in respect of the levels of achievement of the standards. The standards have the potential to influence recreational use of the river through the influence of public perception. As a result, those options which effectively eliminate discharges to the river are accorded the highest score. For options which discharge to the river, the score is a mix of the level of treatment provided and the extent to which discharge is removed from the river. Option 2 scores above option 1 because of the removal of wastewater discharge during the summer low flow period despite both options achieving similar very high levels of treatment.	3	4	2	5	5	3	3	3	3	5	5

Objectives	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
7. Is affordable and cost effective	Costs associated with each option have been assessed and scored in accordance with the Comparative Cost Assessment (CCA) prepared as part of this assessment process i.e. the same scores have been used.	5	3	4	3	1	4	4	1	1	2	3
8. Minimises whole of life carbon emissions and optimises resource recovery												
Carbon Emissions	Options including carbon sequestration from trees on coastal land/soils score higher on the basis that they contribute meaningfully to reducing Council's organisational greenhouse gas emissions. Options 3 to 11 (inclusive) will continue to utilise aerated lagoons, and so will continue to have higher emissions compared to Options 1 and 2 which use alternative treatment processes with lower emissions.	4	3	2	2	5	2	2	5	5	3	1
Resource Recovery	This assessment has considered the extent to which an option provides opportunity for energy recovery, treated wastewater re-use and beneficial use of biosolids. Options 1 and 2 were given high scores on the basis that the enhanced treatment provides opportunities for enhanced energy production (for other use) and treated wastewater re-use due to the high quality and biosolids production (for re-use). A biosolids strategy provides the Council with an opportunity for resource recovery. Options with aerated lagoons have lower scores due to the lower solids yield contributing to lower energy recovery opportunities. Land application options provide for beneficial re-use of treated wastewater, due to the liquid and nutrient contributions to productive land use activities i.e. crops and so were given intermediate scores.	5	5	2	3	3	3	3	3	3	2	1
9. Is innovative while being evidence based	Treatment technology is the focus of this assessment, and options utilising current best practice in respect of treatment technology available in New Zealand were given the highest scores. Options including large land areas, that are significantly larger than any existing operational facilities, are considered high risk in terms of operation and management of potential adverse effects ie the largest land application site in NZ is approximately 500ha, over two separate sites and pumice soils. Options with land areas exceeding 1,500ha, have scored relatively low on the basis that land-based irrigation at this scale has no precedent within New Zealand so is high risk. Options 10 and 11, which require significant lengths of conveyance piping and multiple pump stations to discharge the treated wastewater to the ocean (over 34km) are considered well proven in a New Zealand context based on existing applications of this approach e.g. Timaru and Waimakariri.	4	5	3	1	1	2	2	1	1	2	3
10. Facilitates long term growth and economic development	While all options have been designed to cater for 35 years' growth (minimum) those options which could be adapted to provide a sub-regional scheme solution or can be easily expanded to accommodate more rapid growth have been given higher scores. Options with large land areas that require conversion from a current high value land use to a cut and carry operation, have the potential to adversely impact regional economic activity and so are scored lower as a result. Options involving large areas of coastal land which would require conversion from livestock grazing to forestry have been scored slightly higher, although there is a risk of potential negative economic impact where current land use involves a higher value activity such as dairy farming. Options with limited capacity (in respect of the receiving environment) to support ongoing increases in the discharge of the city's wastewater beyond 35 years have also been scored lower. Where there is the opportunity to improve treatment quality through plant upgrades, that are proven and affordable, such options have also been scored slightly higher.	3	4	3	2	3	2	2	3	3	4	4

Objectives	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
	Options with significant conveyance infrastructure are likely to face capacity constraints which cannot be resolved until an alternative solution is provided i.e. additional pipeline or storage.											
11. Is developed with the active engagement of the community and key stakeholders	The BPO process has been based on a series of stakeholder and community engagement phases. It is not considered feasible to differentiate options based on this Objective given that all options have been included in each phase of the engagement process.	-	-	-	-	-	-	-	-	-	-	-
	TOTAL SCORE (out of 55)	34	34	25	24	25	23	23	23	23	31	35

4 Overall Recommendation

The technical advisors recommend a scale of 1 to 5 is used to compare how well options align with the Project Objectives (refer Table 2). Those objectives where it is not possible to differentiate options have been excluded. For all other objectives the options have been scored on the degree to which the option aligns with the overall objective or sub-category. None of the options were considered to be fatally flawed. Technical advisors and Iwi have been involved in the assessment of all options against the Project Objectives.

Overall, the options with the highest level of treatment and therefore lowest impact on the Manawatū River and ocean receiving environments (Options 1, 2, 10 and 11), are ranked in the top 4 when assessed against the level of alignment with the Project Objectives. Options with significant land area in the fluvial soil areas (Options 4, 6, 7, 8 and 9) have ranked the lowest within the Project Objectives on the basis of their economic impact and technical and operational uncertainty.

Following the scoring assessment, an overall score for each option's alignment with all of the eight objectives was calculated. Based on this score the options were placed in rank order with the option having the highest alignment and highest score accorded the top rank. Options with equivalent scores were given equivalent ranking e.g. 8 and 10 equal.

Table 4 provides the overall scores and the ranking of the shortlisted options.

Table 4 Summary of Options Ranking against Project Objectives

Option Description	Total Score	Ranking
R2 (b) (Level 4)	34	3
R2 (b) (75% DWF land): 760 ha. (Level 4)	34	2
Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	25	6
L+R(a): 3760 ha. (Level 1)	24	7
L+R(b): 2570 ha. (Level 3, TN=10)	25	5
L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	23	10
L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	23	10
L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	23	8
L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	23	8
O+L: 1470 ha. (Level 1)	31	4
O no land (Level 1)	35	1

Palmerston North Wastewater
Best Practicable Option (BPO) Review

Eco-City Strategy Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Melaina Voss / Jim Bradley

Report Details

Prepared by:	Melaina Voss / Jim Bradley	21/07/2021
Checked by:	Jim Bradley	27/07/2021
Reviewed by:	Client / Jim Bradley / Simpson Grierson	4/08/2021
Approved & Issued by:	Roger Hulme	5/08/2021

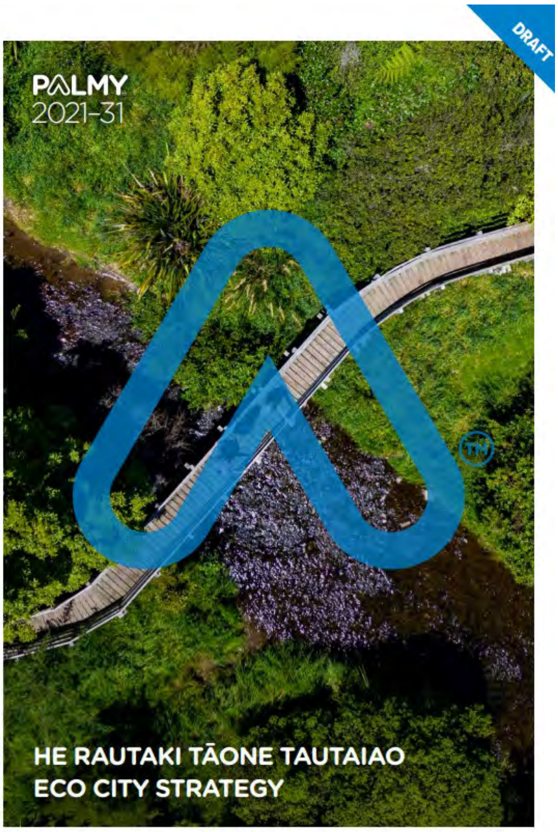
Executive Summary

This report has been prepared to assist the Council in identifying options that may be considered through the final Best Practicable Option (BPO) assessment. This assessment forms one of seven assessments being carried out, prior to confirming the BPO with Horizons Regional Council.

This Assessment has been undertaken with the involvement of technical experts, who have advised the Council on options development and assessments throughout the Project.

Each of the 11 shortlisted options has been assessed against the 11 project objectives. And a score of 1 (least aligned) to 5 (most aligned). The basis for this score is documented in the assessment (refer Table 2, Section 3 of this report).

Technical advisors and Iwi have been involved in the assessment of all options against the Eco-City Strategy. Specific work has been undertaken to identify the carbon effects from each option and related back to the City's goal of 30% carbon reduction by 2031. The technical advisors have recommended a scale of 1 to 5 be used for comparing how well options align with the various Eco-City Strategy Plans (refer Table 2).



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APPENDICES

1 Introduction

1.1 Overview of Assessment Process

An assessment of the short list options has been undertaken to determine levels of alignment for each option, with Council's Eco-City Strategy. This assessment has been undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the eco-city strategy assessment integrates with the other assessments and processes involved in determining the BPO.

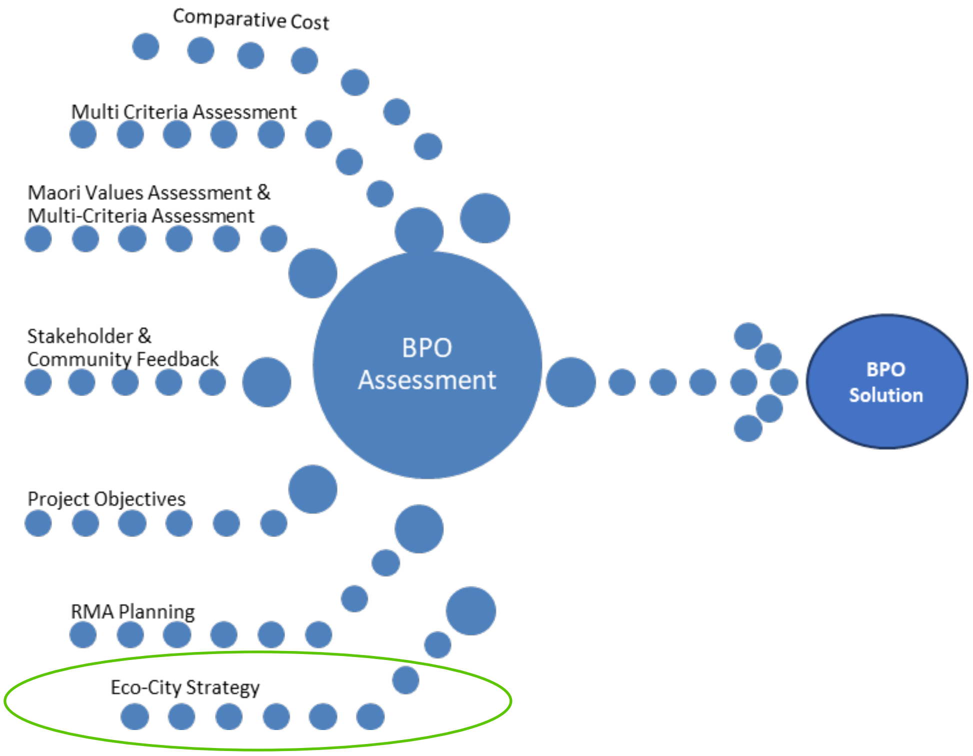

Figure 1 BPO Assessment Process

The Eco-City Strategy assessment involves considering how each of the Short List of Options aligns with the key 'Measures of Success' and 'what the Council wants to achieve' through its Strategy. An outline of the methodology used to undertake this assessment is provided in Section 3 of this Report.

1.2 Shortlist Options

The following table lists the shortlist options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, May 2021.

Table 1 Options Description / Reference

Option No.	Option Summary Description
1	R2(b) River discharge with Enhanced Treatment
2	R2 (b-2) River discharge with Enhanced Treatment, 75% ADWF to Land at low River flow.
3	Dual R+L (b) Two river discharge points, with 75% ADWF to Land low River flow.
4	L+R (a) 97% of the time to Land (inland)
5	L+R (b) 97% of the time to Land (coastal)
6	L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)
7	L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)
8	L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35 mg/L
9	L+R (e-2) to Land <62m³/s / 43%of the time to Land (coastal) TN = 35 mg/L
10	O+L / Ocean with Land
11	Ocean discharge

1.3 Supporting Project Information

The following technical documents, developed to inform the shortlist options development and assessment process to date includes:

- Wastewater BPO Shortlist Options Report, August 2021
- Wastewater BPO Treatment Options Report, May 2021 & Addendum Report, May 2021
- Carbon Footprint Assessment Report, May 2021 (Appendix 1)
- Assessment of Residential Flow & Load Reduction Technology, October 2018
- Wastewater BPO MCA Comparative Assessment Report & Appendices, November 2021
- RMA Assessment Report, August 2021
- Iwi Values Report prepared by Rangitāne o Manawatū, July 2021

2 Eco City Strategy 2021-2031

2.1 Overview & Key Aspects

Figure 2 Council's Strategic Direction, including the Eco-City Strategy (Goal 4)

Palmerston North City Council has a vision of "small city benefits, big city ambition". To achieve this, the Council has adopted five goals, one of which is to be an Eco-City (Goal 4). As an Eco-City, the Council recognises the city has a role to play in the response to climate change. A goal for Palmerston North is to decrease carbon emissions and reduce ecological footprint. Council also wants to protect and enhance the natural and built environments, accommodate growth through intensification and support active transport. Council is also committed to working with partners, including Rangitāne o Manawatū and stakeholders.

Five plans sit beneath the Eco-City Strategy, describing the city's activities for the first three years of the 2021-2031 Long Term Plan. These plans include: **Climate Change, Environmental Sustainability, Manawatū River, Resource Recovery** and **Waters**. There are two drivers of the Eco-City Strategy that underpin many of the actions within it. The drivers are Community Wellbeing (Local Government Act 2002) and Climate Change (Ministry for Environment requirements). Climate Change is particularly relevant in the case of the Wastewater BPO Project. This is because the proposed options have the potential to contribute to Council's target of a 30% reduction in CO_2 emissions in Palmerston North by 2031.

2.1.1 Manawatū River & Rangitāne o Manawatū

Across each of the five plans, Council is committed to working in partnership with Rangitāne o Manawatū. In several plans, Council recognises the significance of the Manawatū River as a key cultural, environmental, and recreational resource. A key priority for the Council is to "***Respect and enhance the mauri of the Manawatū River***" and measures are identified in the Eco-City Strategy, Waters Plan and Manawatū River Plan specifically to outline how this will be achieved. Within the overarching Strategy, Council has identified the following effort will be required:

- *Understand the relationship Rangitāne o Manawatū has with the Manawatū River*
- *Increase the use of the Manawatū River environment for passive and active recreation.*
- *Increase the health and amenity of the River environment through increased biodiversity.*[1]

The Council has adopted a partnership approach to working with Rangitāne o Manawatū on the BPO Project. Representatives from the Iwi are on the Project Steering Group for the BPO Project and form part of the technical team to develop and assess options. On this

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[1] Page 6, Eco-City Strategy 2021-2031

basis, the partnership between the Council and Rangitāne o Manawatū has not been assessed across the options, as there is no difference in the partnership for the different options so it will not affect comparative scoring.

2.1.2 Carbon Reduction

There is growing awareness and commitment globally to reducing carbon emissions, and New Zealand has committed to being a leader in this area. The Council is a signatory to the New Zealand Local Government Leaders Climate Change Declaration, which establishes a commitment to addressing climate change in decision making in the interest of community well-being.

Council is committed to reducing electricity, natural gas, and fuel usage, as well as reducing waste and has confirmed to the goal of reducing emissions to reduce costs, while improving air quality and other environmental outcomes. To achieve these reductions, the Council has identified the following overarching commitments:

- Foster sustainable practices and behaviours so that city residents and organisations become more sustainable.
- Develop policies and plans and work with city stakeholders to achieve the target of 30% reduction in greenhouse emissions by 2031, and continue to reduce greenhouse gas emissions from Council's own activities.

Significant work has gone into the Council understanding the emissions profile of the city. For the wastewater BPO Project, technical analysis has been undertaken to identify the potential emissions of CO_2 emissions from each shortlisted option and to determine the impact the option will have on achieving the target (30% reduction by 2031). This detailed analysis is covered in Section 3 and Appendix 1 of this report.

2.2 Eco City Strategy – The Five Plans

The following describes the over-arching strategic goals for each of the five plans that form the Eco-City Strategy.

Environmental Sustainability Plan

This Plan recognises links to the Waters Plan and Manawatū River Plan on the basis the Council is seeking to improve stormwater and wastewater management, thereby improving water quality of the Manawatū River and native biodiversity.

There are two parts to this Plan, comprising the Sustainable Practices Chapter and the Biodiversity Chapter. Within the sustainable practices chapter, Council identifies opportunities for individuals and organisations to contribute to sustainable practices. For the BPO Project, no matter which option is selected, Council is committed to exploring sustainable practices to reduce wastewater production (in the home and within organisations). Council is also committed to wastewater and bi-product re-use, which is addressed in the resource recovery plan assessment.

Waters Plan

The Waters Plan is made up of three chapters - wastewater, water and stormwater. For this assessment, the wastewater chapter has been reviewed to determine options alignment. The primary objectives of the wastewater plan are to manage wastewater well, enhance the mauri of the Manawatū River and avoid adverse effects on the environment.

Specific reference is made to the Wastewater BPO process and Council's commitment to seeking a new consent by June 2022. It also refers to commitments to working with Trade waste customers, Rangitāne o Manawatū and the Manawatū River Leaders Accord. In this case, options have only been assessed when relevant measures and actions allow for a comparison to be made resulting in different scores.

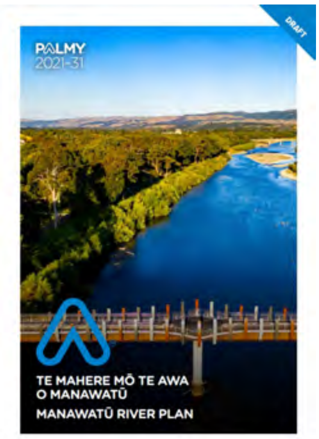
Climate Change Plan

The purpose of this plan is to understand the impacts of climate change and to reduce Council and citywide greenhouse gas emissions.

Council has developed a 'Palmy Climate Calculator', which has been used to allow council to roadmap achieving low carbon emissions by 2050. Each of the BPO Options has been assessed to determine the contribution it will have on carbon emissions (refer Section 3 and Appendix 1). We consider this analysis to be of highest priority compared with other plans and assessment and so it has been assigned a higher weighting.

Resource Recovery Plan

In accordance with the Waste Minimisation Act 2008, the Council is required to adopt a waste management and minimisation plan. This plan is the foundation of the Resource Recovery Plan and the purpose of this is to reduce the generation of waste and the impact of waste on the environment. In relation to the BPO Project, this Plan focuses on solid waste and includes targets for reducing landfill waste as well as setting priorities for residents and commercial premise to contribute to this reduction.



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2021-31

TE MAHERE MŌ TE AWA
O MANAWATŪ
MANAWATŪ RIVER PLAN

Manawatū River Plan

The Manawatū River Plan focuses on the relationship between Rangitāne o Manawatū and the River, as well as community engagement with the river through increased public use and increased the health and amenity of the environment (biodiversity). This Plan is interlinked with the other Eco-City Strategy plans and this is reflected in the measures and actions. The significance of the River to the Council in the Strategy is also strongly reflected in the top priorities for the Strategy.

As most of the options utilise the River to varying degrees (as a discharge location), this Plan provides helpful guidance in the options assessment process.

3 Methodology for this Assessment

3.1 Classification Process

The assessment considers the extent to which a wastewater discharge to a particular receiving environment, aligns with the relevant '*Measures of success'* and '*what Council wants to achieve*' in comparison to the other receiving environments and treatment levels. The assessment considers the balance of multiple discharges where more than one receiving environment is used in any option.

In some cases, the objectives were further interrogated and divided into subcategories within the overall objective and scored accordingly. This was done to provide greater robustness and transparency around the assessment of multiple elements. In each case the score is an average of the subcategory scores.

3.2 Scoring of Objectives

The assessment is based on a determination of the extent to which the proposed treatment solution and discharge environment, aligns with the '*measures of success*' and '*what council wants*'.

Table 2 sets out the banding/scoring used in the assessment. Section 5 of this report details the allocated scores applied to each shortlist option.

Table 2 Scoring Criteria

Level of alignment	**Score**
Strong alignment	5
Good alignment	4
General alignment	3
Weak alignment	2
Fails to align	1

4 Carbon Analysis

4.1 Climate Change Plan and Carbon Footprint Assessment

The goal of reducing the Council's and the community's carbon footprint is reflected in all the four plans but the primary focus of the Climate Change Plan. To understand the contribution of the wastewater BPO to achieving the target reduction a high-level carbon assessment of each of the options was undertaken. The report is referenced in Appendix 1 of this report.

4.2 Carbon Footprint Assessment

The high-level carbon assessment included consideration of both embodied (construction) and operational carbon emissions over a 50-year period [2](refer Appendix A). The total emissions (embodied + operational) are expressed as tonnes of CO_2 equivalent (CO_2-e). CO_2-e includes methane and nitrous oxide emissions from those options continuing to use the existing aerated lagoons at the Totara Road Wastewater Treatment Plant, converted to the equivalent mass of CO_2 in terms of global warming potential.

The estimated 50-year carbon emissions are presented in Table 3 and Figure 3, from lowest to highest. The net change relative to the current Treatment Plant emissions is also shown, with those options with a net reduction highlighted.

Annual operational carbon emissions ranged from 5,000 – 8,000 tonnes CO_2-e per annum (not including reduction due to carbon sequestration in trees). This amounts to around 1% of the estimated total annual carbon emissions from Palmerston North (500,000 tonnes CO_2-e p.a.).

The assessment shows that Option 1 with enhanced treatment and a 100% discharge to the river; and Option 2 with the same enhanced treatment but 75% of the Average Dry Weather Flow (ADWF) applied to land at low river flows achieve an estimated 28 and 29% reduction over the 50 year period modelled as compared to the current operation.

The three coastal land options have the lowest carbon footprint due to the contribution of carbon sequestered in the forestry plantation trees, which significantly offsets the operational carbon emissions from wastewater treatment and discharge. Ministry of Primary Industries lookup tables for pinus radiata have been used for this information.

The ocean outfall option (Option 11) has the highest carbon footprint of the shortlisted options due to:

- High embedded carbon (long pipeline); and

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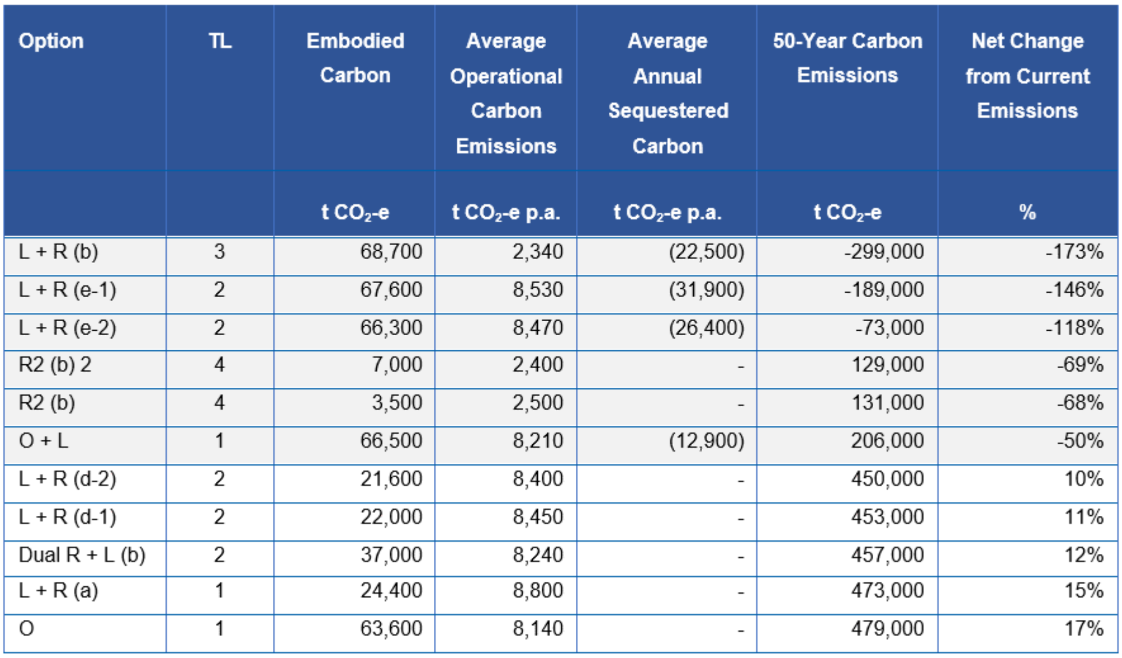
[2] The 50 year period is used as it align with Councils growth planning horizon and infrastructure planning requirements.

- Methane and nitrous oxide emissions (from the aerated lagoons).

If the treatment process for the ocean outfall option was changed to an activated sludge process, the annual operational carbon emissions would reduce to around 5,000 tonnes CO_2-e per annum and the 50-year total would reduce to 312,000 tonnes CO_2-e. This would represent a reduction in emissions of around 24% relative to the current WWTP operation and would improve the carbon ranking of the ocean outfall to 7th on the list.

Table 3 PNCC Wastewater BPO 50-Year Carbon Emissions



Option	TL	Embodied Carbon	Average Operational Carbon Emissions	Average Annual Sequestered Carbon	50-Year Carbon Emissions	Net Change from Current Emissions
		t CO_2-e	t CO_2-e p.a.	t CO_2-e p.a.	t CO_2-e	%
L + R (b)	3	68,700	2,340	(22,500)	-299,000	-173%
L + R (e-1)	2	67,600	8,530	(31,900)	-189,000	-146%
L + R (e-2)	2	66,300	8,470	(26,400)	-73,000	-118%
R2 (b) 2	4	7,000	2,400	-	129,000	-69%
R2 (b)	4	3,500	2,500	-	131,000	-68%
O + L	1	66,500	8,210	(12,900)	206,000	-50%
L + R (d-2)	2	21,600	8,400	-	450,000	10%
L + R (d-1)	2	22,000	8,450	-	453,000	11%
Dual R + L (b)	2	37,000	8,240	-	457,000	12%
L + R (a)	1	24,400	8,800	-	473,000	15%
O	1	63,600	8,140	-	479,000	17%

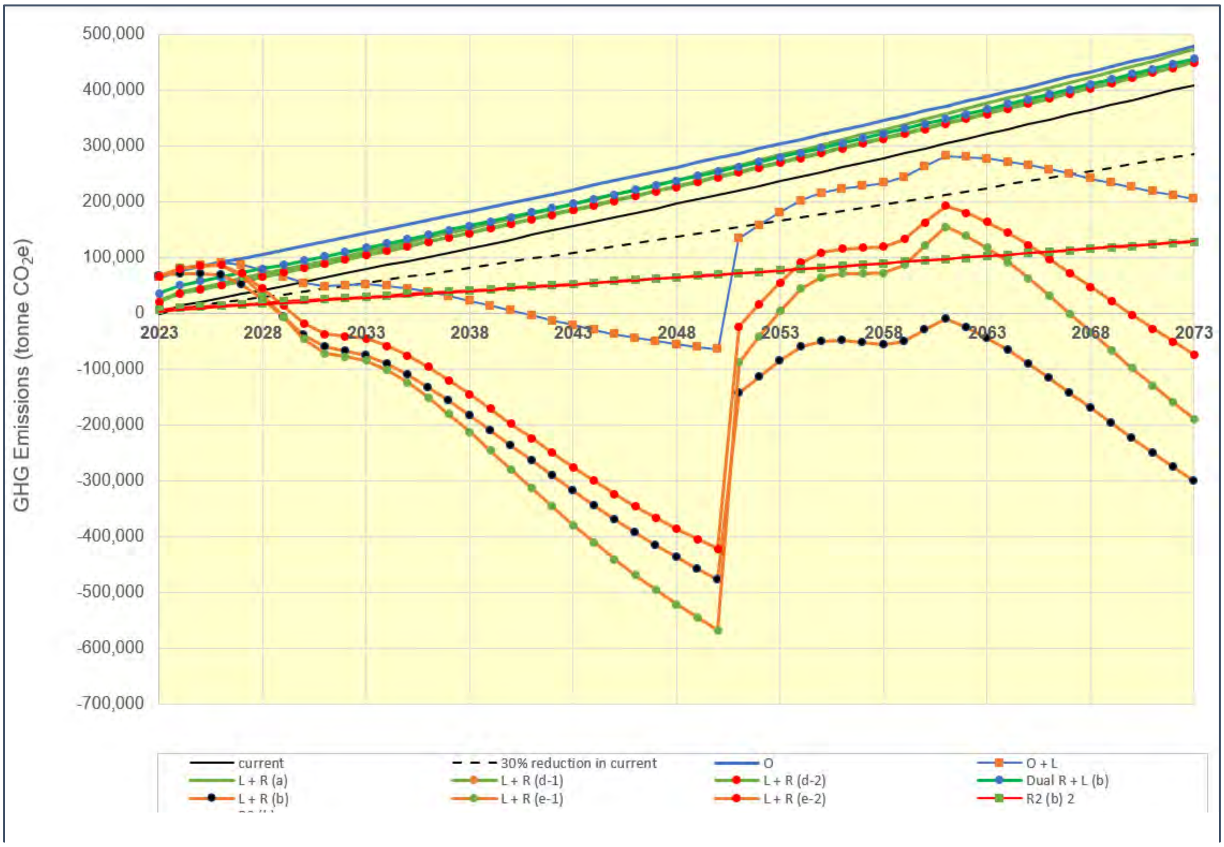


Figure 3 PNCC Wastewater BPO Carbon Emissions

4.3 Resource Recovery Plan

The purpose of the Resource Recovery Plan is to set out 10 year plan levels of service that:

- Ensure the city's solid waste is adequately and affordably managed
- Maximise the proportion of waste diverted from landfill (e.g. through recycling and composting)
- Manage hazardous waste in an environmentally responsible manner.

This Plan has a solid waste, landfill and hazardous waste focus. This focus has been used in the assessment and scoring as included in section 5 of this report.

Optimising resource recovery is an objective of the BPO Project.

Resource recovery opportunities and drivers have been investigated and compared for the short-listed options. Appendix 2 to this report includes excerpts from project work packages that cover the resource recovery assessments undertaken to date.

Once a preferred BPO solution is identified in depth evaluation of resource recovery opportunities will be undertaken and those considered practical for implementation identified. The approach followed to date and to be developed further is based on a "circular economy" philosophy where all waste streams are considered as values stream. Figure 4 illustrates this approach.

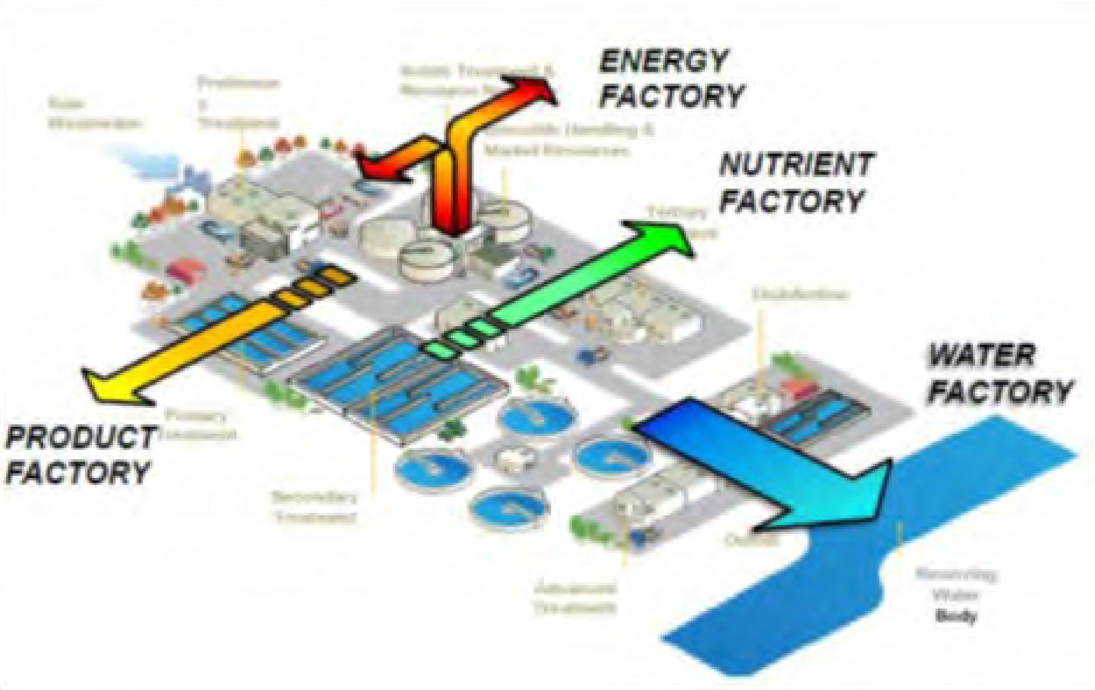


Figure 4 WWTP Resource Recovery

5 Assessment & Scoring

Table 4 below provides the assessment of options against relevant 'Measures of success' and 'what council wants to achieve', including a description of the scoring rationale for each option.

Table 4 Options against relevant Eco-City Strategy Measures and Achievements

Relevant Plan	Measures of Success	What does Council want to Achieve?	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
Environmental Sustainability Plan	*Sustainable Practices Chapter* *Improvement in Council's environmental performance (e.g. per capita / average basis) in terms of:* • *Energy Efficiency* • *Water Consumption* • *Waste Generation* • *Waste Diversion* • *Carbon emissions from transportation*	*Council staff internalise best practices in sustainability in day-to-day decision making, activities and operations towards reducing impacts on the environment (air, water, and land) in a cost-effective manner.*	Not assessed on the basis there is no ability to differentiate between the options.	-	-	-	-	-	-	-	-	-	-	-
	Biodiversity Chapter: *Improvement in water quality*	*The city's urban waterways are attractive places to visit, and the mauri of these waterways is enhanced where practicable.*	The focus of this assessment is the mauri of the city's urban waterways only. Options 5, 10 and 11 have scored the highest on the basis the treated wastewater discharge will be removed from the Manawatū River. Options including large coastal land application areas will not impact on the city's urban waterways.	2	3	2	4	5	3	3	4	4	5	5
		The mauri of urban streams is enhanced, and native aquatic life is thriving	The focus of this assessment is considered equivalent to that of the urban waterways so the same scores have been used.	2	3	2	4	5	3	3	4	4	5	5
			Avg Total	2	3	2	4	5	3	3	4	4	5	5
Waters Plan - Wastewater Chapter	*A regional resource consent for wastewater discharge is lodged by June 2022*	*Wastewater has a lesser impact on the health and mauri of the Manawatū River.*	The focus of this assessment is considered equivalent to that of the urban waterways so the same scores have been used.	2	3	2	4	5	3	3	4	4	5	5
	The wastewater network has the capacity to function without failure in significant rainfall events	*Rangitāne o Manawatū have opportunities for early involvement in all wastewater projects and initiatives.*	Rangitāne o Manawatū have been working with Council in a partnership from the outset of the BPO process. Therefore, this is not assessed on the basis that all options have been developed with a similar level of engagement resulting in there being no ability to differentiate between the options.	-	-	-	-	-	-	-	-	-	-	-

Relevant Plan	Measures of Success	What does Council want to Achieve?	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
		Council understands impact of flows and loads from large trade waste discharges	Investigation on existing and future flows and loads from Tradewaste customers has occurred through the project and impacts all options equally. This is not assessed on the basis that there is no ability to differentiate between the options for this criterion.	-	-	-	-	-	-	-	-	-	-	-
		Council's renewal planning and investment in wastewater infrastructure is based on a better understanding of the asset condition.	This is not assessed on the basis that there is no ability to differentiate between the options for this criterion.	-	-	-	-	-	-	-	-	-	-	-
		Stormwater infiltration and inflow into the wastewater network is reduced.	This is not assessed on the basis that there is no ability to differentiate between the options for this criterion.	-	-	-	-	-	-	-	-	-	-	-
		Wastewater infrastructure is provided to support urban growth.	All options account for 'medium' growth until 2051 (35-year consent duration). After 2051 the growth rate of 0.8/annum has been adopted until 2073. This assessment considers the ability of the option to meet requirements under a high growth rate assumption. i.e. design capacity reached before 35 years requiring additional capacity to be provided. Options 4 and 5 have scored 1 on the basis that the already large land parcels will need to be expanded, resulting in further operational complexity. Option 1 will require a step change in treatment levels and/or the purchase of land not currently allowed for. Options 8,9, 10 and 11 have lower constraints with respect to the receiving environment although there are constraints in respect of infrastructure capacity.	2	3	3	1	1	3	3	4	4	4	4
		Wastewater infrastructure has improved resilience to natural disasters and mechanical failures.	Assessment considers the resilience of the specific infrastructure, the spatial extent of the infrastructure (location and lengths of pipeline) and land areas as well as the complexity of operation and its vulnerability to natural events. Option 1 and 2 has scored 4 on the basis the treatment plant and infrastructure are located at a single site, close to Palmerston North and on the basis that the WWTP will be designed with significant redundancy. Options that include coastal land and/or an ocean outfall (i.e. significant infrastructure at a distance from Palmerston North) are scored lower on the basis of their vulnerability to natural disasters and remote mechanical failure.	4	4	3	3	2	3	3	2	2	2	2
			Avg Total	2.7	3.3	2.7	2.7	2.7	3.0	3.0	3.3	3.3	3.7	3.7
Climate Change Plan	*Decrease in Council's total organisational emissions*	*Reduce Council's organisational greenhouse gas emissions.*	Options including carbon sequestration from trees on coastal land/soils score higher on the basis that they contribute meaningfully to reducing Council's organisational greenhouse gas emissions. Options 3 to 11 (inclusive) will continue to utilise aerated lagoons, and	4	3	2	2	5	2	2	5	5	3	1

Relevant Plan	Measures of Success	What does Council want to Achieve?	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
			so will continue to have higher emissions compared to options 1 and 2 which use alternative treatment processes with lower emissions.											
	Decrease in citywide emissions	*City-wide reduction of CO2e emissions of 30% by 2031*[3]	Assessed as equivalent to the greenhouse gas emissions sub-criteria so scored similarly.	4	3	2	2	5	2	2	5	5	3	1
			Avg Total	4	3	2	2	5	2	2	5	5	3	1
Resource Recovery Plan	*Decrease in per capita volume of waste sent to landfill*	*The amount of waste that is sent to landfill is minimised (the goal of the WMMP).*	Sludge and biosolids currently composted using green waste and applied as a capping material to the closed landfill site. This is not a long-term option, and the option of applying treated biosolids to land is the preferred future state. The assessment has been based on the total volume of biosolids generated by each option on the basis that the larger the biosolids volumes, the more challenging will be implementing a beneficial re-use strategy for biosolids which avoids disposal to landfill. The score has also considered the extent to which the option concentrates contaminants which may impact on the ability to re-use the biosolids i.e. as a soil amendment. Option1 and 2 score lower on both sludge volume and contaminant concentration as a result.	2	2	3	4	4	4	3	4	3	4	4
	Increase in the proportion of waste diverted from landfill (target 48% by 2025)	*The community considers, and where appropriate implements, new initiatives, and innovative ways to assist in reducing, reusing and recycling wastes.*	The Council is considering a range of interventions (education, incentives and regulations) as a means to achieving adoption of more sustainable water use and waste disposal practices in the home, in order to reduce water use and wastewater flows and loads. As this will apply equally across all options there is considered to be no ability to differentiate between the options so this has not been assessed.	-	-	-	-	-	-	-	-	-	-	-
			Avg Total	2	2	3	4	4	4	3	4	3	4	4
Manawatū River Plan	*Increase in the public use of the river environment*	*Council understands the contribution the Manawatū River makes to the City as its key cultural, environmental and recreation resource.*	Council has developed an understanding of the contribution the Manawatū River makes to the City. This is recognised through the Project Objectives as well as by the importance given to environmental and cultural values assessments within the Project's options development and assessment process. On the basis that this is equivalent for all options this criterion has not been assessed.	-	-	-	-	-	-	-	-	-	-	-
	Increase in native planting and observed biodiversity improvements in suitable locations in the river environment	*Rangitāne o Manawatū is involved in all aspects of planning and delivery of Manawatū River projects and services.*	Rangitāne o Manawatū have been working with Council in a partnership from the outset of the BPO process. As this applies equally across all options there is considered to be no ability to differentiate between the options so this has not been assessed.	-	-	-	-	-	-	-	-	-	-	-

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[3] Refer to Goal 4 of Eco-City Strategy Report.

Relevant Plan	Measures of Success	What does Council want to Achieve?	Options Assessment	1	2	3	4	5	6	7	8	9	10	11
		There is increased use of the river environment by the public for active and passive recreation.	Recreational water quality standards can be met for all options including those with a river discharge. There are however differences between options in respect of the levels of achievement of the standards. The options also have impacts on recreation through their influence on public perception. Those options which effectively eliminate discharges to the river are accorded the highest score. For options which discharge to the river the score is a balance of the level of treatment provided and the extent to which the discharge is removed from the river. Option 2 score higher than option 1 on the basis that option 2 removes discharge during the summer low flow period despite both providing very high treatment levels.	3	4	2	5	5	3	3	3	3	5	5
			Avg Total	3	4	2	5	5	3	3	3	3	5	5
			TOTAL (out of 30)	**14**	**16**	**12**	**17**	**21**	**15**	**14**	**19**	**18**	**20**	**18**
			TOTAL Average Score	**3**	**3**	**2**	**3**	**4**	**3**	**3**	**4**	**4**	**4**	**4**

6 Recommendation

6.1 Weighting

A key objective for the Eco-City Strategy is the goal of meeting a 30% reduction in carbon emissions by 2031. On this basis, a carbon analysis was completed to determine how each option contributed to meeting this goal. In summary, the options do not contribute significantly to reducing carbon emissions on the basis that wastewater emissions comprise around 1% of the total emissions for the city. The wastewater BPO option is however a major contributor to Council's carbon emissions. On this basis, it is recommended that the score for alignment with the climate change plan is given greater weighting than scores describing alignment with the other plans. The recommended weightings are as follows:

Table 5 Technical Recommendation of weighting within Eco-City Strategy Plans

Plan	Weighting
Environmental Sustainability Plan	15%
Waters	15%
Climate Change	40%
Resource Recovery	15%
Manawatū River	15%

6.2 Recommended Options

The recommended scoring uses a scale of 1 to 5 to compare how well options align with the Eco-City Strategy Plans (refer Table 2). Each of the options aligns with each of the Plans to varying degrees. None of the options are considered fatally flawed. Technical advisors and Iwi have been involved in the assessment of all options against the Eco-City Strategy to develop the scores.

Overall, those options with the largest land areas which provide for forestry have achieved a higher ranking based on the significant carbon emissions reductions compared to options with long pipelines and land irrigation areas on the fluvial soils.

Table 6 below shows the ranked order of options based on the assessment of 9 sub-attributes across the 5 plans considered within the Eco-City Strategy.

Table 6 Options ranking against Eco-City Strategy Measures

Option Description		Treatment Level	Total Score (out of 30)	Average (total)	Ranking
1	R2 (b)	4	14	3	5
2	R2 (b) (75% DWF land): 760 ha.	4	16	3	6
3	Dual R+L (b) (75% DWF to land): 870 ha.	2	12	2	11
4	L+R(a): 3760 ha	1	17	3	7
5	L+R(b): 2570 ha.	3	21	4	1
6	L+R(d-1) 80 m3/s trigger: 2000 ha.	2	15	3	9
7	L+R(d-2) 62 m3/s trigger: 1640 ha.	2	14	3	10
8	L+R(e-1) 80 m3/s trigger: 3640 ha.	2	19	4	2
9	L+R(e-2) 62 m3/s trigger: 3010 ha.	2	18	4	3
10	O+L: 1470 ha	1	20	4	4
11	O no land	1	18	4	8

It is recommended that all options are considered in conjunction with the wider assessment approach before being recommended for assessment through the BPO Criteria. This will be determined in the BPO Recommendation Report.

Appendix 1: Carbon Footprint Assessment

PALMERSTON NORTH WASTEWATER BEST PRACTICABLE OPTION (BPO) REVIEW

Draft Carbon Footprint Assessment

JULY 2021

PALMERSTON NORTH
CITY COUNCIL

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

Project Manager:	Roger Hulme
Project Technical lead:	Jim Bradley

Report Details

Prepared by:	Andrew Slaney	7/05/2021
Checked by:	Andrew Wong	10/05/2021
Reviewed by:	Peter Brown	12/05/2021
Approved & Issued by:	Roger Hulme	14/05/2021

Revision Schedule

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
1	14/5/21	Draft for Client Review	Andrew Slaney	Andrew Wong	Peter Brown	Roger Hulme
2	27/5/21	Update for carbon sequestration	Andrew Slaney	Andrew Wong	Jim Bradley	Melaina Voss
3	30/7/21	Update following updated summaries and Peer Review comments	Andrew Slaney	Michael Tan	Jim Bradley	Melaina Voss

Executive Summary

A high-level assessment of the carbon footprints of the shortlisted PNCC BPO wastewater treatment and discharge options was undertaken to compare the relative global warming impact of the options and to assess the compatibility of the options with the goal of a 30% reduction in CO_2-e emissions by 2031 contained in Palmerston North's Eco City Strategy 2021-31.

The carbon assessment included both embodied (construction) and operational carbon emissions over a 50-year period. The total emissions (embodied + operational) are expressed as tonnes of CO_2 equivalent (CO_2-e). CO_2-e includes methane and nitrous oxide emissions converted to the equivalent mass of CO_2 in terms of global warming potential.

The estimated 50-year carbon emissions are presented in Table 1-1 and Figure 1-1 overleaf, from lowest to highest. The net change relative to the current WWTP emissions are also shown, with those options with a net reduction highlighted.

Annual operational carbon emissions ranged from 2,000 – 8,000 tonnes CO_2-e per annum (not including reduction due to carbon sequestration in trees). This amounts to around 1% of the estimated total annual carbon emissions from Palmerston North (500,000 tonnes CO_2-e p.a.).

The three coastal land options have the lowest carbon footprint due to the carbon sequestered in the forestry plantation trees, which significantly offsets the operational carbon emissions from wastewater treatment and discharge.

The ocean outfall option (O) has the highest carbon footprint of the shortlisted options due to:

- High embedded carbon (long pipeline)
- Methane emissions (from the aerated facultative lagoons)

Aside from the coastal land options, the only other options that meet the 30% reduction in CO_2-e emissions by 2031 are the two local river discharge options (R(2) and R(2)b). These options have the lowest embodied carbon as well as low operational emissions (due to removing the aerated facultative lagoons).

Table 1-1: PNCC Wastewater BPO 50-Year Carbon Emissions

Option	TL	Embodied Carbon	Average Operational Carbon Emissions	Average Annual Sequestered Carbon	50-Year Carbon Emissions	Net Change from Current Emissions
		t CO_2-e	t CO_2-e p.a.	t CO_2-e p.a.	t CO_2-e	%
L + R (b)	3	68,700	2,340	(22,500)	-299,000	-173%
L + R (e-1)	2	67,600	8,530	(31,900)	-189,000	-146%
L + R (e-2)	2	66,300	8,470	(26,400)	-73,000	-118%
R2 (b) 2	4	7,000	2,400	-	129,000	-69%
R2 (b)	4	3,500	2,500	-	131,000	-68%
O + L	1	66,500	8,210	(12,900)	206,000	-50%
L + R (d-2)	2	21,600	8,400	-	450,000	10%
L + R (d-1)	2	22,000	8,450	-	453,000	11%
Dual R + L (b)	2	37,000	8,240	-	457,000	12%
L + R (a)	1	24,400	8,800	-	473,000	15%
O	1	63,600	8,140	-	479,000	17%

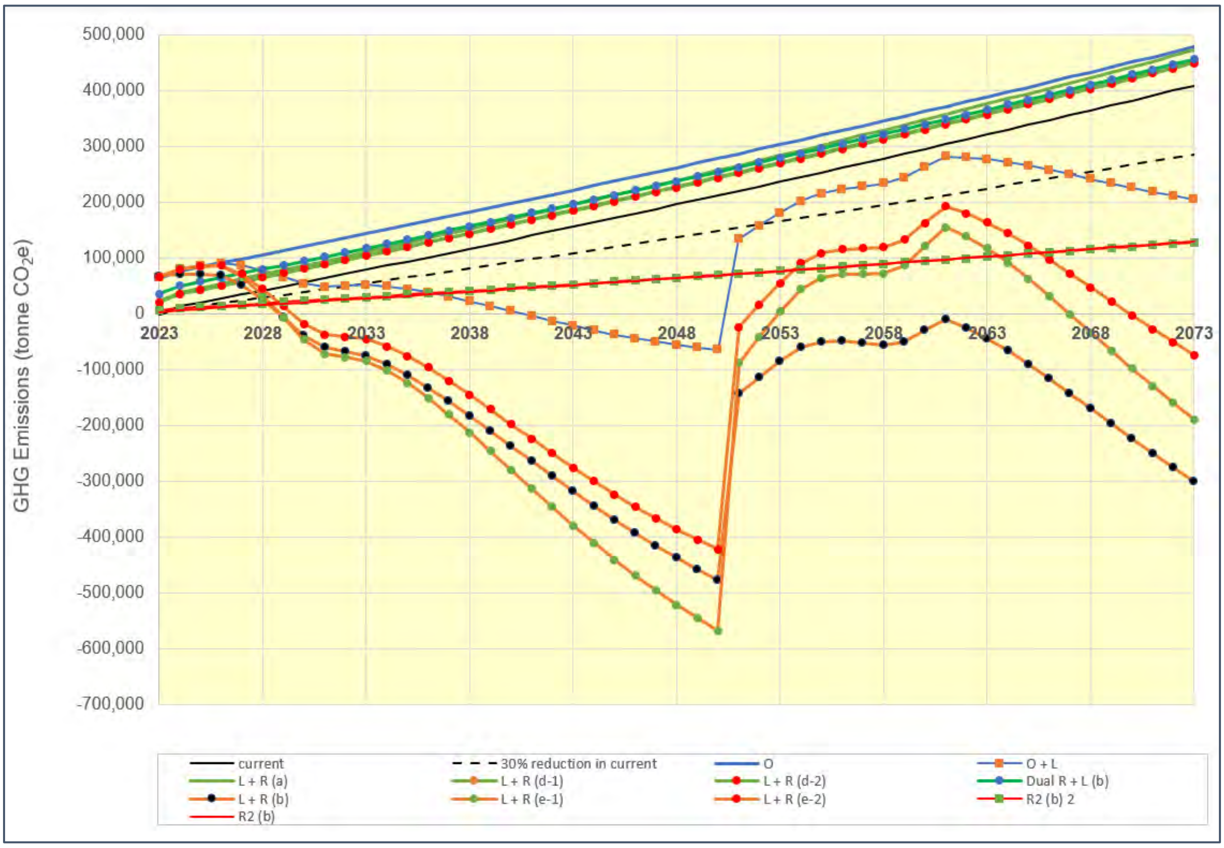

Figure 1-1: PNCC Wastewater BPO 50-Year Carbon Emissions

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1 Introduction

1.1 Background

Palmerston North City Council (PNCC) are currently reviewing options for the city's wastewater treatment and discharge, in preparation for the Palmerston North wastewater treatment plant (WWTP) resource consent application. The aim of the review is to identify a Best Practicable Option (BPO) for the treatment and discharge of treated wastewater to be taken forward for resource consent application.

The BPO review has identified a shortlist of 11 options which are currently being presented to stakeholders for consultation and feedback (Stantec, February 2021b).

An important criterion in the BPO assessment is compatibility with Palmerston North's 2021-31 (Draft) Eco City Strategy. This Eco City Strategy was developed to achieve the goal of an "eco city" which is for Palmerston North to decrease carbon emissions and reduce its ecological footprint (PNCC, 2021). The strategy contains a target reduction in carbon dioxide equivalent (CO_{2}-e) emissions of 30% by 2031.

1.2 Purpose of this Report

The purpose of this report is to undertake a high level comparison of the carbon footprints of the shortlisted wastewater treatment and discharge options. This will allow:

- Comparison of the carbon footprints of the shortlisted options.
- Comparison of the carbon footprints of the shortlisted options against the current WWTP
- Assess the compatibility of the shortlisted options with the goal of a 30 % reduction in CO_{2}-e emissions for the city.

Note:

Due to the early stage of this project (BPO assessment), there is insufficient design definition to undertake a detailed carbon inventory for the options, and the hence the objective of this report is to assess the ranking of the options in terms of carbon footprint, as well as gain an idea of the main emissions contributors and a rough estimate of the magnitude of emissions from the schemes.

2 Shortlisted Options

The shortlisted options along with the receiving environments are presented in Table 2-1 and in Figure 2-1. For descriptions and details of the treatment levels and discharge options, refer to Stantec (February 2021) and Stantec (August 2021).

Table 2-1: PNCC Wastewater BPO Shortlisted Options and Receiving Environments (Percent of Annual Volume)

Option	Treatment Level	Primary Environment	Secondary Environment	High Wet Weather Flows
O	1	Ocean 90%	n/a	Tōtara Rd 10%
O+L	1	Ocean 71%	Land (Coastal) 19%	Tōtara Rd 10%
L+R (a)	1	Land (Inland) 90%	n/a	Tōtara Rd 10%
L+R (d-1)	2	Land (Inland) 53%	River Tōtara Rd 47%	n/a
L+R (d-2)	2	River Tōtara Rd 57%	Land (Inland) 43%	n/a
Dual R+L (b)	2	River Tōtara Rd / Opiki 86%	Land (Inland) 14%	n/a
L+R (b)	3	Land (coastal) 90%	n/a	Tōtara Rd 10%
L+R (e-1)	2	Land (coastal) 53%	River Tōtara Rd 47%	n/a
L+R (e-2)	2	River Tōtara Rd 57%	Land (coastal) 43%	n/a
R2 (b) 2	4	River (Tōtara Rd) 86%	Land (Inland) 14%	n/a
R2 (b)	4	River (Tōtara Rd) 100%	n/a	n/a

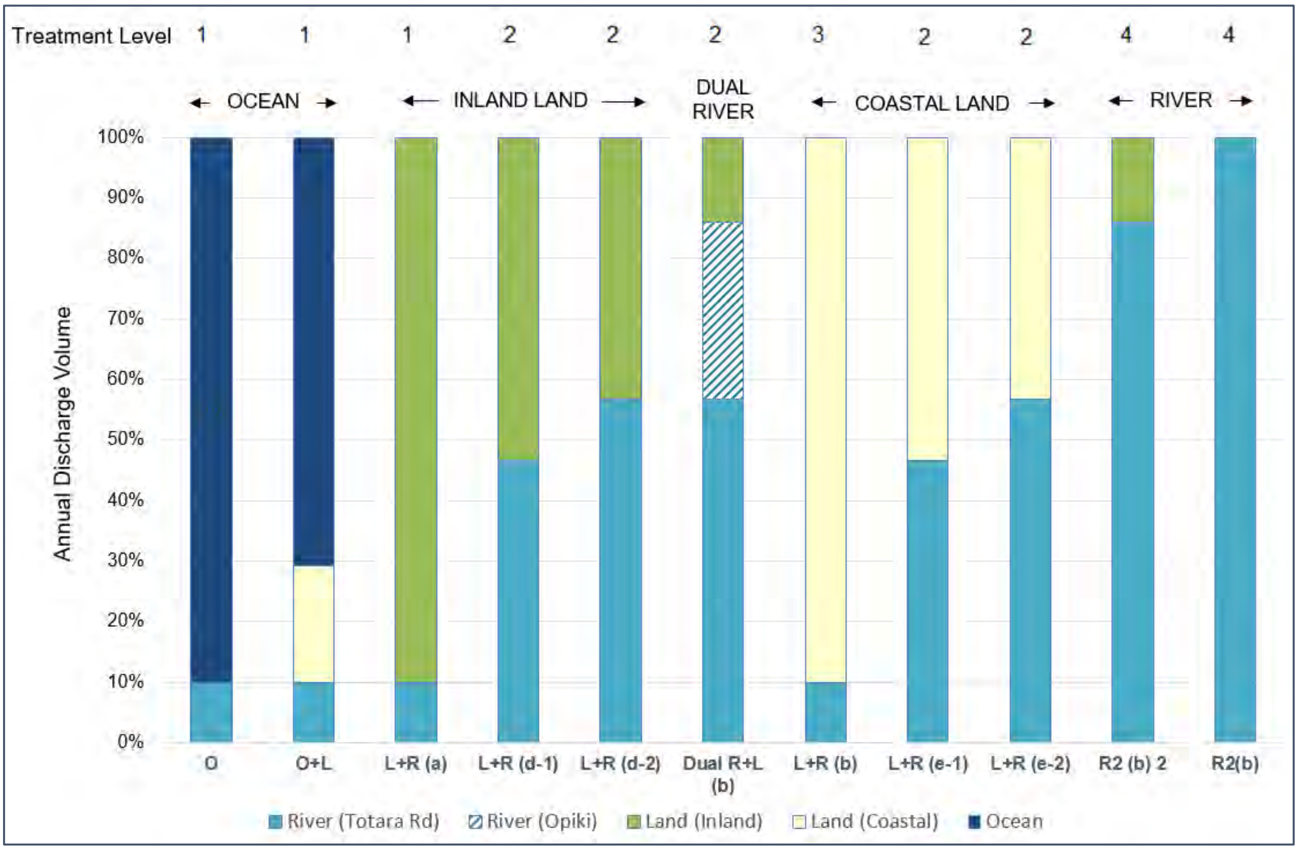

Figure 2-1: PNCC Wastewater BPO Shortlisted Options and Receiving Environments (Percent of Annual Volume)

3 Embodied Carbon

3.1 Major Capital Works Items

As the project is at the initial concept stage, the level of project definition does not allow for a detailed embodied carbon inventory of each option. Therefore, only the major civil works elements were included in the embodied carbon assessment as these were assumed to comprise the bulk of the embodied carbon. These are discussed below.

Treatment

The BPO review identified four treatment levels to meet the requirements of the shortlisted receiving environments for the treated wastewater. All four treatment levels require upgrade works to the existing WWTP, for either population growth, asset renewal or increased treatment.

The major treatment capital works items for the treatment levels are presented in Table 3-1. For a more detailed description of the treatment requirements, refer to the Shortlist Treatment Addendum (Stantec, February 2021).

Table 3-1: PNCC Wastewater BPO Major Treatment Capital Works Items

Treatment Levels 1 & 2	Treatment Level 3	Treatment Level 4
• Grit removal tank • Primary sedimentation tanks • Secondary clarifier	• Grit removal tank • Primary sedimentation tanks • Activated sludge bioreactors • Secondary clarifier • Secondary sludge facilities	• Grit removal tank • Primary sedimentation tanks • Activated sludge bioreactors • Membrane bioreactors • Secondary sludge facilities

Discharge

The BPO review identified five environments for the treated wastewater:

- Manawatū River (at the WWTP Tōtara Rd site)
- Manawatū River (below Oroua River confluence at Opiki)
- Land (inland fluvial/loam soils)
- Land (coastal sandy soils)
- Ocean (in the South Taranaki Bight)

The major capital works items associated with the discharge options are presented in Table 3-2. For a more detailed description of the discharge requirements, refer to the Shortlisted Options Summary Report (Stantec, August 2021).

Table 3-2: PNCC Wastewater BPO Major Discharge Capital Works Items

River at Tōtara Rd	River at Opiki	Inland or Coastal Land	Ocean
• Constructed wetland	• Transfer pipe and pump station • Constructed wetland	• Transfer pipe and pump stations • Irrigation storage lagoon • Irrigation infrastructure	• Transfer pipe and pump stations • Ocean outfall

Exclusions

Due to the high-level nature of this assessment, only the major reinforced concrete water retaining structure embodied carbon emissions were calculated. This forms only part of the total embodied carbon of the WWTP upgrade works, other items include:

- Access platforms and structures
- Buildings
- Pipework, pumps and other mechanical equipment
- Earthworks

To account for total WWTP embedded carbon, a factor was applied to the reinforced concrete tank embodied carbon estimates on the basis that roughly, the total amount of mechanical, electrical and ancillary works should be proportional to the major water retaining structures which form the main civil aspects of the WWTP upgrades. The following factors were applied to the reinforced concrete tank embodied carbon estimates, based on a published embodied carbon inventory for a water recovery park in the UK (Georgiou *et al*, 2019):

Treatment levels 1 & 2:	50%
Treatment level 3:	150%
Treatment level 4:	150%.

3.2 Capital Works Items Sizing

Concept sizing of the major capital works elements for each option is provided in Table 3-3.

Table 3-3: PNCC Wastewater BPO: Capital Works Sizing

Option	TL	Reinforced Concrete Volume	Wetland Volume	Transfer Pipe OD	Transfer Pipe Length	Irrigation Lagoon Volume	Irrigation Area
		m^3	m^3	mm	km	m^3	Ha
O	1	1,240	40,000	1,332	38.0	n/a	n/a
O+L	1	1,240	40,000	1,332	38.0	10,000	1,130
L+R (a)	1	1,240	40,000	1,332	11.0	200,000	2,890
L+R (d-1)	2	1,240	40,000	1,332	11.0	90,000	1,540
L+R (d-2)	2	1,240	40,000	1,332	11.0	90,000	1,260
Dual R+L (b)	2	1,240	80,000	1,332* 1,332*	14.0 7.0	30,000	670
L+R (b)	3	3,400	40,000	1,332	36.0	160,000	1,975
L+R (e-1)	2	1,240	40,000	1,332	36.0	60,000	2,800
L+R (e-2)	2	1,240	40,000	1,332	36.0	50,000	2,315
R2 (b) 2	4	2,000	180,000	630	11.0	40,000	585
R2 (b)	4	**2,000**	180,000	n/a	n/a	n/a	

* Dual R + L option has two pipes: The longer pipe is to the river discharge at Opiki; the shorter pipe is to land discharge

3.3 Embodied Carbon Emission Factors

Carbon emission factors for materials and construction activities are available from a variety of sources. In New Zealand, the Ministry for the Environment has published a useful summary (MfE, 2020). Other sources of emissions factors are published by the Transport Authorities Greenhouse Group Australia and New Zealand (TAGG, 2013) and the Infrastructure Sustainability Council of Australia (ISCA, 2020).

Note: Emissions from transport of materials to site are ignored in this assessment as they are assumed to be minor and would not affect the comparative assessment significantly. The embodied carbon emissions factors used in the assessment are presented in Table 3-4.

Table 3-4: PNCC Wastewater BPO: Embodied Carbon Emission Factors

Component	Unit	Embodied Carbon kgCO_2-e/unit	Comment / Reference
Concrete	m^3	337	40 MPa concrete - MfE (2020) Table 71
Reinforcing steel	kg	1.23	ISCA (2020)
Reinforced concrete at 200 kg/m^3 steel	m^3	583	From the above two values
Galvanised steel pipe (material only)	kg	2.46	ISCA (2020)
GRP pipe (material only)	kg	8.02	ISCA (2020)
PE pipe (material only)	kg	2.54	ISCA (2020)
Diesel	litre	2.70	MfE (2020) Table 4
Aggregate for pipe laying	m^3	3.14	ISCA (2020)
Earthworks (at 1.2 litres diesel / m^3)	m^3	3.24	TAGG (2013) Table 5-6

For the transfer pipes, embodied carbon emissions from earthworks needed to install the pipes were included. The earthworks required were calculated using the dimensions in Figure 3-1.

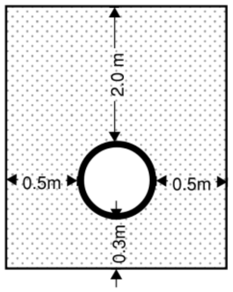

Figure 3-1: Transfer Pipe Trench Dimensions for Earthworks Volume Calculation

The embodied carbon of the transfer and irrigation pipes are presented in .

Table 3-5: PNCC Wastewater BPO: Transfer Pipe Embodied Carbon per Metre Installed

Outside Diameter	Inside Diameter	Material	Class	Pipe Mass	Earthworks Volume	Embodied Carbon (kgCO_2-e/m)		
mm	Mm			kg/m	m^3/m	Plastic	Earthworks + Aggregate	Total
1332	1287	GRP	PN16	195	16.9	1,564	77.7	1,642
1229	1189	GRP	PN16	167	15.7	1,339	72.2	1,412
900	765	PE100	SDR 13.6	176	12.2	447	55.9	1,467
630	528	PE100	SDR 13.6	110	10.3	178	43.8	222
315	285	PE100	SDR 21	14	1.7	36	5.4	41
50	45	PE100	SDR 21	0.37	n/a	0.94	0	0.94

For irrigation areas, the following assumptions were made for the purposes of embodied carbon estimates (note these are for the purposes of embodied carbon estimate only. No preliminary design has been undertaken on irrigation infrastructure at this stage).

Table 3-6: PNCC Wastewater BPO: Embodied Carbon Irrigation Assumptions

Component	Unit	Value	Reference
Centre Pivot Irrigation (inland land)			
Centre pivot radius (inland land)	m	400	Estimate, large areas require large pivots
Area covered per pivot	Ha	50	
Fraction of area covered by pivots	%	79	
Weight of steel per centre pivot	tonnes	19.5	At 48.6 kg per metre (Jacobs, 2006)
Weight of concrete per centre pivot	tonnes	7.2	Jacobs, 2006
Length of distribution main per centre pivot	m	800	2 x radius; See Figure 3-2
Distribution main diameter	mm	300	
Solid Set Irrigation (coastal land)			
Distribution main spacing	m	250	
Lateral spacing	m	25	
Distribution main diameter	mm	300	
Lateral diameter	mm	50	

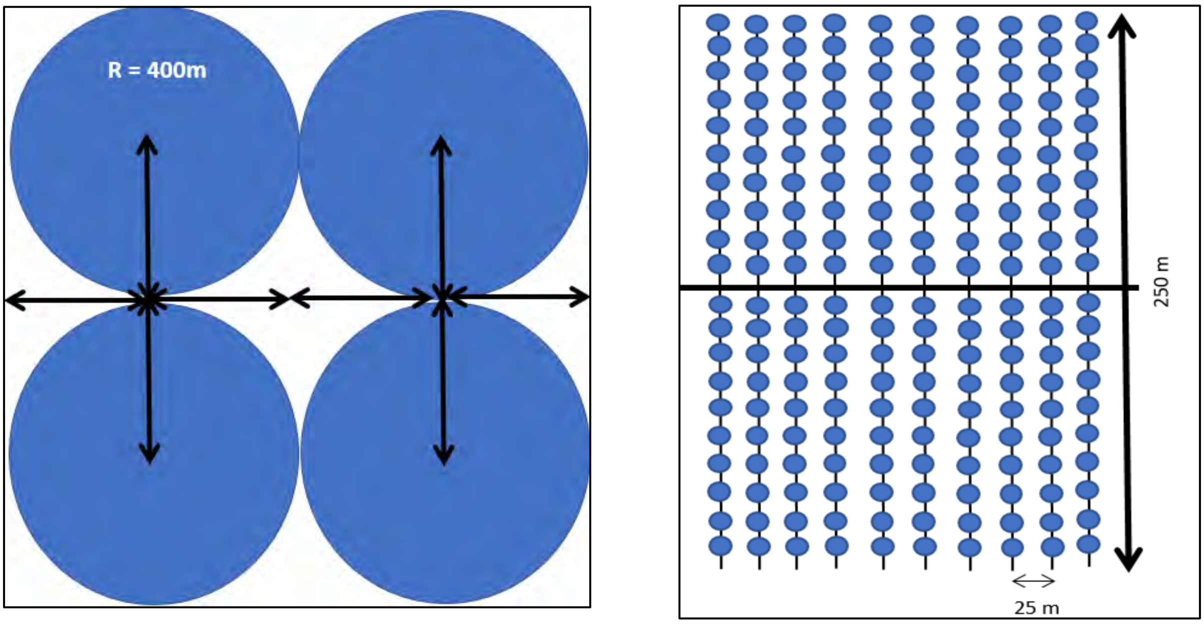

Figure 3-2: Centre Pivot and Solid Set Irrigation Layout Assumptions: Centre Pivot (L) and Solid Set (R)

Concept sizing of the major irrigation works elements for each option is provided in Table 3-7.

Table 3-7: PNCC Wastewater BPO: Irrigation Sizing for Purposes of Embodied Carbon Assessment

Option	Irrigation Location	Irrigation Area	Irrigation System	No. of Centre Pivots	Distribution Main Length	Lateral Length
		Ha			km	km
O+L	Coastal	1,130	SS	n/a	45	452
L+R (a)	Inland	2,890	CP	46	36	n/a
L+R (d-1)	Inland	1,540	CP	24	20	n/a
L+R (d-2)	Inland	1,260	CP	20	16	n/a
Dual R+L (b)	Inland	670	CP	10	8.0	n/a
L+R (b)*	Coastal	1,975	SS	n/a	79	790
L+R (e-1)	Coastal	2,800	SS	n/a	112	1,120
L+R (e-2)	Coastal	2,315	SS	n/a	93	926
R2 (b) 2	Inland	585	CP	9	7.2	n/a

* Coastal land discharge option based on treatment level 3 to achieve lower TN and lower land area. Alternative of larger land area and treatment level 1 available but not assessed.

3.4 Embodied (Construction) Carbon Estimates

The embodied carbon estimates for the shortlisted options are presented in Table 3-8 from lowest to highest.

Table 3-8: PNCC Wastewater BPO: Embodied Carbon Summary

Option	Embodied Carbon (tonnes CO_2e)						
	WWTP Concrete	WWTP Other	Wetland	Transfer Pipe	Storage Lagoon	Irrigation System	Total
R2 (b)	1,170	1,760	590	0	0	0	**3,520**
R2 (b) 2	1,170	1,760	590	2,500	130	890	**7,040**
L + R (d-2)	730	370	130	18,100	300	1,980	**21,610**
L + R (d-1)	730	370	130	18,100	300	2,370	**22,000**
L + R (a)	730	370	130	18,100	650	4,450	**24,430**
Dual R + L (b)	730	370	260	34,500	100	990	**36,950**
O	730	370	130	62,400	0	0	**63,630**
L + R (e-2)	730	370	130	59,100	170	5,830	**66,330**
O + L	730	370	130	62,400	40	2,850	**66,520**
L + R (e-1)	730	370	130	59,100	200	7,050	**67,580**
L + R (b)	1,990	2,990	130	59,100	520	4,980	69,710

* Coastal land discharge option based on treatment level 3 to achieve lower TN and lower land area. Alternative of larger land area and treatment level 1 available but not assessed.

As shown in Table 3-8, options involving land discharge or ocean outfall have the highest embodied carbon due to the long transfer pipe distances and large irrigation areas which require large masses of plastic for buried pipework as well as steel for the centre pivot irrigators.

As a result, the options that maintain the existing discharge location (R2 (b) and R2 (b)2) have the lowest embodied carbon.

4 Operational Carbon

4.1 Emissions Included

The following emissions were included in the operational carbon assessment:

- Methane emissions from the existing aerated facultative lagoons (where retained)
- Nitrous oxide emissions from new biological nitrogen removal (BNR) tanks
- Nitrous oxide emissions from nitrogen applied to land (in treated wastewater)
- Nitrous oxide emissions from nitrogen discharged to surface water (in treated wastewater)
- Carbon emission component of grid electricity consumption
- Carbon emissions from grid natural gas consumption
- Carbon emissions associated with aluminium sulphate consumption (for phosphorus removal)

4.2 Emissions Excluded

The following operational carbon emissions were excluded from the assessment as they were assumed to be insignificant and / or would be common across all options. (As stated previously, the current level of project definition does not allow a detailed emissions inventory of each option).

- Methane emissions from primary clarifiers and sludge handling facilities
- Diesel for transporting screenings, grit and biosolids to landfill
- Methane emissions from landfilled biosolids
- Carbon credits for heat and/or electricity generated from biogas cogeneration engines

4.3 Energy and Chemical Consumption

The energy and chemical consumption of the shortlisted options per unit volume is presented in Table 4-1.

Table 4-1: PNCC Wastewater BPO Energy and Chemical Consumption Summary

Option	WWTP Electricity	Transfer Pumping Electricity	Grid Gas	Alum Consumption
	kWh/ML	kWh/ML	kWh/ML	kg/ML
O	301	230	14	0.0
O+L	301	230	14	0.0
L+R (a)	301	129	14	0.0
L+R (d-1)	301	76	14	12.6
L+R (d-2)	301	62	14	21.5
Dual R+L (b)	301	85	14	38.7
L+R (b)	406	223	14	0.0
L+R (e-1)	301	132	14	12.6
L+R (e-2)	301	107	14	21.5
R2 (b) 2	611	40	14	52.9
R2 (b)	611	0	14	72.1

4.4 Emission Factors

Methane Emissions

Methane emissions from the existing aerated facultative lagoons are thought to be the major source of greenhouse gas emissions from the existing WWTP. The lagoons are designed to store and digest sludge in their base; this process generates methane which is released into the atmosphere.

It should be noted that a significant fraction (at least 50%) of the influent solids are captured in the primary clarifiers and digested in the anaerobic digesters, where the methane generated is either used to generate heat and electricity or is flared (and therefore does not contribute to the carbon footprint of the plant as the IPCC Guidelines exclude CO_2 generated from biogenic sources in WWTP assessments).

In the absence of site measurements there is a high level of uncertainty in the amount of methane emitted from wastewater treatment ponds. The Intergovernmental Panel for Climate Change (IPCC) Guidelines methodology uses a methane correction factor (MCF) which is the ratio of actual methane generated to the theoretical maximum capacity of the waste.

MCF values for ponds found in the literature are presented in Table 4-2.

Table 4-2: Facultative Ponds Methane Correction Factors

Source	Average	Range
IPCC (2019) Ch. 6 Table 6.3	0.20 (default value)	0.0 - 0.3
WSAA (2009) (aerated lagoon)	0.10	0.03 – 0.20
Paredes et al (2015) (includes anaerobic ponds)	0.72	

For the purposes of this study, the IPCC default MCF value has been selected.

The derivation of the aerated facultative lagoons methane emission factor is presented in Table 4-3.

Table 4-3: PNCC Wastewater BPO: Aerated Facultative Lagoon Methane Emission Factor Basis

Component	Unit	Value	Reference
Maximum methane generation	kg CH_4/kg COD	0.250	IPCC (2019) Ch. 6 Table 6.2
Methane correction factor		0.20	IPCC (2019) Ch. 6 Table 6.3
Methane emission factor	kg CH_4/kg COD	0.050	Generation x correction factor
Influent COD particulate fraction		0.60	Estimate - typical value
Particulate COD removal in primary clarifiers		50%	Estimate - typical value
Fraction of influent COD remaining in primary effluent		70%	From above parameters
Methane emission factor (influent COD basis)	kg CH_4/kg COD_{in}	0.035	From above parameters
Average influent COD concentration	mg/L	547	Stantec (2018) Table 6-1
Methane emission factor (volume basis)	kg CH_4/ML	19.1	
Methane global warming potential	x CO_2	25	MfE (2020) Table 1
Methane emission factor	**kgCO_2-e / ML**	**479**	

Nitrous Oxide Emissions

Nitrous oxide (N_2O) has a global warming potential approximately 300 times higher than carbon dioxide and can be a significant source of greenhouse gas emissions from wastewater treatment plants. N_2O is generated as a by-product of nitrification, or as an intermediate product of denitrification.

There are many factors affecting N_2O emissions from wastewater treatment plants, such as the temperature and dissolved oxygen concentration of the wastewater, and other operational conditions. The IPCC Guidelines use a nitrous oxide emission factor (kg N_2O per kg N) to estimate nitrous oxide from wastewater treatment processes. Due to the number of factors affecting N_2O emissions there is a wide range of emission factor values reported in the literature. For example, the IPCC Guidelines have a default emission factor value of 0.016 for “aerobic treatment plants” with a reported range of 0.00016 – 0.045 (IPCC, 2019 Ch. 6).

A recent Australian review of nitrous oxide emission factors for wastewater treatment plants recommended lower emission factors than the IPCC default, and inversely proportional to the degree of nitrogen removal (de Haas and Ye, 2021). A graph of measured emission factors versus total nitrogen (TN) removal is shown in Figure 4-1.

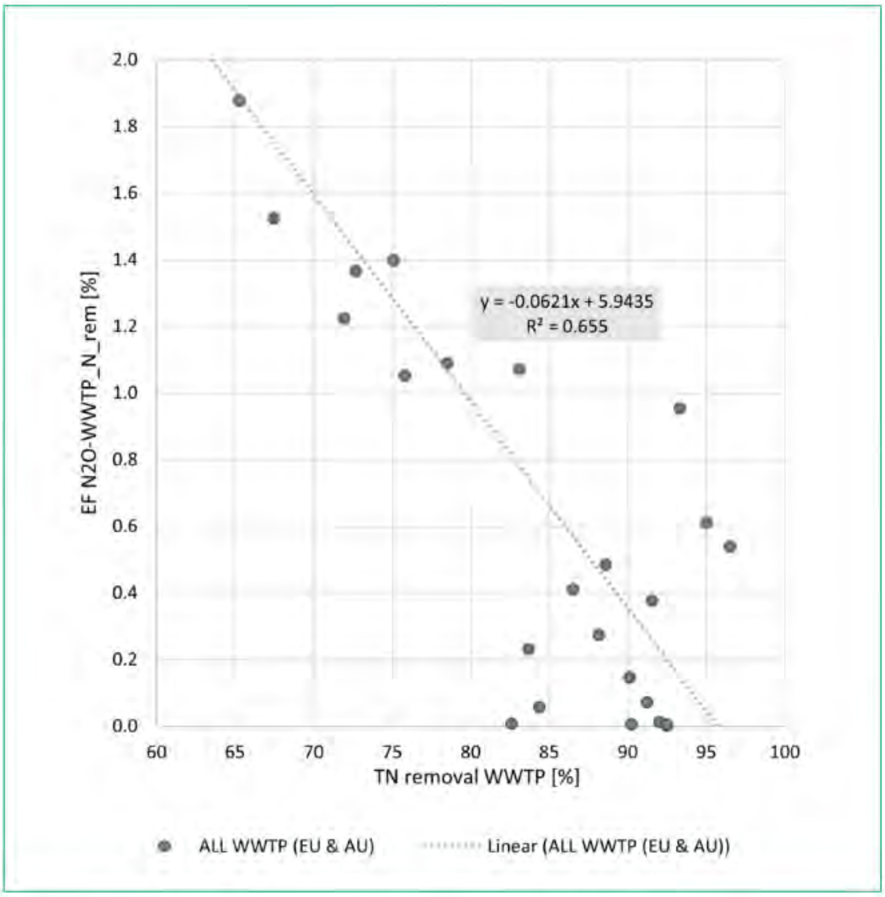

Figure 4-1: Average WWTP N_2O emission factors with respect to TN removal (de Hass & Ye 2021)

For the purposes of this study, a TN removal of 90% is assumed. An emission factor of 0.31 % per % removal is recommended by de Haas and Ye (2021). This equates to an emission factor of 0.28% on the basis of influent TN which is less than a fifth of the current IPCC default value (1.6%).

N_2O emissions can also occur from wastewater discharged into the environment (either into water or onto land). The IPCC Guidelines contain N_2O emissions factors for wastewater discharges to aquatic environments as well as to land (which are covered under the Managed Soils chapter).

The selected emissions factors are presented in Table 4-4.

Table 4-4: Nitrous Oxide Emission Factors

Source	Units	Value
BNR plant emissions (de Haas and Ye, 2021)	kg N_2O-N / kg Nin	0.28%
Freshwater, estuarine, and marine discharge (IPCC 2019)	kg N_2O-N / kg N	0.50%
Discharge to soil (from fertilisers, organic amendments and crop residues) (IPCC 2019)	kg N_2O-N / kg N	1.0%

The derivation of the nitrous oxide emission factors are presented in Table 4-5.

Table 4-5: PNCC Wastewater BPO: Nitrous Oxide Emission Factors

Component	Unit	Value	Reference
Activated sludge N_2O-N emission factor	kg N_2O-N / kg Nin	0.28%	de Haas and Ye (2021)
Average influent TN concentration	mg/L	43	Stantec (2018) Table 6-1
Activated sludge N_2O emission factor (volume basis)	kg/ML	0.19	
N_2O global warming potential	x CO_2	298	MfE (2020) Table 1
Activated sludge N_2O emission factor (volume basis)	**kgCO_2-e / ML**	**56**	
Treated wastewater N concentration – TL 1 & 2	mg/L	35	
Treated wastewater N concentration – TL 3	mg/L	10	
Treated wastewater N concentration – TL 4	mg/L	4	
Treated wastewater N_2O emission factors (volume basis)			
		River / Ocean	Land
Treatment Levels 1 & 2	kgCO_2-e / ML	82	164
Treatment Level 3	kgCO_2-e / ML	23	47
Treatment Level 4	kgCO_2-e / ML	9.4	19

Other Emissions

Other emissions included in the operational carbon assessment are electricity, natural gas and aluminium sulphate (alum). Emissions factors for these are presented in Table 4-6.

Table 4-6: PNCC Wastewater BPO: Operational Carbon Emission Factors

Component	Unit	Value	Reference
Grid Electricity	$kgCO_2$-e / kWh	0.1097	MfE (2020) Table 9 & Table 11
Natural Gas (from grid)	$kgCO_2$-e / kWh	0.2070	MfE (2020) Table 3 & Table 6
Aluminium sulphate	$kgCO_2$-e / kg	0.718	ISCA (2020)

4.5 Operational Carbon Estimates

The operational carbon emission estimates (volumetric basis) for the shortlisted options are presented in Table 4-7 from lowest to highest.

Table 4-7: PNCC Wastewater BPO: Embodied Carbon Summary (Volumetric Basis)

Option	Treatment Level	Operational Carbon (kg CO_2e / ML)					
		CH_4 Emissions	N_2O Emissions	Grid Electricity	Grid Gas	Alum Dosing	Total
L + R (b)	3	0	100	71	14	0	**185**
R2 (b) 2	4	0	67	72	14	38	**190**
R2 (b)	4	0	65	67	14	52	**198**
Current	1	479	82	30	14	33	**637**
O	1	479	82	71	14	0	**645**
O + L	1	479	98	60	14	0	**651**
Dual R + L (b)	2	479	94	39	14	28	**653**
L + R (d-2)	2	479	117	41	14	15	**666**
L + R (d-1)	2	479	126	43	14	9	**670**
L + R (e-2)	2	479	117	46	14	15	**671**
L + R (e-1)	2	479	126	49	14	9	**676**
L + R (a)	1	479	156	49	14	0	**697**

As shown in Table 4-7, options which include treatment levels 3 and 4 have lower calculated operational carbon emissions. This is due to the replacement of the aerated facultative lagoons with an activated sludge process (with activated sludge, all solids are captured within the process rather than a portion being anaerobically digested in the bottom of open lagoons).

As discussed earlier, the calculated CH_4 and N_2O emission factors have a high uncertainty as demonstrated by the wide range of values reported in the literature.

5 Carbon Sequestration

5.1 Methodology

Forestry

As part of the BPO project, consultants PDP in undertaking the land application assessment, determined that *pinus radiata* was the preferred crop for the coastal land options. Therefore, for the shortlisted options that include a coastal land discharge element, it is assumed that the land will be planted in *pinus radiata*. If the land was not already planted in trees (i.e., the plantation is developed specifically for the land treatment system) it is appropriate that the carbon sequestered by the pine trees is included in the carbon footprint assessment. For land already in pine plantation, then there is no change due to the land application system and no sequestration credit should apply.

The carbon sequestered by pine trees was calculated using the methodology described in the Ministry for Primary Industries Carbon Look-up Tables for Forestry in the Emissions Trading Scheme (MPI, 2017). Under the ETS methodology, when the trees are harvested, most of the sequestered carbon is released back into the atmosphere, with the residual carbon left over decaying over a 10-year period at the same time as the new trees grow. This results in a cyclical “saw tooth” pattern of sequestered carbon over time.

The assumptions used in the carbon footprint assessment are presented in Table 5-1.

Table 5-1: PNCC Wastewater BPO: Forestry Carbon Sequestration Assumptions

Component	Unit	Value	Reference / Comment
Fraction of land already planted in pine trees	%	60%	Estimate
Species planted		Pinus radiata	Common species in the region
Age of trees at harvest	years	28	Default value for ETS (MPI, 2017)

Note: It could be argued that operational emissions should take priority over sequestration credits, ie it should not be possible for PNCC to “plant away” carbon emissions from the treatment and discharge scheme as surrounding land use may change to forestry in future meaning no net change due to the scheme. However for the purposes of this assessment, sequestration credits have been included to show the relative impact of forestry sequestration compared to operational emissions of the schemes.

Pasture

For the shortlisted options that include an inland land discharge element, it is assumed that the land will be planted in some form of pasture with the material harvested under a cut and carry system (e.g. silage, bailage, hay). Cut and carry pasture does not have any carbon emissions (above the nitrous oxide emissions due to the treated wastewater, described in Section 4.4). Dairy farms have GHG emissions of between 3 – 19 tonnes CO_2e/ha/y, and sheep and beef farms 0.4 – 6.5 tonnes CO_2e/ha/y (AgFirst, 2019). Therefore, it could be argued that if land that is currently grazed is included in the land treatment system (i.e. converted into cut and carry) there is a net reduction in emissions from that land. However harvested material will be fed to livestock elsewhere so that much then depends on the off-site effects, e.g. farm management, etc. Therefore no carbon credit is applied to the cut and carry land treatment schemes. If inland land discharge options were planted in forestry, sequestration would apply however inland forestry plantations are not included in the shortlisted options considered so far.

6 Life Cycle Carbon Emissions

6.1 10-Year Cumulative Emissions Graph

The calculated 10-year cumulative embedded plus operational carbon emissions for the shortlisted options are presented in Figure 6-1. The dashed black line represents PNCC's target of 30% reduction in carbon emissions, relative to the current operation, by 2031 as set out in the Eco-City Strategy 2021 (shown by the dashed vertical red line).

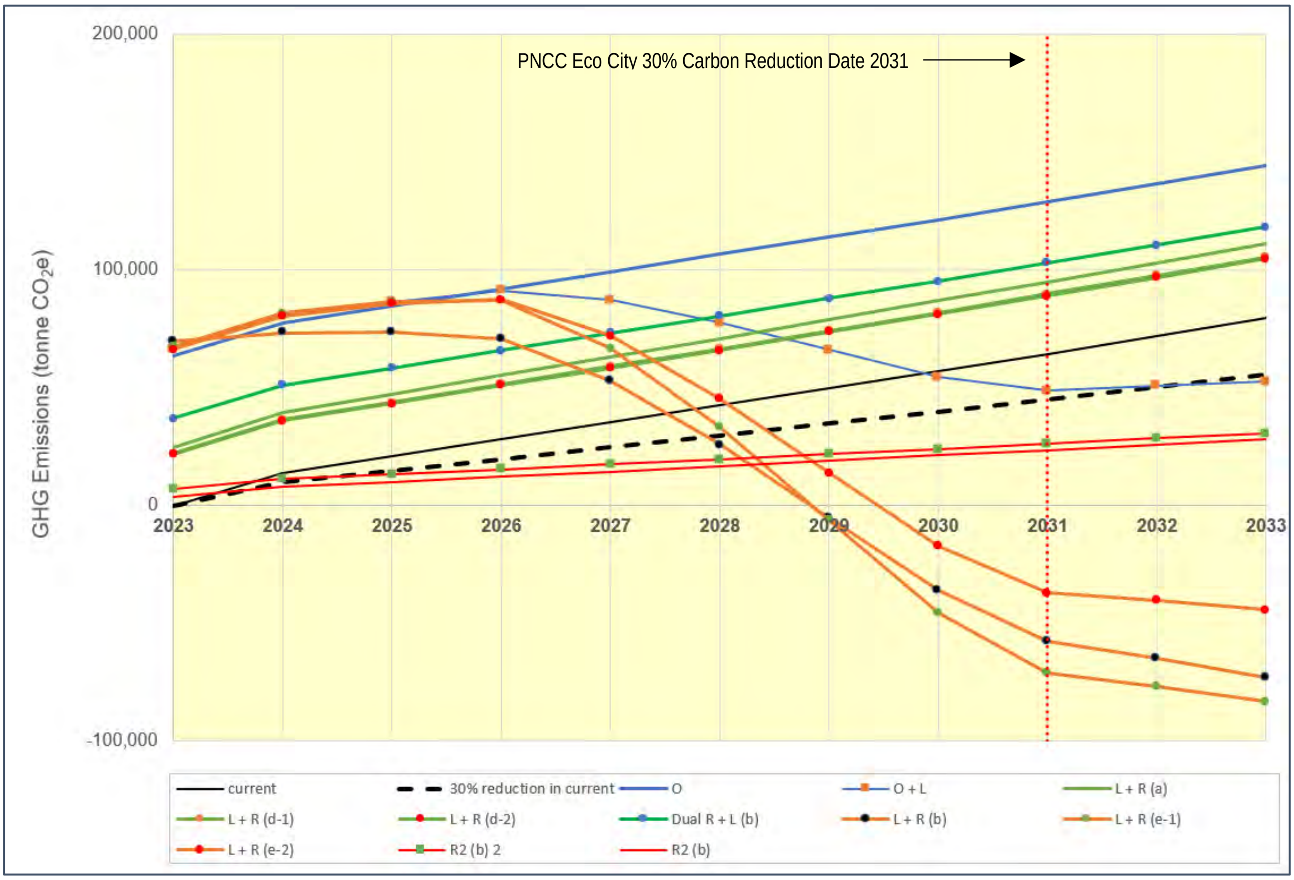

Figure 6-1: PNCC Wastewater BPO 10 Year Cumulative Carbon Emissions

The starting values (year 2023) represent the embodied carbon emissions. For the options not involving forestry the cumulative emissions increase over time.

For the options involving forestry plantations (coastal land discharge), the cumulative emissions reduce with time due to the carbon sequestered in the trees being larger than the operational carbon emissions. As mentioned previously it could be argued that sequestration credits do not apply as surrounding land use may change over time to forestry (ie no net change due to the scheme). However for the purposes of this assessment, sequestration credits have been included to show the relative impact of forestry sequestration compared to operational emissions of the schemes.

Of the non-forestry options, the local river discharge options (R2(b) and R2(b)2) are the only options that will provide a reduction in carbon emissions relative to the current operation. This is due to the removal of the facultative pond methane emissions as well as having the lowest embodied carbon.

6.2 50-Year Cumulative Emissions Graph

The calculated 50-year cumulative embedded plus operational carbon emissions for the shortlisted options are presented in Figure 6-2Figure 6-1. The dashed black line represents PNCC's target of 30% reduction in carbon emissions.

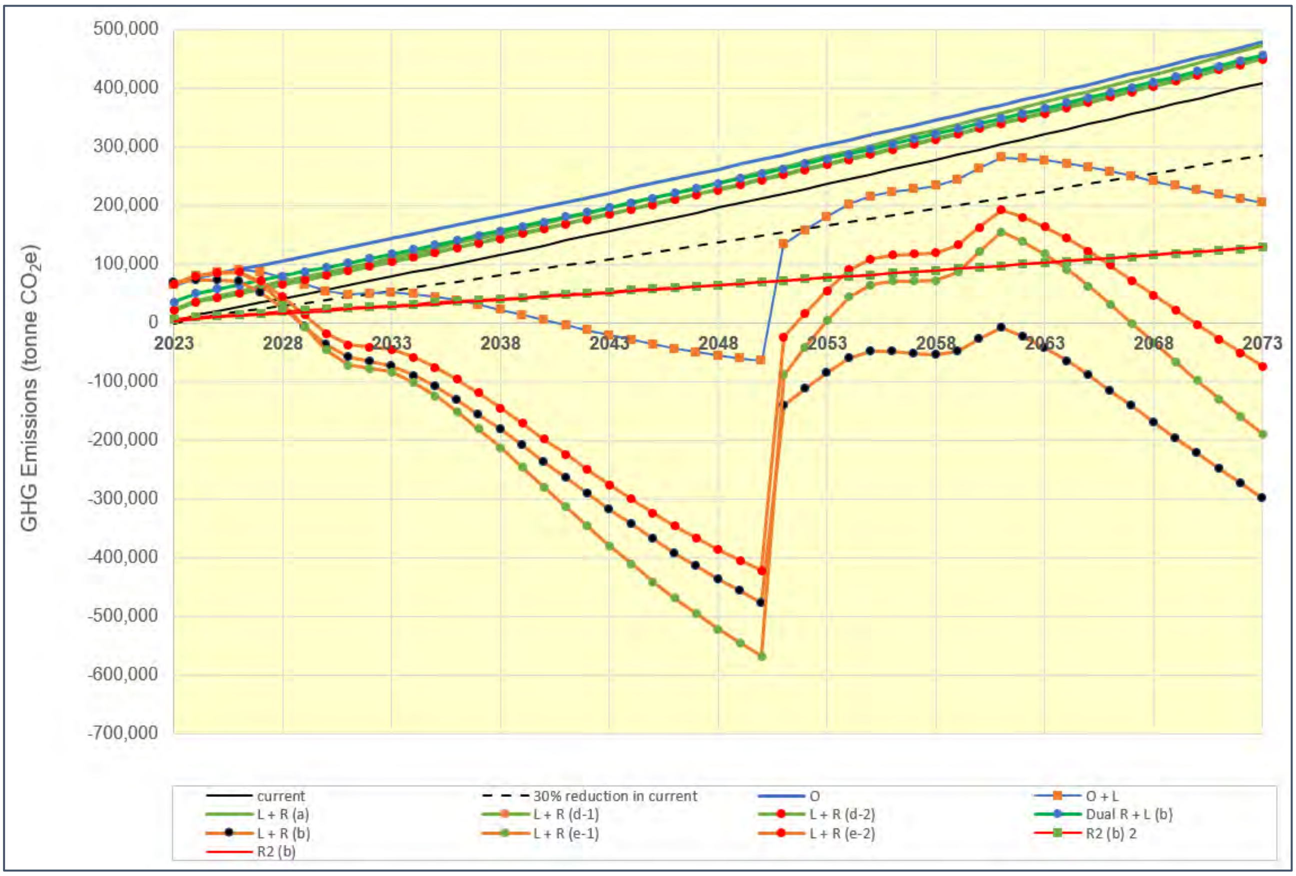

Figure 6-2: PNCC Wastewater BPO 50 Year Cumulative Carbon Emissions

The forestry options show a saw-tooth pattern due to the tree growth and harvesting cycle. After the trees are harvested after 28 years (2051), there is an increase due to the released carbon from the harvested trees. The cumulative carbon starts to decrease again once all of the residual carbon from the harvested trees has decayed (in 2061). The options where most of the wastewater is discharged to forestry land all have a negative cumulative carbon emission after 50 years.

The estimated 50-year carbon emissions are presented in Table 6-1, from lowest to highest. The net change relative to the current WWTP emissions are also shown, with those options with a net reduction highlighted.

Table 6-1: PNCC Wastewater BPO: 50-Year Carbon Emission Summary

Option	TL	Embodied Carbon	Average Operational Carbon Emissions	Average Annual Sequestered Carbon	50-Year Carbon Emissions	Net Change from Current Emissions
		t CO_2-e	t CO_2-e p.a.	t CO_2-e p.a.	t CO_2-e	%
L + R (b)	3	68,700	2,340	(22,500)	-299,000	-173%
L + R (e-1)	2	67,600	8,530	(31,900)	-189,000	-146%
L + R (e-2)	2	66,300	8,470	(26,400)	-73,000	-118%
R2 (b) 2	4	7,000	2,400	-	129,000	-69%
R2 (b)	4	3,500	2,500	-	131,000	-68%
O + L	1	66,500	8,210	(12,900)	206,000	-50%
L + R (d-2)	2	21,600	8,400	-	450,000	10%
L + R (d-1)	2	22,000	8,450	-	453,000	11%
Dual R + L (b)	2	37,000	8,240	-	457,000	12%
L + R (a)	1	24,400	8,800	-	473,000	15%
O	1	63,600	8,140	-	479,000	17%

The average annual operational carbon emissions range from 2,000 – 8,000 tonnes CO_2-e per annum depending on the option. For context, the estimated total annual carbon emissions from Palmerston North are approximately 500,000 tonnes CO_2-e per annum (Aecom, 2018).

For the options that involve forestry discharge, the annual sequestered carbon exceeds the operational carbon emissions, hence the overall net reduction in carbon emissions.

The ocean outfall option (O) has the highest carbon footprint due to:

- High embedded carbon (long pipeline)
- High operational carbon emissions (from the aerated facultative lagoons)

If the treatment process for option O was changed to an activated sludge process, the annual operational carbon emissions would reduce to around 5,000 tonnes CO_2-e per annum and the 50-year total would reduce to 312,000 tonnes CO_2-e which represents a reduction of around 24% relative to the current operation (improving its carbon ranking to 7th)

7 Conclusions

The following conclusions can be made from Figure 6-1 and the preceding sections:

- The three coastal land options have the lowest carbon footprint due to the carbon sequestered in the forestry land, which is larger than the operational carbon emissions from wastewater treatment and discharge. These options have a net accumulation of carbon.
- Apart from the options that include forestry sequestration, local river discharge options with high level of treatment (R2(b) and R2(b) 2) have the lowest carbon footprint. They have the lowest embodied carbon footprint as well as low operational carbon emissions due to the capture and combustion of methane within the treatment process.
- The ocean outfall option O (blue line in Figure 6-1) has the highest carbon footprint, driven by the embodied carbon of the long transfer pipe, coupled with the methane emissions from the aerated facultative lagoons.
- The inland land options (green lines) have the second highest carbon footprint, due to the transfer pipe, irrigation pipework, methane emissions from the aerated facultative lagoons and no sequestration.

8 References

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Stantec (February 2021a)	Palmerston North Wastewater BPO Review Work package 15.9 Treatment Short List Addendum.
Stantec (February 2021b)	Palmerston North Wastewater BPO Review Work Package 15.6/7 Shortlisted Options Summary Report.

TAGG (February 2013)	Greenhouse Gas Assessment Workbook for Road Projects. Revision 6. Transport Authorities Greenhouse Group Australia and New Zealand.

Palmerston North Wastewater
Best Practicable Option (BPO) Review

RMA Planning Assessment

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

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Report Details

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Reviewed by:	Simpson Grierson	9/08/2021
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Executive Summary

An RMA planning assessment of the Short List of Options has been undertaken to help inform the process of determining the best practicable option (BPO) for the Palmerston North City wastewater system.

The RMA planning assessment comprises the following assessments:

- An initial assessment of the three-receiving environment (freshwater, land, marine/coastal) covered by the options against the key relevant planning instruments (National Policy Statement for Freshwater Management 2020 (NPS-FM), New Zealand Coastal Policy Statement 2010 and the Horizons One Plan).
- An assessment of the short list options against the key relevant planning instruments. This assessment is informed by the receiving environment assessments.
- A complexity assessment that involves assessing the options in terms of their consenting complexity and compliance complexity.
- A section 107 of the RMA assessment that involves assessing the options against the requirements of section 107 of the RMA.
- A Part 2 RMA assessment that involves the assessment of each of the options against section 5, 6, 7 and 8 of the RMA
- An assessment of the risk of options being affected by the Marine and Coastal Area (Takutai Moana) Act 2011(MACAA)
- An overall assessment that combines all the assessments to provide an overall ranking of the options.

The result of the overall assessment and ranking of the short list of options are shown in the table below.

Option #	Option Description	Ranking
Option 1	**R2(b) River discharge with Enhanced Treatment**	**2**
Option 2	**R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow**	**3=**
Option 3	**Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow**	**4=**
Option 4	**L+R (a) 97% of the time to Land (inland)**	**4=**
Option 5	**L+R (b) 97% of the time to Land (coastal)**	**1**
Option 6	**L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)**	**3=**
Option 7	**L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)**	**3=**
Option 8	**L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L**	**6=**
Option 9	**L+R (e-2) to land <62m³/s / 43%of the time to land (coastal) TN = 35mg/L**	**6=**
Option 10	**O+L / Ocean with Land**	**7**
Option 11	**Ocean discharge**	**5**

Option 5 has the highest (best) overall ranking because it has "good alignment" with the planning instruments, in particular because it meets the key driver of the NPS-FM of putting the health and well-being of freshwater (Manawatū River) first. It also meets s107 and has no risks in terms of the MACAA. It was assessed as having medium complexity. The only assessment

Option 5 did not perform well against was alignment with Part 2. It was assessed as having weak alignment primarily because it was opposed by Rangitāne and Raukawa and the very high risk to community economic well-being as it is the most expensive option ($836m net present value).

Option 1 ranked second because it has no risks in terms of the MACAA, has a "low to medium complexity", and a "general alignment" with Part 2. However, Option 1 has a "medium risk" of not meeting s107 and a "weak alignment" with the planning instruments. The outcomes of the s107 and planning instruments assessments reflect the potential risk of not meeting the One Plan targets during certain river conditions.

Options 2, 6 and 7 ranked third equal.

Option 2 ranked third equal as it has no risks in terms of the MACCA, "medium complexity" and "general alignment" with Part 2 and the One Plan. It does however have a medium risk of not meeting s107.

Options 6 and 7 ranked third equal because both options have no risks in terms of the MACAA and s107. Both options have general alignment with Part 2 and the planning instruments. The only assessment the options did not perform well in were the complexity assessments where they were assessed as having a "medium to high complexity".

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APPENDICES

1 Introduction

An RMA planning assessment of the Short List of Options has been undertaken to help inform the process of determining the best practicable option (BPO) for the Palmerston North City wastewater system. The diagram below illustrates how this RMA planning assessments integrates with the other assessments and processes involved in determining the BPO.

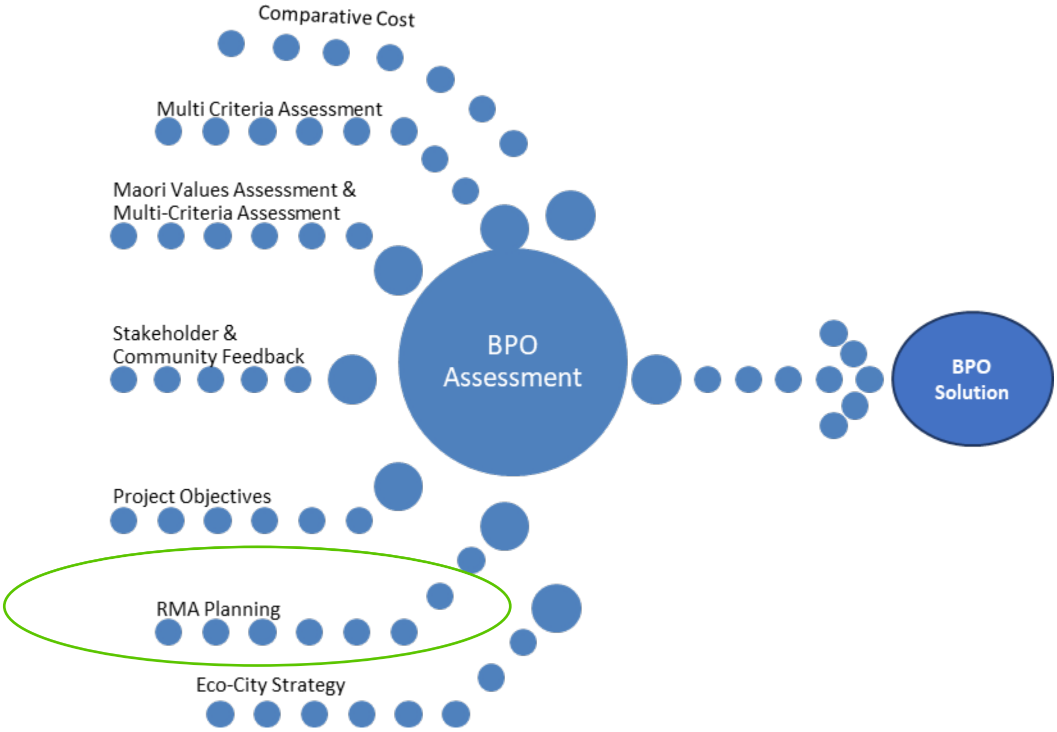

Figure 1 BPO Assessment Process

Section 104 of the RMA, which sets out the matters a consent authority shall have regard to when considering a resource consent application, has informed the scope of the RMA planning assessment.

The assessment involves considering how each of the Short List of Options aligns with the key relevant RMA planning instruments (as identified under section 104 of the RMA) and with Part 2 and section 107 of the RMA. It also assesses each of the options in terms of their consenting complexity and compliance complexity.

Section 104 of the RMA also refers to the Marine and Coastal Area (Takutai Moana) Act 2011(MACAA) and other matters considered relevant. As seven parties have made applications under the MACAA which concern the coastal marine area within or near the location of the discharge associated with two of the options, the MACAA has also been considered in this RMA planning assessment.

1.1 Shortlist Options

The following table lists the shortlist options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, May 2021.

Table 1 Options Description / Reference

Option #	Option Description
Option 1	**R2(b) River discharge with Enhanced Treatment**
Option 2	**R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow**
Option 3	**Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow**
Option 4	**L+R (a) 97% of the time to Land (inland)**
Option 5	**L+R (b) 97% of the time to Land (coastal)**
Option 6	**L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)**
Option 7	**L+R (d-2) to Land <62M^3/s / 43% of the time to Land (inland)**
Option 8	**L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35mg/L**
Option 9	**L+R (e-2) to land <62m^3/s / 43%of the time to land (coastal) TN = 35mg/L**
Option 10	**O+L / Ocean with Land**
Option 11	**Ocean discharge**

2 Methodology

The following methodology has been designed to ensure that the RMA planning assessment can meaningfully inform the selection of a preferred option from the Short List of Options. The approach that has been adopted is set out in the stages below.

2.1 Stage One: Identification of relevant RMA Planning Instruments

Identification of the RMA Planning Instruments that are relevant to the assessment of the options. To simplify this exercise the focus has been on the three receiving environments (freshwater, land, ocean) for the treated wastewater discharge that are covered by the options. **Table 2** identifies all the planning instruments that are relevant to the Wastewater BPO Review and highlights the key planning instruments that have been used for the planning assessment of the options.

The key planning instruments that have been used for the assessment are:

- National Policy Statement for Freshwater Management 2020 (NPS-FM)
- New Zealand Coastal Policy Statement 2010 (NZCPS)
- Horizons Regional Council One Plan (One Plan)

For completeness this first stage also includes the identification of other planning instruments that will apply to all options but have not been assessed because:

- They will not assist in differentiating the options
- They are currently being developed and at the time of undertaking this assessment do not have a statutory status but are likely to come into effect later in 2021.

2.2 Stage Two: RMA Planning Instrument and receiving environment assessment

The assessment of the key provisions of the planning instruments identified in stage 1 is based on the three receiving environments (freshwater, land, marine/coastal) covered by the options. There are a plethora of objective and policies and methods / rules contained within the various planning instruments. It is not the intention of the assessment to provide a comprehensive assessment of all the objectives, policies and rules that could apply to the shortlist of options. This type of assessment will be undertaken once the preferred option (the BPO) has been selected as part of the resource consent process.

The planning instrument provisions that have been assessed have been selected on the basis that they:

a) Are highly relevant to the assessment of the options
b) Will assist in differentiating the options

The planning instrument assessment includes a judgement on the extent to which a discharge to particular receiving environment aligns with the key planning instruments compared to the other receiving environments. In terms of the coastal environment the assessment is based on a discharge and the installation of an ocean outfall.

The Rangitāne o Manawatū Cultural Values Assessment (Rangitāne CVA) and the Raukawa Hapū Evaluation of Options have been relied on in assessing the provisions of the planning instruments relating the matters such as Te Mana o te Wai, mauri, mahinga kai, cultural values.

Appendices 1, 2 and 3 contain the assessments for each of the receiving environments. **Table 3** provides a summary of the receiving environment assessments.

The alignment classifications are as follow:

Strong alignment	🟩
Good alignment	🟩
General alignment	🟧
Weak alignment	🟧
Fails to align	🟥

2.3 Stage Three: Option Alignment with Planning Instruments Assessment

This stage of the RMA planning assessment involves the application of the receiving environment assessment from stage 2 to each of the options. This involves an assessment of the percentage of the wastewater discharged to a particular receiving environment, the percentage of the time the wastewater is discharged to that environment and the level of treatment of the discharge for each option. The output from this stage is a comparative assessment of the extent to which each option aligns with the relevant planning instruments and an overall judgement on alignment with all the planning instruments.

The Rangitāne CVA and the Raukawa Hapū Evaluation of Options have been relied on in assessing the provisions of the planning instruments relating matters such as Te Mana o te Wai, mauri, mahinga kai, cultural values.

Table 4 contains the assessment of each of the options against the relevant key planning instruments. The alignment classifications are the same used for the assessment for Stage 2.

Table 5 provides a summary of the assessment of each option against the relevant key planning instruments.

2.4 Stage Four: Complexity Assessment

Stage 4 of the RMA planning assessment involves assessing the options in terms of their consenting complexity and compliance complexity. The consenting complexity assessment is primarily based on a high-level assessment of the activities that will potentially require consents, the number of receiving environments associated with each option and in terms of the land receiving environment the scale of areas / properties required. The general correlation is the more activities potentially requiring consent the more complex the consenting process will be. Note, this is not a consentability assessment.

The compliance complexity is based on a similar assessment and relates to the number of potential consent conditions that need to be complied with, compliance risks and monitoring complexity.

The assessment is based on comparing the options and is not an assessment of complexity in the context of other unrelated projects. **Table 6** contains the assessment of each of the options in terms of their consenting complexity and compliance complexity.

The complexity classifications are as follows:

Low complexity	🟩
Low to medium complexity	⬜
Medium complexity	🟨
Medium to high complexity	🟧
High complexity	🟥

2.5 Stage Five: Combined Alignment with Planning Instruments and Complexity Assessment

This stage of the planning assessment involves combining the outputs of the planning instrument alignment assessment with the outputs of the complexity assessment and ranking each of the options. **Table 7** contains the combined assessment of each of the options.

2.6 Stage Six: RMA Section 107 Assessment

This stage involves assessing the options against the requirements of section 107 of the RMA. A section 107 assessment is important as this section of the Act specifically relates to discharges to water (freshwater and marine waters) and discharges to land in circumstances which may result in that contaminant entering water. Section 107 states that a consent authority shall not grant a discharge permit or a coastal permit if, after reasonable mixing, the contaminant is likely to give rise a particular effect. This is why assessing each of the options against section 107 of the RMA is an important test. **Table 8** sets out the effects listed in section 107 and provides an assessment of the risk of any of the options resulting in one or more of these effects on the receiving environment.

Meets s107	🟩
Low risk of not meeting s107	🟩
Medium risk of not meeting s107	🟧
High risk of not meeting s107	🟧
Very high risk of not meeting s107	🟥

2.7 Stage Seven: RMA Part 2 Assessment

This stage involves the assessment of each of the options against Part 2 of the RMA. Part 2 is a critical part of the RMA as it sets out the purpose and principles of the Act. An option might not be able to be consented under the RMA if it was contrary to (fails to align with) Part 2. This is why assessing each of the options against Part 2 of the RMA is an important test.

Rangitāne CVA and the Raukawa Hapū Evaluation of Options have been relied on in assessing the Part 2 matters relating to the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.

Table 9 sets out the assessment of the extent to which each option aligns with Part 2 of the RMA.

2.8 Stage Eight: Marine and Coastal Area (Takutai Moana) Act Assessment

Stage 8 provides an assessment of the risks associated with the options that have the potential to be affected by applications made by parties under the Marine and Coastal Area (Takutai Moana) Act 2011 (MACAA) for protected customary rights and customary marine titles. Although the MACAA assessment only involves those options with discharges and works (ocean outfall) in the coastal marine area (option 10 and 11), it is important that this assessment is included as it has significant ramifications for these options. This is because if either option 10 or 11 are determined to be the BPO, and the applications under the MACAA are determined before the BPO consent is lodged and are successful then the Council would need:

- The consent of the parties granted protected customary rights and/or customary marine titles; or
- Prove that the discharge is a "deemed accommodated activity" under the MACAA.

Table 10 contains the MACAA assessment.

Section 12 provides more information about the MACAA, and an assessment of the risks associated with the MACAA.

2.9 Stage Nine: Overall RMA Planning Assessment

This final stage of the assessment involves combining the outputs of the planning instrument assessment, the complexity assessment, the section 107 and Part 2 assessments and the MACAA assessment and provides an overall ranking of the options in terms of the combined planning assessments.

Table 11 contains the results of the overall assessment.

3 Assumptions and Limitations

The following assumption and limitation apply to this planning assessment:

- The landward side of the ocean outfall will be constructed using horizontal directional drilling methods. However, access tracks and plant and equipment storage areas will be required in proximity to the outfall location and the establishment of these areas will require vegetation removal and earthworks in the coastal environment.
- For the options involving land components no potential sites have been identified yet. This work will be undertaken once the BPO has been confirmed. Therefore, no site specific or surrounding area effects have been identified and assessed.

4 Information

This RMA planning assessments has been informed by:

- The technical assessments prepared for the Multicriteria Assessment of the short list of options.
- Information provided by technical experts in response to questions about specific plan and RMA provisions.
- Wastewater BPO Short List Report August 2021
- Rangitāne o Manawatū Cultural Values Assessment
- Raukawa Hapū Evaluation of Options
- Advice from Simpson Grierson on the effect of the Marine and Coastal Area (Takutai Moana) Act 2011on the short list options
- Advice from Simpson Grierson on how the Environment Court has interpreted Policy 5-11 of the One Plan

5 Stage One: Identification of relevant RMA Planning Instruments

Table 2 below identifies the RMA planning instruments that are relevant to the Palmerston North Wastewater BPO Review in terms of the three receiving environments (freshwater, land marine/coastal) affected by the short list options.

The planning instruments shown as red text are those that have been identified as the key planning instruments and have been used to undertake the planning assessment of the options and are:

- National Policy Statement for Freshwater Management 2020 (NPS-FM)
- New Zealand Coastal Policy Statement 2010 (NZCPS)
- Horizons Regional Council One Plan (One Plan)

Table 2: Planning instruments that are relevant to the Palmerston North Wastewater BPO Review

Receiving Environment	National Planning Instruments	Regional Planning Instruments	District Planning Instruments
Freshwater	• National Policy Statement for Freshwater Management 2020 • National Environmental Standards for Freshwater 2020 • National Environmental Standards for Sources of Human Drinking Water 2007 (under review)	• Horizons Regional Council One Plan	• Palmerston North City District Plan • Horowhenua District Plan
Land	• National Policy Statement for Freshwater Management 2020 • National Environmental Standards for Sources of Human Drinking Water 2007 (under review) • National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health	• Horizons Regional Council One Plan • Proposed Plan Change 2 to the One Plan	• Palmerston North City District Plan • Horowhenua District Plan • Manawatu District Plan
Coastal Waters / Coastal Environment (ocean outfall installation)	• New Zealand Coastal Policy Statement 2010 • National Policy Statement for Freshwater Management 2020	• Horizons Regional Council One Plan	• Horowhenua District Plan[1] • Manawatu District Plan

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[1] The Horowhenua District Plan and the Manawatu District Plan have been used to identify areas of outstanding natural landscapes and features in the coastal environment

5.1 Other potentially relevant planning instruments

For completeness other planning instruments that will apply to the short list of options have been identified below but have not been assessed because they will not assist in differentiating the options or they are currently being developed and at the time of undertaking this assessment do not have legal effect.

- National Policy Statement on Urban Development – applies to all receiving environments – drives growth and consequential increases in wastewater volumes
- Proposed National Policy Statement for Highly Productive Land (likely to take effect late 2021) – will apply to land receiving environments
- Proposed National Environmental Standards for Wastewater Discharges and Overflows (to be confirmed) – will apply to all receiving environments
- Proposed National Policy Statement for Indigenous Biodiversity (likely to take effect late 2021) – will apply to land receiving environments
- National Environmental Standards for Sources of Human Drinking Water Update (likely to take effect late 2021) – will apply to freshwater and land receiving environments

6 Stage Two: RMA Planning Instrument Receiving Environment Assessments

This is a high level assessment of potential discharges of treated wastewater to the three receiving environments (freshwater, land, marine/coastal) covered by the options against the key provisions of the planning instruments identified in stage 1. In terms of the coastal environment the assessment is based on a discharge and the installation of an ocean outfall.

The planning instrument provisions that have been assessed have been selected on the basis that:

- They are highly relevant to the assessment of the options
- Will assist in differentiating the options

Appendices 1, 2 and 3 contain the detailed assessments for each of the receiving environments.

The alignment classifications are as follow:

Strong alignment	🟩
Good alignment	🟩
General alignment	🟧
Weak alignment	🟧
Fails to align	🟥

6.1 Freshwater Receiving Environment Assessment

The freshwater receiving environment primarily comprises the Manawatū River, but also includes local streams, coastal lakes and ground water. A detailed assessment of the freshwater receiving environment against the relevant objectives and policies of the NPS-FM and the One Plan is contained in **Appendix 1**.

The river options only have a "weak alignment" with the key relevant objectives and policies of the NPS-FM. This is primarily because of the need to give effect to Te Mana o te Wai and the requirement to place the health and well-being of the Manawatū River first. When the river as a receiving environment is compared to the options that predominantly discharge to other receiving environments, the river options do not align with the NPS-FM as well as the options to other receiving environments. Noting that the next stage of the assessment will take into account the components of the river options that discharge to land.

Overall, the river options have a "general alignment" with the One Plan. This is primarily because the options have been designed to ensure that the Schedule B values are recognised and provided for (but not pristine state of the values) and to meet key Schedule E targets with a particular focus on achieving the periphyton biomass targets. Noting the exception of one option (R2(b)) which may not provide for Schedule B ecological and recreational values.

6.2 Land Receiving Environment Assessment

The land receiving environment primarily comprises two general areas, fluvial soils in proximity of Palmerston North City and the Manawatū River and sandy soils in coastal areas between the mouths of the Rangitikei and Manawatū Rivers.

A detailed assessment of the land receiving environment against the relevant objectives and policies of the NPS-FM and the One Plan is contained in **Appendix 2**.

The group of options that have discharges to land that require significant land areas have a better alignment with the NPS FM objective and Te Mana o te Wai than the options with significant discharges to the Manawatū River noting that a number of land discharge options include reasonably significant discharges to the Manawatū River. The reason for this is that removing or significantly reducing the discharge to the Manawatū River will put the health and well-being of the Manawatū River first which is consistent with the Te Mana o te Wai hierarchy. The reason why the assessment is “good alignment” and not “strong alignment” is because of the potential risks to local water bodies.

The land options have an overall assessment of “good alignment” with the One Plan primarily because of the reduction of the discharge to the Manawatū River which should assist with improving the ability to meet water quality targets for the river and the Schedule B Values. However, the land discharge options could have potential risks to local water bodies and effects on sensitive and incompatible land uses.

6.3 Marine/Coastal Receiving Environment Assessment

The marine/coastal receiving environment comprises the coastal marine area and the coastal environment which includes areas on the landward side of the coastal marine area. The assessment takes into account the discharge of the treated wastewater to the coastal marine area and the installation of the ocean outfall.

A detailed assessment of the marine/coastal receiving environment against the relevant objectives and policies of the NPS-FM and the One Plan is contained in **Appendix 3**.

The group of options that have discharges to the ocean have a better alignment with the NPS FM objective and Te Mana o te Wai than the group of options with significant discharges to the Manawatū River noting that a number of land discharge options include reasonably significant discharge to the river. The reason for this is that removing or significantly reducing the discharge to the Manawatū River will put the health and well-being of the Manawatū River first which is consistent with the Te Mana o te Wai hierarchy. However, the discharge is going to another water body – marine water and Rangitāne and Raukawa have clearly expressed their opposition to a wastewater discharge to this receiving environment. This is the reason for classifying the alignment as “general alignment” and not “good alignment” which is the classification for the discharge to land options

The ocean options have "good alignment" with the with the NZCPS. The NZCPS has a strong focus on preserving natural character, protecting natural features and landscape values and indigenous biodiversity. Given the proposed construction methodologies and the location of the proposed discharge it is unlikely that these features and values will be adversely affected. The NZCPS also includes a policy (Policy 23(2)) that directly relates to the discharge of human sewage and the options strongly align with this policy.

The ocean options generally align the relevant objectives and policies of the One Plan. This is primarily because while discharge, after reasonable mixing, aligns with the management values and does not exceed the Schedule I targets in the One Plan for typical flows (and in a number of cases is significantly less than the targets), there could be exceedances of some targets during peak wet weather flows. This requires further investigation.

6.4 Summary of receiving environment assessments

Table 3: Summary of Receiving Environment Assessments

Receiving Environment	**NPS-FM**	**NZCPS**	**One Plan**
Freshwater	🟥	N/A	🟧
Land	🟩	N/A	🟩
Marine / Coastal	🟧	🟩	🟧

Table 3 provides a summary of the assessments of the three receiving environments (freshwater, land, marine/coastal) against the key planning instruments.

The land and marine/coastal receiving environments have been assessed against the NPS-FM because the current wastewater discharge is to freshwater (Manawatū River). This is because the options involving discharges to land and/or marine/coastal receiving environments will result in the removal or part removal of the discharge to the Manawatū River which will have benefits to that receiving environment and will contribute to the outcomes sought by the NPS-FM. However, the freshwater and land receiving environments have not been assessed against the NZCPS as the current discharge is not to the marine/coastal receiving environment.

The receiving environment that aligns best with the planning instruments is land. This is mainly because the Te Mana o te Wai hierarchy in the NPS-FM requires the health and well-being of freshwater to be put first, above the health needs of people and the ability of people and communities to provide for their social, economic, and cultural well-being.

The One Plan includes a policy in the RPS (Policy 5-11) that is important when considering wastewater discharges to water. The policy requires a discharge of human sewage to first be applied onto or into land, flow overland, or pass through an alternative system to mitigate adverse effects on the mauri before entering surface water. Policy 5-11 is designed to address the resource management issue of significance to hapū and iwi that "sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred".

The Environment Court has found that, in relation to Policy 5-11, direct discharges of treated wastewater to freshwater will not meet Policy 5-11, and that wetland systems proposed in those cases satisfy the requirements of Policy 5-11. The Court's interpretation carries weight in terms of interpreting what Policy 5-11 and the One Plan requires. However, Rangitāne have stated in their CVA that they do not believe the discharge of wastewater through artificial wetlands will restore the mauri of the wastewater and protect the Manawatū Awa.

As all options with discharges to the Manawatū River include wetlands which the discharge will pass through before entering the river, "on its face" Policy 5-11 can be met ("good alignment" / "strong alignment") for these options. However, in view of the position of Rangitāne that wetlands will not restore the mauri of the wastewater and protect the river which is likely to be important from a consenting perspective, the freshwater receiving environment has been assessed as having "general alignment" with Policy 5-11.

7 Stage Three: Option Alignment with Planning Instruments Assessment

This stage of the RMA planning assessment involves the application of the receiving environment assessments from stage 2 to each of the short list options. The assessment takes into account the percentage of the wastewater discharged to a particular receiving environment, the duration of the discharge to that environment and the level of treatment of the discharge for each option. The output from this stage is a comparative assessment of the extent to which each short list option aligns with the NPS-FM, the NZCPS and the One Plan.

Table 4: Alignment of the shortlisted options with the relevant planning instruments

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
Options 1: R2(b) River discharge with Enhanced Treatment 100% treated wastewater discharge to river Discharge via a wetland and/or land passage system Highest level of treatment (treatment level 4) No land requirement	🟧	N/A	🟧	• This option involves 100% of the wastewater flow to the river for 100% of the year with the highest level of treatment and discharge to the river via a wetland and/or land passage system • Issue with giving effect to Te Mana o te Wai – putting the health and well-being of the Manawatū River first • Because of the high level of treatment there will be a significant reduction in contaminant loads discharged to the river. • Potential risk that the water quality targets on the One Plan will not be fully met • No risk to local water bodies (streams, lakes, groundwater) • Rangitāne consider the impact on mauri can only be mitigated by removing wastewater from waterways • On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves "general alignment" with Policy 5-11 • Raukawa consider this option to be fundamentally unacceptable • Considering the above matters overall option 1 does not align well with the NPS-FM and only has general alignment with the One Plan
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow Continuous discharge to river. 75% average dry weather flow discharge to land	🟧	N/A	🟧	• The Manawatū River is below half median flow (37.5m³/s) approx. 25% of the year • 75% of year 100% discharge to river • 25% of the year 75% discharge to land • 25% of the year 25% discharge to river • Discharge via a wetland and/or land passage system • Still a significant proportion of the discharge going to the river

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
when river below 37.5m3/s (half median flow) Discharge via a wetland and/or land passage system to river. Highest level of treatment (treatment level 4). 760ha land required	🟧		🟧	• Because of the high level of treatment there will be a significant reduction in contaminant loads discharged to the river. • Designed to achieve the One Plan Schedule B Values and the water quality targets • Slight risk to local water bodies (streams, lakes, groundwater) from the land discharge • Rangitāne consider a small portion of land-based discharge is unlikely to protect the wairua of Rangitāne or their waterways • On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves “general alignment” with Policy 5-11 • Raukawa consider this option to be fundamentally unacceptable • Considering the above matters overall Option 2 does not align well with the NPS-FM and only has general alignment with the One Plan
Option 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow When river flow is greater than 62m³/s discharge to river at Totara Rd When river flow between 62m³/s and 37.5m³/s discharge to river below Opiki When river below 37.5m³/s discharge to land Discharge via a wetland and/or land passage system Upgraded treatment (treatment level 2). 870ha land required	🟧	N/A	🟧	• The Manawatū River is below half median flow (37.5m³/s) approx. 25% of the year • 75% of year 100% discharge to river • 25% of the year 75% discharge to land • 25% of the year 25% discharge to river • Discharge via a wetland and/or land passage system Still a significant proportion of the discharge going to the river • Discharging into a new receiving environment (below Opiki Bridge) in the Manawatū River • Slight risk to local water bodies (streams, lakes, groundwater) from the land discharge • Designed to achieve the One Plan Schedule B Values and the water quality targets • Rangitāne consider a small portion of land-based discharge is unlikely to protect the wairua of Rangitāne or their waterways. • On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves “general alignment” with Policy 5-11 • Raukawa consider this option to be fundamentally unacceptable • Considering the above matters overall Option 3 does not align well with the

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
	🟧		▨	NPS-FM and only has general alignment with the One Plan
Option 4: L+R (a) 97% to Land (inland) 97% treated wastewater discharge to land (inland fluvial soils). Exceptional flow conditions (highest 3% of days by WWTP flow) discharge to river Similar level of treatment to existing WWTP (level of treatment 1) 3,760ha land required	🟩	N/A	🟩	• This option involves 97% of year 100% discharge to land • Puts the health and well-being of the Manawatū River first • Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) • Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. • Raukawa consider this option to be currently unacceptable • Considering the above matters overall option 4 aligns well with the NPS-FM and the One Plan
Option 5: L+R (b) 97% to Land (coastal) 97% treated wastewater discharge to land (inland fluvial soils). Exceptional flow conditions (highest 3% of days by WWTP flow) discharge to river Upgraded treatment (treatment level 3) 2,570ha land required	🟩	N/A	🟩	• This option involves 97% of the flow discharge to land 100% of the year • Puts the health and well-being of the Manawatū River first • Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) • Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. • Raukawa consider this option to be fundamentally unacceptable • Considering the above matters overall option 5 aligns well with the NPS-FM and the One Plan
Option 6: L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland) When river flow is greater than 80m³/s discharge to river Similar level of treatment to existing WWTP + phosphorus removal) (level of treatment 2) Wetland 2,000ha land required	▨	N/A	▨	• The Manawatū River is below 80m³/s approx. 53% of the year • 53% of year 100% discharge to land • 47% of year 100% discharge to river via a wetland and/or land passage system • Reasonable proportion of the discharge going to land • Does assist in putting the health and well-being of the Manawatū River first • Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) • Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau.

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
	🟧		🟧	- On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves "general alignment" with Policy 5-11 - Raukawa consider this option to be currently unacceptable - Considering the above matters overall option 6 has a general alignment with the NPS-FM and the One Plan
Option 7: L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland) When river flow is greater than 62m^3/s discharge to river Similar level of treatment to existing WWTP + phosphorus removal) (level of treatment 2) Wetland 1,640ha land required	🟧	N/A	🟧	- The Manawatū River is below 62m^3/s approx. 43% of the year - 57% of year 100% discharge to river via a wetland and/or land passage system - 43% of year 100% discharge to land - Reasonable proportion of the discharge going to land - Does assist in putting the health and well-being of the Manawatū River first - Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) - Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. - On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves "general alignment" with Policy 5-11 - Raukawa consider this option to be currently unacceptable - Considering the above matters overall option 7 has a general alignment with the NPS-FM and the One Plan
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L When river flow is greater than 80m^3/s discharge to river Similar level of treatment to existing WWTP + phosphorus removal) (level of treatment 2) Wetland 3,640ha land required	🟧	N/A	🟧	- The Manawatū River is below 80m^3/s approx. 53% of the year - 53% of year 100% discharge to land - 47% of year 100% discharge to river via a wetland and/or land passage system - Reasonable proportion of the discharge still going to the rive - Does assist in putting the health and well-being of the Manawatū River first - Partially meets Policy 5-11 (RPS One Plan) - Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) - Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. - On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
	🟧		🟧	achieves "general alignment" with Policy 5-11 - Raukawa consider this option to be fundamentally unacceptable - Considering the above matters overall option 8 has a general alignment with the NPS-FM and the One Plan
Option 9: L+R (e-2) to land <62m³/s / 43% of the time to land (coastal) TN = 35mg/L When river flow is greater than 62m³/s discharge to river Similar level of treatment to existing WWTP + phosphorus removal (level of treatment 2) Wetland 3,010ha land required	🟧	N/A	🟧	- The Manawatū River is below 62m³/s approx. 43% of the year - 57% of year 100% discharge to river via a wetland and/or land passage system - 43% of year 100% discharge to land - Reasonable proportion of the discharge still going to the rive - Does assist in putting the health and well-being of the Manawatū River first - Partially meets Policy 5-11 (RPS One Plan) - Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) - Rangitāne consider a land-based discharge is preferable and could support the protection the wairua, health and wellbeing of Rangitāne whānau. - Rangitāne have stated in their CVA that they do not believe the discharge of wastewater through artificial wetlands will restore the mauri of the wastewater and protect the Manawatū Awa. - On its face Policy 5-11 can be met, however, in view of the position of Rangitāne on wetlands this option only achieves "general alignment" with Policy 5-11 - Raukawa consider this option to be fundamentally unacceptable - Considering the above matters overall option 9 has a general alignment with the NPS-FM and the One Plan
Option 10: O+L / Ocean with Land 50% ADWF discharged to land 50% year. Exceptional flow conditions (highest 3% of days by WWTP flow) discharge to river via land passage Similar level of treatment to existing WWTP (level of treatment 1)	🟩	🟩	🟧	- 50% of year 50% of average dry weather flow discharged to land - 47% of year 100% of the flow goes to ocean - Removal of the discharge form the Manawatū River, which puts the health and well-being of the river first - Aligns with the management values and does not exceed the Schedule I targets in the One Plan for typical flows. However, there could be exceedances of some targets during peak wet weather flows - Potential to cause adverse effects on local water bodies (streams, lakes, groundwater) - Meets Policy 23 of the NZCPS (human sewage)

Option	NPS for Freshwater Management 2020	New Zealand Coastal Policy Statement	Horizons One Plan	Commentary
No wetland, land passage, overland flow before discharge to ocean 1,470ha land required	🟩	🟩	🟧	• Policy 8-6 applies Policy 5-11 (human sewage discharges) to the CMA as if any reference to water in those policies is a reference to water in the CMA • Does not meet Policy 5-11 (RPS One Plan) as there is no discharge to land and no wetland, land passage, overland flow before discharge to the ocean • Both Rangitāne and Raukawa oppose the discharge of treated wastewater to marine water • Considering the above matters overall option 10 has a good alignment with the NPS-FM and the NZCPS and a general alignment with the One Plan
Option 11: Ocean discharge Discharge 97% to ocean Exceptional flow conditions (highest 3% of days by WWTP flow) discharge to river via land passage Similar level of treatment to existing WWTP (level of treatment 1) No wetland, land passage, overland flow before discharge to ocean	🟩	🟩	🟧	• 97% of year 100% of the flow goes to ocean • Removal of the discharge form the Manawatū River, which puts the health and well-being of the river first • Aligns with the management values and does not exceed the Schedule I targets in the One Plan for typical flows. However, there could be exceedances of some targets during peak wet weather flows based on the adoption of a relatively small mixing zone • Meets Policy 23 of the NZCPS (human sewage) • Policy 8-6 applies Policy 5-11 (human sewage discharges) to the CMA as if any reference to water in those policies is a reference to water in the CMA • Does not meet Policy 5-11 (RPS One Plan) as there is no discharge to land and no wetland, land passage, overland flow before discharge to the ocean • Both Rangitāne and Raukawa oppose the discharge of treated wastewater to marine water • Considering the above matters overall option 11 has a good alignment with the NPS-FM and the NZCPS but a weak alignment with the One Plan mainly due to the background levels in the ocean of some contaminants

7.1 Alignment with Planning Instruments Assessment Conclusion

Table 5: Summary of alignment of the shortlisted options with the relevant planning instruments

Options	NPS-FM 2020	NZCPS	Horizons One Plan
Option 1: R2(b) River discharge with Enhanced Treatment	🟧	N/A	🔸
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow	🟧	N/A	🔸
Option 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	🟧	N/A	🔸
Option 4: L+R (a) 97% to Land (inland)	🟢	N/A	🟢
Option 5: L+R (b) 97% to Land (coastal)	🟢	N/A	🟢
Option 6: L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)	🔸	N/A	🔸
Option 7: L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)	🔸	N/A	🔸
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L	🔸	N/A	🔸
Option 9: L+R (e-2) to Land <62m³/s / 43% of the time to Land (coastal) TN = 35mg/L	🔸	N/A	🔸
Option 10: O+L / Ocean with Land	🟢	🟢	🟧
Option 11: Ocean discharge	🟢	🟢	🟧

Classification of the extent to which the option aligns with the relevant planning instrument.

Strong alignment	🟩
Good alignment	🟢
General alignment	🔸
Weak alignment	🟧
Fails to align	🟥

The options with significant discharges to the Manawatū River (Option 1, 2 and 3) have a weak alignment with the objectives and policies of the NPS-FM. This is because of the focus of the NPS-FM puts the health and wellbeing of freshwater first. These options have been assessed as having general alignment with the provisions of the One Plan. This is because they have ben designed to meet the values and targets of the One Plan, however there is a potential risk that Option 1 may not fully meet all the targets all the time.

As all options with discharges to the Manawatū River include wetlands which the discharge will pass through before entering the river, “on its face” Policy 5-11[2] can be met (“good alignment” / “strong alignment”) for these options. However, in view of the position of Rangitāne that wetlands will not restore the mauri of the wastewater and protect the river, the freshwater receiving environment has been assessed as having “general alignment” with Policy 5-11. This matter was previously discussed in section 6.4 above.

The options with reasonable discharge to land (43% and 53% of the year discharge to land) have a general alignment with the objectives and policies of the NPS-FM and the One Plan. Options with significant discharges to land (97% of the year) have a good alignment with alignment with the objectives and policies of the NPS-FM and the One Plan.

Both options that discharge to the ocean have a good alignment with the objectives and policies of the NPS-FM and the NZCPS. However, they only have a weak alignment with the One Plan objectives and policies. Both Rangitāne and Raukawa opposed these options.

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[2] Policy 5-11 is an important policy for assessing wastewater discharges.

8 Stage Four: Complexity Assessment

Stage Four of the RMA planning assessment involves assessing the options in terms of their consenting complexity and compliance complexity. The consenting complexity assessment is primarily based on a high-level assessment of the activities that will potentially require consents, the number of receiving environments and in terms of the land receiving environment the scale of areas / properties required. The general correlation is the more activities potentially requiring consent the more complex the consenting process will be. Note, this is not a consentability assessment.

The compliance complexity is based on a similar assessment and relates to the number of potential consent conditions that need to be complied with, compliance risks and monitoring complexity.

The assessment is based on comparing the options and not the assessment of complexity in the context of other unrelated consent projects. **Table 6** contains the assessment of each of the options in terms of their consenting complexity and compliance complexity.

Table 6: Consenting and Compliance Complexity

Option	**Consenting Complexity**		**Compliance complexity**	
	Commentary	**Classification**	**Commentary**	**Classification**
Option 1: R2(b) River discharge with Enhanced Treatment 100% of the flow to the river 100% of the year	• Only one discharge location / receiving environment • Consents associated with one discharge • Consents / designation associated with the 36ha wetland / land passage • Consents for possible new river outfall structure depending on wetland / land passage location • Assume existing WWTP designation can accommodate plant upgrades • Assume lowest number of consents required	🟩	• Ongoing compliance and monitoring of river discharge • Compliance – wetland / land passage construction, possible new outfall, one discharge • Assume lowest number of consents to be complied with	🟩
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow • River below half median flow (37.5m³/s) approx. 25% of the year	• Two or more discharge locations / receiving environments • Consent associated with one river discharge • Consent for one or more land application areas, storage facilities	🟧	• Monitoring of river discharge • Monitoring of one or more land application areas (760ha land) • Compliance – triggers for changing receiving environments	🟧

Option	Consenting Complexity		Compliance complexity	
	Commentary	**Classification**	**Commentary**	**Classification**
• 75% of year 100% discharge to river • 25% of the year 75% discharge to land • 25% of the year 25% discharge to river • 760ha land requirement	• Designations for one or more land application areas • Consents / designations associated with the 36ha wetland / land passage • Consents for possible new river outfall structure depending on wetland location • Consents associated with conveyance to land applications areas (stream crossings, earthworks etc.), pumps stations • Assume existing WWTP designation can accommodate plant upgrades		• Compliance – wetland / land passage, possible new outfall, storage facility and conveyance construction, two discharges	
Option 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow • River below half median flow (37.5m^3/s) approx. 25% of the year • 75% of year 100% discharge to river • 25% of the year 75% discharge to land • 25% of the year 25% discharge to river • 870ha land requirement	• Three or more discharge locations / receiving environments • Consents associated with two river discharges • Consent for one or more land application areas, storage facilities • Designations for land application areas • Consents / designations associated with two wetlands / land passages • Consents for new river outfall structure (Opiki) • Consents associated with conveyance to land applications areas and conveyance to Opiki (stream crossings, earthworks etc.), pumps stations • Assume existing WWTP designation can accommodate plant upgrades		• Monitoring of two river discharges • Monitoring of one or more land application areas (870ha land) • Compliance – triggers for changing receiving environments • Compliance – wetland / land passage, outfall, storage facility, and conveyance construction, three discharges	

Option	Consenting Complexity		Compliance complexity	
	Commentary	Classification	Commentary	Classification
Option 4: L+R (a) 97% to Land (inland) • 97% of the flow discharge to land 100% of the year • 3% to river • 3,760ha land requirement	• Two receiving environments but potentially numerous locations for land application • Consent for 3% river discharge • Consents for numerous locations for land application, storage facilities • Designations for land application areas • Significant number of potentially affected parties (directly affected landowners / adjoining landowners) • Given large land area requirement assumed authorities required under the Heritage New Zealand Pouhere Taonga Act • Consents associated with conveyance to numerous land applications areas (stream crossings, earthworks etc.), pumps stations • Consent for land passage / overland flow • Assumed numerous consents required particularly because of the potential high number of separate land application areas	🟥	• Monitoring of 3% river discharge • Monitoring of numerous land application areas (3,760ha land) • Compliance – triggers for changing receiving environments • Compliance – land passage / overland flow, conveyance, storage facility construction, two discharges • Compliance risks if third parties (farmers) operating land application	🟥
Option 5: L+R (b) 97% to Land (coastal) • 97% of the flow discharge to land 100% of the year • 3% to river • 2,570ha land requirement	• Assumed limited number of locations for land application • Two receiving environments • Consent for 3% river discharge • Consents for locations for land application, storage facilities • Designations for land application areas	▨	• Monitoring of 3% river discharge • Monitoring of land application areas (2,570ha land) • Compliance – triggers for changing receiving environments • Compliance – land passage / overland flow, conveyance,	▨

Option	Consenting Complexity		Compliance complexity	
	Commentary	Classification	Commentary	Classification
	- Given large land area requirement assumed authorities required under the Heritage New Zealand Pouhere Taonga Act - Consents associated with conveyance to numerous land applications areas (stream crossings, earthworks etc.), pumps stations - Consent for wetland / land passage / overland flow		storage facility construction, two discharges - Compliance risks if third parties (forestry companies) operating land application	
Option 6: L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland) - River below 80m^3/s approx. 53% of the year - 53% of year 100% discharge to land - 47% of year 100% discharge to river - 2,000 land requirement	- Two receiving environments but potentially a number of locations for land application - Consent for river discharge - Consents for a number of locations for land application, storage facilities - Designations for land application areas - Potentially affected parties (directly affected landowners / adjoining landowners) - Potentially authorities required under the Heritage New Zealand Pouhere Taonga Act - Consents associated with conveyance to land applications areas (stream crossings, earthworks etc.), pumps stations - Consent for wetland		- Monitoring of river discharge - Monitoring of land application areas (2,000ha land) - Compliance – triggers for changing receiving environments - Compliance – land passage, conveyance, storage facility construction, two discharges	
Option 7: L+R (d-2) to Land <62M^3/s / 43% of the time to Land (inland) - River below 62m^3/s approx. 43% of the year	- Two receiving environments but potentially a number of locations for land application - Consent for river discharge - Consents for a number of locations		- Monitoring of river discharge - Monitoring of land application areas (1,640ha land) - Compliance – triggers for changing receiving environments	

Option	Consenting Complexity		Compliance complexity	
	Commentary	Classification	Commentary	Classification
• 57% of year 100% discharge to river • 43% of year 100% discharge to land • 1,640 land requirement	for land application, storage facilities • Designations for land application areas • Potentially affected parties (directly affected landowners / adjoining landowners) • Potentially authorities required under the Heritage New Zealand Pouhere Taonga Act • Consents associated with conveyance to land applications areas (stream crossings, earthworks etc.), pumps stations • Consent for wetland / land passage	🟧	• Compliance – wetland / land passage, conveyance, storage facility construction, two discharges	🟧
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L • River below 80m³/s approx. 53% of the year • 53% of year 100% discharge to land • 47% of year 100% discharge to river • 3,640 land requirements	• Assumed limited number of locations for land application • Two receiving environments • Consent for river discharge • Consents for locations for land application, storage facilities • Designations for land application areas • Given large land area requirement assumed authorities required under the Heritage New Zealand Pouhere Taonga Act • Consents associated with conveyance to numerous land applications areas (stream crossings, earthworks etc.), pumps stations • Consent for wetland / land passage	🟧	• Monitoring of river discharge • Monitoring of land application areas (3,640ha land) • Compliance – triggers for changing receiving environments • Compliance – wetland / land passage, conveyance, storage facility construction, two discharges	🟧
Option 9: L+R (e-2) to land <62m³/s / 43% of the time to land (coastal) TN = 35mg/L	• Assumed limited number of locations for land application • Two receiving environments	🟧	• Monitoring of river discharge • Monitoring of land application areas (3,010ha land)	🟧

Option	Consenting Complexity		Compliance complexity	
	Commentary	Classification	Commentary	Classification
• River below 62m³/s approx. 43% of the year • 57% of year 100% discharge to river • 43% of year 100% discharge to land • 3,010 land requirement	• Consent for river discharge • Consents for locations for land application, storage facilities • Designations for land application areas • Given large land area requirement assumed authorities required under the Heritage New Zealand Pouhere Taonga Act • Consents associated with conveyance to numerous land applications areas (stream crossings, earthworks etc.), pumps stations • Consent for wetland / land passage	🟧	• Compliance – triggers for changing receiving environments • Compliance – wetland / land passage, conveyance, storage facility construction, two discharges	🟧
Option 10: O+L / Ocean with Land • 50% of year 50% of the flow goes to land • 47% of year 100% of the flow goes to ocean • 3% of year discharge to river in extreme high flow • 1,470ha land requirement	• Three receiving environments but potentially one or more locations for land application • Consent for CMA discharge • Consents for one or more locations for land application, storage facilities • Consent for discharge to river via overland flow and land passage in extreme high flow (approximately 3% of the year) • Designations for land application areas • Consents for ocean outfall construction • Consents associated with conveyance to ocean outfall and land application areas (stream crossings, earthworks etc.), pumps stations • Consent for land passage / overland flow (3% discharge to river)	🟥	• Monitoring of CMA discharge • Monitoring of land application areas (1,470ha land) • Monitoring 3% river discharge • Compliance – triggers for changing receiving environments • Compliance – ocean outfall (construction and operation), conveyance, storage facility construction, three discharges	🟥

Option	Consenting Complexity		Compliance complexity	
	Commentary	Classification	Commentary	Classification
Option 11: Ocean discharge • 97% of year 100% ocean discharge • 3% of year discharge to river in extreme high flow	• Two receiving environments • Consent for CMA discharge • Consent for discharge to river via overland flow and land passage in extreme high flow (approximately 3% of the year) • Consents for ocean outfall construction • Consents for outfall occupation of seabed • Consents associated with conveyance to ocean outfall, (stream crossings, earthworks etc.), pumps stations • Consent for land passage / overland flow (3% discharge to river)	🟧	• Monitoring of CMA discharge • Monitoring 3% river discharge • Compliance – ocean outfall (construction and operation), conveyance, storage facility construction, two discharges	🟠

Complexity classification

Low complexity	🟩
Low to medium complexity	🟢
Medium complexity	🟠
Medium to high complexity	🟧
High complexity	🟥

8.1 Consenting and Compliance Complexity Assessment Conclusion

The options with significant discharges to more than one receiving environment and/or involve large land area requirements with the potential for a significant number of landowners to be affected have been assessed as having a high complexity or a medium to high complexity.

Option 1: R2(b)is the only option to be assessed as low complexity as it only involves one discharge and no significant construction activities. Although Option 11 only involves only one discharge it has been assessed as having medium consenting complexity because of the construction of the ocean outfall and conveyance infrastructure.

9 Stage Five Combined Alignment with Planning Instruments and Complexity Assessment

This stage of the planning assessment involves combining the outputs of the planning instrument assessment with the outputs of the complexity assessment and ranking each of the options. **Table 7** contains the combined assessment of each of the options.

Table 7: Summary of Alignment and Complexity (Stage Five of the methodology)

Option	Planning Instrument Alignment			Complexity		Score	Ranking
	NPS-FM	NZCPS	One Plan	Consenting	Compliance		
Option 1: R2(b) River discharge with Enhanced Treatment	2	N/A	3	4	4	13	2
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow	2	N/A	3	3	3	11	3=
Options 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	2	N/A	3	2	2	9	5=
Option 4: L+R (a) 97% of the time to Land (inland)	4	N/A	4	1	1	10	4=
Option 5: L+R (b) 97% of the time to Land (coastal)	4	N/A	4	3	3	14	1
Option 6: L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)	3	N/A	3	2	2	10	4=
Option 7: L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)	3	N/A	3	2	2	10	4=
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L	3	N/A	3	2	2	10	4=
Option 9: L+R (e-2) to land <62m³/s / 43%of the time to land (coastal) TN = 35mg/L	3	N/A	3	2	2	10	4=
Option 10: O+L / Ocean with Land	4		2	1	1	9	5=
Option 11: Ocean discharge	4		2	2	3	11	3=

Classification of the extent to which the option aligns with the relevant planning instrument

Strong alignment	🟩
Good alignment	🟩
General alignment	🟧
Weak alignment	🟧
Fails to align	🟥

Complexity classification

Low complexity	🟩
Low to medium complexity	🟩
Medium complexity	🟧
Medium to high complexity	🟧
High complexity	🟥

9.1 Combined Alignment with Planning Instrument and Complexity Assessment Conclusion

Table 7 above brings together the assessment of the options against the relevant planning instruments and the complexity assessments for consenting and compliance. For the scoring “1” is the worst and “5” is the best. For comparison reasons the assessments of the NZCPS have not been scored as the NZCPS only applies to the options with a marine discharge (Options 10 and 11).

Of interest is that some of the options that have generally scored well in the planning instrument alignment assessments have not scored well in the complexity assessments (e.g. Options 4 and 10).

In ranking the options, the top two are:

- Option 1: R2(b) River discharge with Enhanced Treatment
- Option 5: L+R (b) 97% of the time to land (coastal)

With the following options ranked third equal

- Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow
- Option 11: Ocean discharge

10 Stage Six – RMA Section 107 Assessment

Section 107 of the RMA specifically applies to the discharge of contaminants to water and the discharge of contaminants onto or into land in circumstances which may result in that contaminant entering water. It states that a consent authority shall not grant a discharge permit or a coastal permit if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the effects in the receiving waters listed in the **Table 8** below. Table 8 sets out the assessment of the risk of each of the options triggering any of the effects identified in section 107.

Table 8: RMA Section 107 Assessment

Options	Conspicuous oil or grease films, scums or foams, or floatable or suspended materials s107(1)(c)	Conspicuous change in the colour or visual clarity s107(1)(d)	Emission of objectionable odour s107(1)(e)	Rendering of fresh water unsuitable for consumption by farm animals s107(1)(f)	Significant adverse effects on aquatic life s107(1)(g)	Commentary
Option 1: R2(b) River discharge with Enhanced Treatment	🟩	🟩	🟩	🟩	🟧	• Likely to meet s107(1)(g) most of the time, however there is a moderate risk of not fully meeting (i.e. at times and within a certain reach of the river) s107(1)(g)
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow	🟩	🟩	🟩	🟩	🟩	• Likely to meet s107(1)(g) most of the time, however there is a low risk of occasional effect on periphyton and macroinvertebrates (less often and within a shorter reach of the river compared with R2(b)
Options 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	🟩	🟩	🟩	🟩	🟩	• Likely to meet s107(1)(g) both in the Manawatū River and local waterbodies
Option 4: L+R (a) 97% of	🟩	🟩	🟩	🟩	🟩	• Negligible effect on Manawatū River.

Options	Conspicuous oil or grease films, scums or foams, or floatable or suspended materials s107(1)(c)	Conspicuous change in the colour or visual clarity s107(1)(d)	Emission of objectionable odour s107(1)(e)	Rendering of fresh water unsuitable for consumption by farm animals s107(1)(f)	Significant adverse effects on aquatic life s107(1)(g)	Commentary
the time to Land (inland)	🟩	🟩	🟩	🟩	🟩	• Low risk to local waterbodies
Option 5: L+R (b) 97% of the time to Land (coastal)	🟩	🟩	🟩	🟩	🟩	• Negligible effect on Manawatū River. • Low risk to local waterbodies
Option 6: L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)	🟩	🟩	🟩	🟩	🟩	• Small effect on Manawatū River. • Low risk to local waterbodies
Option 7: L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)	🟩	🟩	🟩	🟩	🟩	• Small effect on Manawatū River. • Low risk to local waterbodies
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L	🟩	🟩	🟩	🟩	🟧	• Moderate risk and uncertainty of effects on coastal streams and lakes due to large land area extending into lake catchments.
Option 9: L+R (e-2) to land <62m³/s / 43%of the time to land (coastal) TN = 35mg/L	🟩	🟩	🟩	🟩	🟧	• Moderate risk and uncertainty of effects on coastal streams and lakes due to large land area extending into lake catchments.
Option 10: O+L / Ocean with Land	🟩	🟩	🟩	🟩	🟩	• The effects of the discharge on benthic habitats and fish is expected to be negligible • Construction effects on dune habitats and birds expected to be less than minor with appropriate mitigation.

Options	Conspicuous oil or grease films, scums or foams, or floatable or suspended materials s107(1)(c)	Conspicuous change in the colour or visual clarity s107(1)(d)	Emission of objectionable odour s107(1)(e)	Rendering of fresh water unsuitable for consumption by farm animals s107(1)(f)	Significant adverse effects on aquatic life s107(1)(g)	Commentary
Option 11: Ocean discharge	🟩	🟩	🟩	🟩	🟩	• The effects of the discharge on benthic habitats and fish is expected to be negligible • Construction effects on dune habitats and birds expected to be less than minor with appropriate mitigation.

Classification of the risk of an option not meeting the requirements of section 107

Meets s107	🟩
Low risk of not meeting s107	⬜
Medium risk of not meeting s107	⬜
High risk of not meeting s107	🟧
Very high risk of not meeting s107	🟥

10.1 RMA Section 107 Assessment Conclusion

As section 107 requires that a consent authority shall <u>not grant</u> a discharge permit or a coastal permit if the discharge is likely to give rise to <u>any</u> of the effects listed in the table above, this assessment has not involved making an overall judgement of the extent to which an option meets the requirements of section 107. If an option has the potential to result in one of the effects listed in section 107 then the assessment of the option against section 107 relates to the risk of the option potentially resulting in the effect.

Option 1: R2(b) which is the option with a discharge 100% of the time to the Manawatu River has a medium risk of not meeting s107. This is because there is a potential risk that Option 1 will not fully meet the water quality targets in the One Plan. Options 8 and 9 also have a moderate risk of not meeting s107. This is because of the uncertainty regarding effects on coastal streams and lakes due to the large land area component of these options that extend into the coastal lake catchments.

Option 2 has a low risk of not meeting s107 due to the potential occasional effect on periphyton and macroinvertebrates in the Manawatū River.

All the other options have been assessed as meeting s107 as the technical assessment undertaken to date indicate these options are not at risk of having significant adverse effects on aquatic life.

11 Stage 7 – RMA Part 2 Assessment

Part 2 of the RMA sets out the purpose (section 5) and principles (sections 6, 7, and 8) of the RMA. Section 6 sets out the matters of national importance which decision makers must recognise and provide for. Section 7 sets out other matters which decision makers must have particular regard to, and section 8 requires decision-makers to take into account the principles of the Treaty of Waitangi. **Table 9** contains the assessment of the extent to which each option aligns with Part 2 of the RMA.

Table 9: RMA Part 2 Assessment

Options	Section 5 – Purpose, Section 6 – Matters of national importance, Section 7 – Other matters Section 8 – Treaty of Waitangi	Commentary
Option 1: R2(b) River discharge with Enhanced Treatment		• Significant issues for Rangitāne with cultural well-being and health, relationship of Māori with and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga, sites of significance, kaitiakitanga because 100% discharge to Manawatū River • Raukawa has assessed this option as fundamentally unacceptable • Significant improvement in effects on water quality and periphyton growth compared to current situation, but potential risk that water quality targets in the One Plan will not be fully met • Very low risk of effects on social and economic well-being of individuals because there is no land component • Low risk of community economic well-being effects as this is the cheapest option ($337m NPV) • No outstanding natural features, character and landscapes affected • No risk of effects on local water bodies
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow		• Significant issues for Rangitāne with cultural well-being and health, relationship of Māori with and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga, sites of significance, kaitiakitanga because significant discharge to Manawatū River • Raukawa has assessed this option as fundamentally unacceptable • One Plan Schedule B Values and water quality target should be met • Low risk of effects on social and economic well-being of individuals (only 760ha land required) • Risk of community economic well-being effects due to the cost of the option ($496m NPV) • No outstanding natural features, character and landscapes affected • Slight risk to local water bodies from land discharge

Options	Section 5 – Purpose, Section 6 – Matters of national importance, Section 7 – Other matters Section 8 – Treaty of Waitangi	Commentary
Options 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	🟧	• Significant issues for Rangitāne with cultural well-being and health, relationship of Māori with and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga, sites of significance, kaitiakitanga because significant discharge to Manawatū River • Raukawa has assessed this option as fundamentally unacceptable • Discharge to a new receiving environment in the Manawatū River • One Plan Schedule B Values and water quality target should be met • Low risk of effects on social and economic well-being of individuals (only 870ha land required) • Risk of community economic well-being effects due to the cost of the options ($419m NPV) • No outstanding natural features, character and landscapes affected • Slight risk to local water bodies from land discharge
Option 4: L+R (a) 97% of the time to Land (inland)	🟧	• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga are reasonably well addressed. However, given the very significant land requirement there could be effects on local water bodies and sites of significance • Raukawa has assessed this option as currently unacceptable • High to very high risk of effects on social and economic well-being of individuals (3,760ha inland land required) because of potential large number of landowners affected • High risk of community economic well-being effects due to the cost of the options ($604m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement • Could be effects from climate change given the large land requirement and limited flexibility to discharge to another receiving environment
Option 5: L+R (b) 97% of the time to Land (coastal)	🟧	• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga are partly addressed because the wastewater had been removed from the river. However, Rangitāne lore requires the city to deal with wastewater within it associated geographic area which this option does not. Also given the very significant land requirement there could be effects on local water bodies and sites of significance. • Raukawa has assessed this option as fundamentally unacceptable

Options	Section 5 – Purpose, Section 6 – Matters of national importance, Section 7 – Other matters Section 8 – Treaty of Waitangi	Commentary
		• Medium risk of effects on social and economic well-being of individuals (2,570ha of coastal land required) because potentially fewer number of landowners affected in the coastal area. • Very high risk of community economic well-being effects because this option is the most expensive ($836m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement • Potential effects on outstanding natural features and landscapes given the coastal location • Could be effects from climate change given the large land requirement and limited flexibility to discharge to another receiving environment
Option 6: L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)		• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga addressed to some extent due to the land component, but still a significant discharge to the river. Also, given the significant land requirement there could be effects on local water bodies and sites of significance. • Raukawa has assessed this option as currently unacceptable • Medium to high risk of effects on social and economic well-being of individuals (2,000ha of inland land required) given the potential number of landowners affected • Risk of community economic well-being effects because this option is the most expensive ($470m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement
Option 7: L+R (d-2) to Land <62M³/s / 43% of the time to Land (inland)		• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga addressed to some extent due to the land component, but still a significant discharge to the river. Also, given the significant land requirement there could be effects on local water bodies and sites of significance. • Raukawa has assessed this option as currently unacceptable • Medium to high risk of effects on social and economic well-being of individuals (1,640ha of inland land required) given the potential number of landowners affected

Options	Section 5 – Purpose, Section 6 – Matters of national importance, Section 7 – Other matters Section 8 – Treaty of Waitangi	Commentary
	🟧	• Risk of community economic well-being effects because this option is the most expensive ($433m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement
Option 8: L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35mg/L	🟧	• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga addressed to some extent due to the land component, but this land is not in the geographical area of Palmerston North and there is still a significant discharge to the river. Also, given the significant land requirement there could be effects on local water bodies and sites of significance. • Raukawa has assessed this option as fundamentally unacceptable. • Medium to high risk of effects on social and economic well-being of individuals (3,640ha of coastal land required) but potentially fewer number of landowners affected in the coastal area. • High risk of community economic well-being effects as this is one of the most expensive options ($786m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement • Potential effects on outstanding natural features and landscapes given the coastal location
Option 9: L+R (e-2) to land <62m³/s / 43%of the time to land (coastal) TN = 35mg/L	🟧	• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga addressed to some extent due to the land component, but this land is not in the geographical area of Palmerston North and there is still a significant discharge to the river. Also, given the significant land requirement there could be effects on local water bodies and sites of significance • Raukawa has assessed this option as fundamentally unacceptable • Medium to high risk of effects on social and economic well-being of individuals (3,010ha of coastal land required) but potentially fewer number of landowners affected in the coastal area. • High risk of community economic well-being effects as this is one of the most expensive options ($730m NPV) • Potential to cause adverse effects on local water bodies

Options	Section 5 – Purpose, Section 6 – Matters of national importance, Section 7 – Other matters Section 8 – Treaty of Waitangi	Commentary
	🟧	• Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement • Potential effects on outstanding natural features and landscapes given the coastal location
Option 10: O+L / Ocean with Land	🟧	• For Rangitāne cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga fundamentally not addressed because this option discharges to the ocean • Raukawa has assessed this option as fundamentally unacceptable • Medium risk of effects on social and economic well-being of individuals (1,470ha of coastal land required) because fewer potential number of landowners affected in the coastal area. • Medium to high risk of community economic well-being effects due to the cost of the options ($621m NPV) • Potential to cause adverse effects on local water bodies • Potential effects on indigenous biodiversity and heritage (archaeological) given the large land requirement • Potential effects on outstanding natural features and landscapes given the coastal location
Option 11: Ocean discharge	▨	• For Rangitāne and Raukawa cultural well-being and health, relationship of Māori with water, sites of significance, kaitiakitanga fundamentally not addressed because this option discharges to the ocean • Raukawa has assessed this option as fundamentally unacceptable • Very low risk of effects on social and economic well-being of individuals because there is no land component • Medium risk of community economic well-being effects due to the cost of the options ($480m) • Potential effects on outstanding natural features and landscapes given the coastal location • No risk of effects on local water bodies

Classification of the extent to which the option aligns with Part 2 of the RMA

Strong alignment	🟩
Good alignment	▧
General alignment	▨
Weak alignment	🟧
Fails to align	🟥

11.1 RMA Part 2 Assessment Conclusions

All of the options will provide for the community's social and economic well-being and for its health and safety in terms of providing safe and reliable wastewater services.

The options assessed as having "general alignment" with Part 2 of the RMA have been given this assessment classification because the options have elements that demonstrate good or strong alignment with some of the provisions of Part 2 but have other elements that have weak alignment with the provisions. The assessments demonstrate that the options have some positive effects (benefits) and some negative / adverse effects in terms of Part 2. For example, Options 1, 2 and 3 which have significant discharges to the Manawatū have significant issues for Rangitāne and Raukawa, however, they have a low risk of effects on social and economic well-being of individuals. This is because they do not involve significant large areas of land for the application of the treated wastewater and the potential displacement of existing land uses and landowners. The options also have lower costs compared to other options which have economic well-being benefits.

The options assessed as having "weak alignment" with Part 2 of the RMA have been given this assessment classification because the adverse effects of each option on the natural environment and on social, economic and cultural well-being significantly outweigh any positive effects / benefits. For example, the options involving significant large areas of coastal land have significant issues for Rangitāne and Raukawa and have a high risk to community economic well-being because they are some of the most expensive options. They also have potential effects on indigenous biodiversity and heritage (archaeological) because of the large land requirements and potential effects on outstanding natural features and landscapes due to their coastal location.

12 Stage 8: Marine and Coastal Area (Takutai Moana) Act Assessment

Stage 8 provides an assessment of the risks associated with the options that are affected by applications made by parties under the MACAA for protected customary rights and customary marine titles. Although the MACAA assessment only involves those options with discharges and works (ocean outfall) in the coastal marine area (Options 10 and 11), it is important that this assessment is included as it has significant ramifications for these options.

The MACAA provides legal recognition and protection for customary activities and interests in the common marine and coastal area (which essentially is the coastal marine area under the RMA) through protected customary rights and customary marine title.

Applications for recognition and protection for Māori customary activities and interests had to be filed with the Minister for Treaty of Waitangi Negotiations by 3 April 2017. There are seven applications that apply to the general area where the ocean outfall and discharge is proposed (Options 10 and 11). These applications have yet to be determined.

If a customary marine title is granted in the area where the ocean outfall and discharge is proposed Council would not be able to build the outfall or commence the discharge until permission is obtained from the holders of the title. The holders of the title may give or decline permission on any grounds they see fit and there are no rights of appeal or objection to permission decisions. These are very significant powers holders of the title.

There are exemptions for “accommodated activities” and “deemed accommodated” activities, but there are high thresholds in the MACAA to qualify as one of these activities and the interpretation of these provisions has yet to be tested.

Table 10 provides an assessment of the risks associated with the MACAA.

Table 10: Marine and Coastal Area (Takutai Moana) Act Assessment

Options	Marine and Coastal Area (Takutai Moana) Act	Commentary
Option 1: R2(b) River discharge with Enhanced Treatment	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Options 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 4: L+R (a) 97% of the time to Land (inland)	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 5: L+R (b) 97% of the time to Land (coastal)	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 6: L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)	🟩	• The MACAA does not apply to this option, therefore it does not present any risk

Options	Marine and Coastal Area (Takutai Moana) Act	Commentary
Option 7: L+R (d-2) to Land <62M^3/s / 43% of the time to Land (inland)	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 8: L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35mg/L	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 9: L+R (e-2) to land <62m^3/s / 43%of the time to land (coastal) TN = 35mg/L	🟩	• The MACAA does not apply to this option, therefore it does not present any risk
Option 10: O+L / Ocean with Land	🟧	• There is clear opposition by Rangitāne and Raukawa to the options involving an ocean outfall and discharge • If a customary marine title was to be granted in the area where the ocean outfall and discharge is proposed it is extremely unlikely that permission from the customary title holder would be granted. This poses a significant risk for this option. • The risk has been assessed as high rather than very high because it is unknown at this stage whether customary titles will be granted and the ability to apply for an exemption for "accommodated activities" under the MACAA
Option 11: Ocean discharge	🟧	• There is clear opposition by Rangitāne and Raukawa to the options involving an ocean outfall and discharge • If a customary marine title was to be granted in the area where the ocean outfall and discharge is proposed it is extremely unlikely that permission from the customary title holder would be granted. This poses a significant risk for this option. • The risk has been assessed as high rather than very high because it is unknown at this stage whether customary titles will be granted and the ability to apply for an exemption for "accommodated activities" under the MACAA

Classification of the risks associated with the Marine and Coastal Area (Takutai Moana) Act

No risk	🟩
Low risk	⬜
Medium risk	⬜
High risk	🟧
Very high risk	🟥

12.1 MACAA Assessment Conclusion

The only options subject to the MACAA are the options with discharges to marine waters (Option 10 and 11). The options not subject to the MACAA have been assessed as having no risk.

Options 10 and 11 have been assessed as high risk in terms of the MACAA. This is because if a customary marine title was to be granted for a part of the area where the ocean outfall and discharge is proposed it is extremely unlikely that permission from the customary title holder would be granted. This poses a significant risk for Options 10 and 11.

The risk has been assessed as high rather than very high because it is unknown at this stage whether customary titles will be granted and the ability to apply for an exemption for “deemed accommodated activities” under the MACAA.

13 Stage Nine: Overall RMA Planning Assessment

This final stage of the RMA Planning assessment involves combining the outputs of the planning instrument assessment, the complexity assessment, the section 107 and Part 2 assessments and the MACAA assessment to provide a total score of the assessments for each option and an overall ranking of the options.

Table 11: Combine RMA Planning Assessment

Option	Planning Instrument Alignment			Complexity		RMA		MACAA	Score	Rank
	NPS-FM	NZCPS	One Plan	Consenting	Compliance	Section 107	Part 2			
Option 1: R2(b) River discharge with Enhanced Treatment	2	N/A	3	4	4	3	3	5	24	2
Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow	2	N/A	3	3	3	4	3	5	23	3=
Options 3: Dual R+L (b) Two River discharge points with 75% ADWF to Land at low River flow	2	N/A	3	2	2	5	3	5	22	4=
Option 4: L+R (a) 97% of the time to Land (inland)	4	N/A	4	1	1	5	2	5	22	4=
Option 5: L+R (b) 97% of the time to Land (coastal)	4	N/A	4	3	3	5	2	5	26	1
Option 6: L+R (d-1) to Land <80m^3/s / 53% of the time to Land (inland)	3	N/A	3	2	2	5	3	5	23	3=
Option 7: L+R (d-2) to Land <62M^3/s / 43% of the time to Land (inland)	3	N/A	3	2	2	5	3	5	23	3=
Option 8: L+R (e-1) to Land <80m^3/s / 53% of the time to Land (coastal) TN = 35mg/L	3	N/A	3	2	2	3	2	5	20	6=
Option 9: L+R (e-2) to land <62m^3/s / 43%of the time to land (coastal) TN = 35mg/L	3	N/A	3	2	2	3	2	5	20	6=
Option 10: O+L / Ocean with Land	4		2	1	1	5	2	2	17	7
Option 11: Ocean discharge	4		2	2	3	5	3	2	21	5

Classification of the extent to which the option aligns with the relevant planning instrument and Part 2 of the RMA

Strong alignment	🟩
Good alignment	🟩
General alignment	🟧
Weak alignment	🟧
Fails to align	🟥

Complexity classification

Low complexity	🟩
Low to medium complexity	🟩
Medium complexity	🟧
Medium to high complexity	🟧
High complexity	🟥

Classification of the risk of an option not meeting the requirements of section 107 of the RMA

Meets s107	🟩
Low risk of not meeting s107	🟩
Medium risk of not meeting s107	🟧
High risk of not meeting s107	🟧
Very high risk of not meeting s107	🟥

Classification of the risks associated with Marine and Coastal Area (Takutai Moana) Act

No Risk	🟩
Low risk	🟩
Medium risk	🟧
High Risk	🟧
Very high risk	🟥

13.1 Overall RMA Planning Assessment Conclusion

The inclusion of the RMA section 107, Part 2 and MACAA assessments with the planning instrument and complexity assessments has resulted in some changes to the rankings from those set out in **Table 7**.

Under the combined alignment with planning instruments and complexity assessment set out in **Table 7**, the top three ranking options were:

- Option 5: L+R (b) 97% of the time to land (coastal) (1)
- Option 1: R2(b) River discharge with Enhanced Treatment (2)
- Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow (3=)
- Option 11: Ocean Discharge (3=)

Adding the RMA section 107, Part 2 and MACAA assessments as set out in **Table 11** has resulted in Option 5 remaining as the first ranked option, but with three options being ranked second equal. The ranking from the overall assessments is:

- Option 5: L+R (b) 97% of the time to land (coastal) (1)
- Option 1: R2(b) River discharge with Enhanced Treatment (2)
- Option 2: R2 (b-2) River discharge with Enhanced Treatment 75% ADWF to Land at low River flow (3=)
- Option 6: L+R (d-1) to Land <80m3/s / 53% of the time to Land (inland) (3=)
- Option 7: L+R (d-2) to Land <62M3/s / 43% of the time to Land (inland) (3=)

Option 11 which was ranked third equal in combined alignment with planning instruments and complexity assessment does not appear in the top four of the overall assessment. This is primarily to do with the MACAA assessment.

Option 5 is ranked the highest (best) because it has “good alignment” with the planning instruments, particularly because it meets the key driver of the NPS-FM of putting the health and well-being of freshwater (Manawatū River) first. It also meets s107 and has no risks in terms of the MACAA. It was assessed as having medium complexity. The only assessment Option 5 did not perform well against was alignment with Part 2. It was assessed as having weak alignment primarily because it was opposed by Rangitāne and Raukawa and the very high risk to community economic well-being as it is the most expensive option ($836m NPV).

Option 1 ranked second because it has no risks in terms of the MACAA, has a “low to medium complexity”, and a “general alignment with Part 2. However, Option 1 has a “medium risk” of not meeting s107 and a “weak alignment / general” with the planning instruments. The outcomes of the s107 and planning instruments assessments reflect the potential risk of not meeting the One Plan targets during certain river conditions.

Options 2, 6 and 7 ranked third equal.

Option 2 ranked third equal as it has no risks in terms of the MACCA, “medium complexity” and “general alignment” with Part 2 and the One Plan. It does however have a medium risk of not meeting s107.

Options 6 and 7 ranked third equal because both options have no risks in terms of the MACAA and s107. Both options have general alignment with Part 2 and the planning instruments. The only assessment the options did not perform well in were the complexity assessments where they were assessed as having a “medium to high complexity”.

Appendix 1: Freshwater Receiving Environment Assessment

Assessment of a wastewater discharge to freshwater receiving environments

Red text identifies key clauses and components of objectives and policies that have influenced the assessment

Planning Instrument	Provision	Assessment	Alignment
National Policy Statement for Freshwater Management 2020	2.1 Objective (1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises: (a) first, the health and well-being of water bodies and freshwater ecosystems (b) second, the health needs of people (such as drinking water) (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.	• This is the only objective in the NPS-FM • The objective reflects the Te Mana o te Wai hierarchy of obligations • The explanation of the concept of Te Mana o te Wai refers to Te Mana o te Wai protecting the mauri of the wai • The options that involve significant ongoing discharges to the Manawatū River at Totara Road have the highest level of treatment. • Other options that involve ongoing discharges to the Manawatū River also involve reasonable periods of time when the discharge will go to land (43% and 53%) • These options should help improve the health and well-being of the Manawatū River when compared with the current situation. However, a comparative assessment of these river options with the options involving 97% to another receiving environment concludes that the options with 97% to another receiving environment better align with putting the health and wellbeing of the river first. • The majority of the river options are less costly than the options involving 97% to another receiving environment and would therefore better align with providing for people and communities economic well-being • The Rangitāne Cultural Values Assessment (CVA) states that "any discharge of wastewater to waterways will impact the mauri (lifeforce) of the environment. The amount of wastewater discharged to waterways is exponentially related to mauri." [3] • The Rangitāne CVA states that "Rangitāne do not believe that the discharge of wastewater through artificial wetlands will restore the mauri of the wastewater and protect the Manawatū Awa."[4] • Raukawa has assessed the river discharge options as fundamentally unacceptable. • Given the assessments by Rangitāne and Raukawa it is difficult to conclude that discharges to freshwater receiving environments align well with the only objective in the NPS-FM.	🟧

Planning Instrument	Provision	Assessment	Alignment
	Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai. Policy 7: The loss of river extent and values is avoided to the extent practicable. Loss of river values in defined in the NPS-FM and includes • Māori freshwater values including mahinga kai (compulsory value) kai is safe to harvest and eat, Mahinga kai – Kei te ora te mauri (the mauri of the place is intact) • Human contact (compulsory value) i.e. extent to which an FMU or part of an FMU supports people being able to connect with the water through a range of activities such as swimming, waka, boating, fishing, mahinga kai, and water skiing, in a range of different flows or levels.	• As per the discussion above • The public health risk assessment that informed the MCA workshop identified factors such as mahinga kai and contact recreation as high risk for options involving discharges to the Manawatū River depending on the level of treatment • This is an avoid policy although tempered by "the extent practicable" • The Rangitāne CVA states that "the discharge of wastewater to the awa eliminates the ability of Rangitāne people to bathe and collect mahinga kai in traditional hunting and gathering grounds downstream of the discharge because of the tapu nature of wastewater. This in turn impacts Rangitāne in exercising their kaitiakitanga and the role of the iwi to nourish their people".[5] • Given the assessment by Rangitāne it would be difficult to argue that the discharge of treated wastewater to the Manawatū River avoids the loss of river values in terms of Māori freshwater values and food gathering and consumption even though the avoid is tempered by "the extent practicable"	
	Policy 15: Communities are enabled to provide for their social, economic, and cultural well-being in a way that is consistent with this National Policy Statement.	• It could be argued that the discharge of treated wastewater to the Manawatū River is enabling communities to provide for their social and economic well-being • The majority of the river options are less costly than the options involving 97% to another receiving environment and would therefore better align with enabling communities to provide for their economic well-being • However, the options involving 97% to another receiving environment are considered to be more consistent with the NPS.	

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[3] Rangitāne o Manawatū Cultural Values Assessment page 20

[4] Rangitāne o Manawatū Cultural Values Assessment page 23

[5] Rangitāne o Manawatū Cultural Values Assessment page 23

Planning Instrument	Provision	Assessment	Alignment
Overall alignment with the NPS-FM		Overall, it is concluded that the freshwater receiving environment has a weak alignment with the relevant objectives and policies of the NPS-FM. This is primarily because of the requirement to put the health and well being of freshwater first and the effects identified by Rangitāne on mauri and the fundamental opposition to the river options by Raukawa.	🟧
One Plan Regional Policy Statement			
Chapter 2 Te Ao Māori	Policy 2-4: Other resource management issues The specific issues listed in 2.2 (Resource Management Issues of Significance to Hapū and Iwi) which were raised by hapū and iwi must be addressed in the manner set out in Table 2.1 below. Table 2.1 highlights issues of significance to the Region's hapū and iwi, provides explanations in the context of Māori belief and demonstrates how the Regional Council must address these matters. Table 2.1 Resource management issues of significance to hapū and iwi (h) Sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred	• Policy 2-4 requires that the Regional Council must address the issues raised by iwi and hapū • This policy specifically identifies Objective 5-2 and Policy 5-11 as demonstrating how the One Plan has addressed the significant resource management issue that "sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred" • This policy is included to provide context for assessing Objective 5-2 and Policy 5-11	Policy 2-4 has been included for context. It does not require assessment

Planning Instrument	Provision	Assessment	Alignment
Chapter 5 Water	Objective 5-1: Water management values Surface water bodies and their beds are managed in a manner which safeguards their life supporting capacity and recognises and provides for the Values in Schedule B.	• The key effects caused by the existing discharge to the Manawatū River are associated with the nutrient (nitrogen and phosphorus) content of the discharge, which then causes frequent excessive periphyton growth, which then causes effects on macroinvertebrate communities and key ecosystem health indicators like dissolved oxygen. These affect ecological and recreational values of a significant reach the lower Manawatū River • All of the options with significant discharges to the Manawatū River have been designed to ensure that the Schedule B values are recognised and provided for (but not pristine state of the values) with the exception of Option 1 (R2(b) which may not provide for Schedule B ecological and recreational values.	🟩
	Objective 5-2: Water quality (a) Surface water quality is managed to ensure that: (i) water quality is maintained in those rivers and lakes where the existing water quality is at a level sufficient to support the Values in Schedule B (ii) water quality is enhanced in those rivers and lakes where the existing water quality is not at a level sufficient to support the Values in Schedule B	• Meeting the Schedule B Values is primarily informed by whether or not the Schedule E water quality targets that are measures of the Schedule B values are met. • Upstream of the current discharge the targets for periphyton biomass and SIN are generally met. The DRP target and the E.coli are not met. • The Manawatū River generally does not meet the target for macroinvertebrate community index (MCI). Macroinvertebrates are a key indicator of ecological health. • The Manawatū River generally does not meet the target for water quality and sediment • Given the above assessment sub-clause (ii) of Objective 5-2 applies and the water quality of the Manawatū River will need to be enhanced.	🟥

Planning Instrument	Provision	Assessment	Alignment
		• All of the options with significant discharges to the Manawatū River have been designed to ensure that the Schedule B values are recognised and provided for (but not pristine state of the values) with the exception of Option 1 (R2(b) which may not provide for schedule B ecological and recreational values. • The options with significant discharges to the Manawatū River are a significant improvement on the current discharge in terms of treatment and/or the amount of time the treated wastewater is discharged to the river. • A comparative assessment of the river options with the options involving 97% to another receiving environment concludes that the options with 97% to another receiving environment better align with the enhancement of water quality objectives	🟧
	Policy 5-2: Water quality targets The water quality targets in Schedule E must be used to inform the management of surface water quality in the manner set out in Policies 5-3, 5-4 and 5-5. One Plan Definition of Water Quality Target Water quality target means an objective or result for water quality towards which efforts are directed.	• All options with significant discharges to the Manawatū River have been designed to meet key Schedule E targets with a particular focus on achieving the periphyton biomass as targets as this is the key, and most directly measurable adverse effect caused by the existing discharge. • All options also result in major reductions in contaminant loads being discharged to the river. • Only one option (R2(b)) presents a risk of not fully meeting the targets	Policy 5-2 has been included for context. It does not require assessment

Planning Instrument	Provision	Assessment	Alignment
	Policy 5-4: Enhancement where water quality targets are not met (a) Where the existing water quality does not meet the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality within that sub-zone must be managed in a manner that enhances existing water quality in order to meet: (i) the water quality target for the Water Management Zone in Schedule E, and/or (ii) the relevant Schedule B Values and management objectives that the water quality target is designed to safeguard.	• Given the assessment in relation to the existing water quality of the Manawatū River in Objective 5-2, the water quality of the Manawatū River will need to be enhanced. • The options with significant discharges to the Manawatū River are a significant improvement on the current discharge in terms of treatment and/or the amount of time the treated wastewater is discharged to the river. • All options with significant discharges to the Manawatū River have been designed to meet key Schedule E targets with a particular focus on achieving the periphyton biomass as targets as this is the key, and most directly measurable adverse effect caused by the existing discharge. • All options also result in major reductions in contaminant loads being discharged to the river. • Only Option 1 (R2(b) presents a risk of not fully meeting the targets • All of the options with significant discharges to the Manawatū River have been designed to ensure that the Schedule B values are recognised and provided for (but not pristine state of the values) with the exception of Option 1 (R2(b) which may not provide for Schedule B ecological and recreational values.	

Planning Instrument	Provision	Assessment	Alignment
	Policy 5-9: Point source discharges to water The management of point source discharges into surface water must have regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, while having regard to: (a) the degree to which the activity will adversely affect the Schedule B Values for the relevant Water Management Sub-zone (b) whether the discharge, in combination with other discharges, including non-point source discharges will cause the Schedule E water quality targets to be breached (c) the extent to which the activity is consistent with contaminant treatment and discharge best management practices (d) the need to allow reasonable time to achieve any required improvements to the quality of the discharge (e) whether the discharge is of a temporary nature or is associated with necessary maintenance or upgrade work and the discharge cannot practicably be avoided (f) whether adverse effects resulting from the discharge can be offset by way of a financial contribution set in accordance with Chapter 19 (g) whether it is appropriate to adopt the best practicable option.	• This policy requires these matters to be had regard to • The policy does not say shall not adversely affect or shall not breach • In terms of clauses (a) and (b) The options with significant discharges to the Manawatū River are a significant improvement on the current discharge in terms of treatment and/or the amount of time the treated wastewater is discharged to the river. • In terms of clause (a) all of the options with significant discharges to the Manawatū River have been designed to ensure that the Schedule B Values are recognised and provided for and not adversely effected (but not pristine state of the values) with the exception of Option 1 (R2(b) which may not provide for Schedule B ecological and recreational values. • In terms of clause (b), given the assessment in relation to the existing water quality of the Manawatū River in Objective 5-2 a number of Schedule E water quality targets are currently breached. All options with significant discharges to the Manawatū River have been designed to meet key Schedule E targets with the exception of Option 1 R2(b) which presents a risk of not fully meeting the targets. All options also result in major reductions in contaminant loads being discharged to the river. • In terms of clause (c), best management practices for treatment relative to compatibility with the receiving environment have been adopted in the development of the options. • In terms of clause (g), the current consent conditions require the adoption of BPO	🟩

Planning Instrument	Provision	Assessment	Alignment
	Policy 5-11: Human sewage discharges Notwithstanding other policies in this chapter: (a) before entering a surface water body all new discharges of treated human sewage must: (i) be applied onto or into land, or (ii) flow overland, or (iii) pass through an alternative system that mitigates the adverse effects on the mauri of the receiving water body, and (b) all existing direct discharges of treated human sewage into a surface water body must change to a treatment system described under (a) by the year 2020 or on renewal of an existing consent, whichever is the earlier date.	- Policy 2-4 identifies Policy 5-11 as addressing the issue raised by iwi and hapū that "sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred" - The Rangitāne CVA states that the "discharge of wastewater to land has the least impact on Rangitāne"[6]. - The Rangitāne CVA states that "Rangitāne do not believe that the discharge of wastewater through artificial wetlands will restore the mauri of the wastewater and protect the Manawatū Awa."[7] - The Environment Court has found that, in relation to Policy 5-11, direct discharges of treated wastewater to freshwater will not meet Policy 5-11, and that wetland systems proposed in those cases satisfy the requirements of Policy 5-11 - As all options with discharges to the Manawatū River include wetlands which the discharge will pass through before entering the river, "on its face" Policy 5-11 can be met ("good alignment" / "strong alignment") for these options. However, in view of the position of Rangitāne that wetlands will not restore the mauri of the wastewater and protect the river, the freshwater receiving environment has been assessed as having "general alignment" with Policy 5-11	

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[6] Rangitāne o Manawatū Cultural Values Assessment page 19

[7] Rangitāne o Manawatū Cultural Values Assessment page 23

Planning Instrument	Provision	Assessment	Alignment
	Method 5-4 Human Sewage Discharges to Water The Regional Council will provide assistance to Territorial Authorities to upgrade existing sewage treatment systems that directly discharge treated human sewage to the Region's water bodies. The Regional Council to work with Territorial Authorities to reduce water volume, explore land application options and assist with funding opportunities Target: To stop direct human sewage discharges to water by 2020	• Method 5-4 links to Policies 5-2 and 5-11	Method 5-4 has been included for context
One Plan Regional Plan			
Policy to be inserted into the One Plan as required by the NPS-FM 2020	NPS-FM 3.24 Rivers (1) Every regional council must include the following policy (or words to the same effect) in its regional plan(s): "The loss of river extent and values is avoided, unless the council is satisfied: (a) that there is a functional need for the activity in that location; and (b) the effects of the activity are managed by applying the effects management hierarchy."	• As discussed above under the NPS-FM assessment it could be difficult to argue that the discharge of treated wastewater to the Manawatū River avoids the loss of river values in terms of Māori freshwater values • The exception to this policy is that the council (the consent authority) is satisfied that there is a functional need for the discharge in the location (the river) and the effects of the activity are managed by applying the effects management hierarchy • The definition of "functional need" requires proof that the discharge needs to be to the river because the discharge "can only occur" in that environment. This could be difficult to prove given that land and ocean options are included in the shortlist of options.	🟧

Planning Instrument	Provision	Assessment	Alignment
	NPS-FM definition of loss of value in relation to a natural inland wetland or river, means the wetland or river is less able to provide for the following existing or potential values: (a) any value identified for it under the NOF process; or (b) any of the following, whether or not they are identified under the NOF process: (i) ecosystem health (ii) indigenous biodiversity (iii) hydrological functioning (iv) Māori freshwater values (v) amenity NPS-FM definition of Māori freshwater values means the compulsory value of mahinga kai and any other value (whether or not identified in Appendix 1A or 1B) identified for a particular FMU or part of an FMU through collaboration between tangata whenua and the relevant regional council	• The Rangitāne CVA states that "the discharge of wastewater to the awa eliminates the ability of Rangitāne people to bathe and collect mahinga kai in traditional hunting and gathering grounds downstream of the discharge because of the tapu nature of wastewater."[8] • Raukawa has assessed the river discharge options as fundamentally unacceptable. • Given that all options will result in major reductions in contaminant loads being discharged to the river the other values should be provided for. • Given the assessment by Rangitāne and Raukawa it would be difficult to argue that the discharge of treated wastewater to the Manawatū River avoids the loss of river values in terms of Māori freshwater values and food gathering and consumption • All values except Māori freshwater values should be provided for, therefore the assessment can only be general alignment	

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[8] Rangitāne o Manawatū Cultural Values Assessment page 23

Planning Instrument	Provision	Assessment	Alignment
	NPS-FM definition of functional need means the need for a proposal or activity to traverse, locate or operate in a particular environment because the activity can only occur in that environment NPS-FM definition of effects management hierarchy effects management hierarchy, in relation to natural inland wetlands and rivers, means an approach to managing the adverse effects of an activity on the extent or values of a wetland or river (including cumulative effects and loss of potential value) that requires that: (a) adverse effects are avoided where practicable; and (b) where adverse effects cannot be avoided, they are minimised where practicable; and (c) where adverse effects cannot be minimised, they are remedied where practicable; and (d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, aquatic offsetting is provided where possible; and (e) if aquatic offsetting of more than minor residual adverse effects is not possible, aquatic compensation is provided; and (f) if aquatic compensation is not appropriate, the activity itself is avoided		

Planning Instrument	Provision	Assessment	Alignment
Chapter 14 Discharges to Land and Water	Objective 14-1: Management of discharges to land and water and land uses affecting groundwater and surface water quality The management of discharges onto or into land (including those that enter water) or directly into water and land use activities affecting groundwater and surface water quality in a manner that: (a) safeguards the life supporting capacity of water and recognises and provides for the Values and management objectives in Schedule B, (b) provides for the objectives and policies of Chapter 5 as they relate to surface water and groundwater quality, and (c) where a discharge is onto or into land, avoids, remedies or mitigates adverse effects on surface water or groundwater.	• The key effects caused by the existing discharge to the river are associated with the nutrient content of the discharge (which then causes frequent excessive periphyton growth, which then causes effects on macroinvertebrate communities and key ecosystem health indicators like dissolved oxygen). These affect ecological and recreational values of a significant reach the lower Manawatu River • All of the options with significant discharges to the Manawatū River have been designed to ensure that the Schedule B values are recognised and provided for (but not pristine state of the values) with the exception of one option (R2(b)) which may not provide for Schedule B ecological and recreational values. • The objectives and policies of Chapter 5 have been assessed as having "good alignment" or "general alignment" in respect of the options with significant discharges to the Manawatū River. • Some of the discharge options that include relatively large land components present a potential risk of causing adverse effects on local waterbodies (streams, lakes and aquifers)	

Planning Instrument	Provision	Assessment	Alignment
	Policy 14-1: Consent decision-making for discharges to water When making decisions on resource consent applications, and setting consent conditions, for discharges of water or contaminants into water, the Regional Council must specifically consider: (a) the Objectives and Policies 5-1 to 5-5 and 5-9 of Chapter 5, and have regard to: (b) avoiding discharges which contain any persistent contaminants that are likely to accumulate in a water body or its bed,	- This policy is related to matters decision makers must specifically consider or have regard to when making decisions on resource consents. - In terms of clause (a) the relevant Objectives and Policies 5-1 to 5-5 and 5-9 have been assessed as having “good alignment” or “general alignment” in respect of the options with significant discharges to the Manawatū River - In terms of clause (b) concentrations of persistent contaminants / emerging organic contaminants are already very low (often below laboratory limits of detection) in the wastewater influent to the WWTP and are further reduced by the treatment process. Also, the very low concentrations of any persistent contaminants are continually removed by physical processes in the river and therefore should not accumulate in the river or its bed.	🟩
	(c) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where: (i) it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 5, or (ii) the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water, and (d) the objectives and policies of Chapters 2, 3, 6, 9 and 12 to the extent that they are relevant to the discharge.	- In terms of clause (c), the current consent conditions require the adoption of BPO - In terms of clause (d) these other objectives and policies are not considered to be particularly relevant in providing a comparative assessment of the options.	🟩
	Policy 14-4: Options for discharges to surface water and land	- This policy supports the “mix and match” options involving both discharges to land and to the	🟩

Planning Instrument	Provision	Assessment	Alignment
	When applying for consents and making decisions on consent applications for discharges of contaminants into water or onto or into land, the opportunity to utilise alternative discharge options, or a mix of discharge regimes, for the purpose of mitigating adverse effects, applying the best practicable option, must be considered, including but not limited to: (a) discharging contaminants onto or into land as an alternative to discharging contaminants into water, (b) withholding from discharging contaminants into surface water at times of low flow, and (c) adopting different treatment and discharge options for different receiving environments or at different times (including different flow regimes or levels in surface water bodies)	Manawatū River including discharges to land when the river is at low flow - A number of options are strongly aligned with this policy	🟩
Overall alignment with the One Plan			🟧

Appendix 2: Land Receiving Environment Assessment

Assessment of a wastewater discharge to land receiving environments

Red text identifies key clauses and components of objectives and policies that have influenced the assessment

Planning Instrument	Provision	Assessment	Alignment
National Policy Statement for Freshwater Management 2020	<u>2.1 Objective</u> (1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises: (a) first, the health and well-being of water bodies and freshwater ecosystems (b) second, the health needs of people (such as drinking water) (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.	• The NPS-FM is relevant because the current receiving environment for the wastewater discharge is freshwater • This is the only objective in the NPS-FM • The objective mimics the Te Mana o te Wai hierarchy of obligations • The explanation of the concept of Te Mana o te Wai refers to Te Mana o te Wai protecting the mauri of the wai • By removing the discharge of treated wastewater from the Manawatū River and discharging it to land puts the health and well-being of water bodies and freshwater ecosystems first and protects the mauri of the wai • However, the discharge to land options have the potential to cause adverse effects on local waterbodies (streams, lakes and groundwater). These would be new effects on these waterbodies. • The discharge of treated wastewater to land better aligns with this objective and therefore the hierarchy of obligations in Te Mana o te Wai when compared with options with significant discharges to the Manawatū River noting the potential to effect local water bodies.	🟩
One Plan Regional Policy Statement			
Chapter 2 Te Ao Māori	<u>Policy 2-4: Other resource management issues</u> The specific issues listed in 2.2 (Resource Management Issues of Significance to Hapū and Iwi) which were raised by hapū and iwi must be addressed in the manner set out in Table 2.1 below.	• Policy 2-4 requires that the Regional Council must address the issues raised by iwi and hapū • This Policy specifically identifies Objective 5-2 and Policy 5-11 as how the One Plan has addressed this issue.	Policy 2-4 has been included for context. It does not require assessment

Planning Instrument	Provision	Assessment	Alignment
	Table 2.1 highlights issues of significance to the Region's hapū and iwi, provides explanations in the context of Māori belief and demonstrates how the Regional Council must address these matters. Table 2.1 Resource management issues of significance to hapū and iwi (h) Sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred		
Chapter 5 Water	Policy 5-6: Maintenance of groundwater quality (a) Discharges and land use activities must be managed in a manner which maintains the existing groundwater quality, or where groundwater quality is degraded/over allocated as a result of human activity, it is enhanced. (b) An exception may be made under (a) where a discharge onto or into land better meets the purpose of the RMA than a discharge to water, provided that the best practicable option is adopted for the treatment and discharge system. (c) Groundwater takes in the vicinity of the coast must be managed in a manner which avoids saltwater intrusion.	• The land application options have incorporated buffer zones to minimise effects on groundwater • Some options involving very large land areas potentially may affect groundwater quality. • Clause (b) of this policy provides an exception to maintaining groundwater quality if a discharge to land better meets the purpose of the RMA and the BPO is adopted • The wastewater solution for the city is designed to be the BPO and given the policy support in the One Plan for land application it could be argued that the discharge to land better meets the purpose of the RMA.	🟩

Planning Instrument	Provision	Assessment	Alignment
	Policy 5-10: Point source discharges to land Discharges of contaminants onto or into land must be managed in a manner which: (a) does not result in pathogens or other toxic substances accumulating in soil or pasture to levels that would render the soil unsafe for agricultural, domestic or recreational use (b) has regard to the strategies for surface water quality management set out in Policies 5-3, 5-4 and 5-5, and the strategy for groundwater management set out in Policy 5-6 (c) maximises the reuse of nutrients and water contained in the discharge to the extent reasonably practicable (d) results in any discharge of liquid to land generally not exceeding the available water storage capacity of the soil (deferred irrigation) (e) ensures that adverse effects on rare habitats, threatened habitats and at-risk habitats are avoided, remedied or mitigated.	• In terms of clause (a) concentrations of persistent contaminants / emerging organic contaminants are already very low (often below laboratory limits of detection) in the wastewater influent to the WWTP and are further reduced by the treatment process. • The extremely low concentrations in the treated wastewater of persistent contaminants / emerging organic contaminants mean that accumulation in soils as a result of the discharge, even over an extended time period out to 35 years, will not give rise to levels that would result in the soil being unsafe for agricultural, domestic or recreational use • For pathogens the same factors apply, with the impacts of UV light on the receiving soil being an additional attenuating agent that, when combined with the mitigation afforded by soil microbial activity, results in a negligible accumulation of pathogens. • In terms of clause (b) Policies 5-3, 5-4 and 5-5 relate to meeting water quality targets. A significant reduction of the discharge to the Manawatū River due to applying the discharge to land should assist with improving the ability to meet water quality targets in the river. Noting the potential to effect local water bodies. Policy 5-6 has been assessed as "good alignment" • In terms of clause (c) the reuse of nutrients and water will occur through the cropping of the land. • In terms of clause (d) the land application options involving more than a small percentage of the discharge going to land are likely to exceed the water storage capacity of the soil. This could be mitigated through design and management • In terms of clause (e) the land application areas will be selected to avoid or minimise any adverse effects on rare habitats, threatened habitats and at-risk habitats • The options involving discharges to land mostly align with the clauses in the policy with the exception of clause (d). Therefore, the assessments is that of general alignment.	

Planning Instrument	Provision	Assessment	Alignment
One Plan Regional Plan			
Chapter 14 Discharges to Land and Water	<u>Objective 14-1: Management of discharges to land and water and land uses affecting groundwater and surface water quality</u> The management of discharges onto or into land (including those that enter water) or directly into water and land use activities affecting groundwater and surface water quality in a manner that: (a) safeguards the life supporting capacity of water and recognises and provides for the Values and management objectives in Schedule B, (b) provides for the objectives and policies of Chapter 5 as they relate to surface water and groundwater quality, and (c) where a discharge is onto or into land, avoids, remedies or mitigates adverse effects on surface water or groundwater.	• It is assumed that removing or reducing the treated wastewater discharge from the Manawatū River will assist in safeguarding the life supporting capacity of water, recognising and providing for the Values and management objectives in Schedule B and providing for the objectives and policies of Chapter 5 as they relate to the Manawatū River. • However, the discharge to land options have the potential to cause adverse effects on local waterbodies (streams, lakes and groundwater). These would be new effects on these waterbodies. • Some options involving very large land areas may affect groundwater quality. • RPS Policy 5-6 provides an exemption for maintaining or enhancing ground water where a discharge onto or into land better meets the purpose of the RMA than a discharge to water, provided that the best practicable option is adopted for the treatment and discharge system. • Removing or reducing the treated wastewater discharge from the Manawatū River strongly aligns with this policy, however there are potential risks associated with local waterbodies and for this reason the land application options are assessed as "good alignment" rather than "strong alignment"	🟩
	<u>Policy 14-2: Consent decision-making for discharges to land</u> When making decisions on resource consent applications, and setting consent conditions, for discharges of contaminants onto or into land the Regional Council must have regard to: (a) the objectives and policies of Chapter 5 regarding the management of groundwater quality and discharges,	• This policy is related to matters decision makers must have regard to when making decisions on resource consents. • In terms of clause (a) some options involving very large land areas may affect groundwater quality. • In terms of clause (b) it is assumed that removing or reducing the treated wastewater discharge from the Manawatū River will assist in safeguarding the life supporting capacity of water, recognising and providing for the Values and management objectives in Schedule B and providing for the objectives and policies of Chapter 5 as they relate to the Manawatū River.	🟧

Planning Instrument	Provision	Assessment	Alignment
	(b) where the discharge may enter surface water or have an adverse effect on surface water quality, the degree of compliance with the approach for managing surface water quality set out in Chapter 5, (c) avoiding as far as reasonably practicable any adverse effects on any sensitive receiving environment or potentially incompatible land uses, in particular any residential buildings, educational facilities, churches, marae, public areas, infrastructure and other physical resources of regional or national importance identified in Policy 3-1, wetlands, surface water bodies and the coastal marine area, (d) the appropriateness of adopting the best practicable option to prevent or minimise adverse effects in circumstances where: (i) it is difficult to establish discharge parameters for a particular discharge that give effect to the management approaches for water quality and discharges set out in Chapter 5, (ii) the potential adverse effects are likely to be minor, and the costs associated with adopting the best practicable option are small in comparison to the costs of investigating the likely effects on land and water, (e) avoiding discharges which contain any persistent contaminants that are likely to accumulate in the soil or groundwater, and	• However, the discharge to land options have the potential to cause adverse effects on local waterbodies (streams, lakes and groundwater). These would be new effects on these waterbodies. • In terms of clause (c) discharges to land will be managed through buffers to ensure the discharges do not adversely affect sensitive land uses and incompatible land uses. However, given some of the very large areas of land required this could be challenging to achieve. Noting the potential risks with option L+R(e) associated with the effect of nutrients on coastal lakes. • In terms of clause (d), the current consent conditions require the adoption of BPO • In terms of clause (e) concentrations of persistent contaminants / emerging organic contaminants are already very low (often below laboratory limits of detection) in the wastewater influent to the WWTP and are further reduced by the treatment process. Also, the very low concentrations of any persistent contaminants are continually removed by physical processes in the river and therefore should not accumulate in the river or its bed. • In terms of clause (f) these other objectives and policies are not considered to be particularly relevant in providing a comparative assessment of the options. • While the discharge to land options align well with a number of clauses of this policy there are potential risks associated with local water bodies, and effects on sensitive and incompatible land uses and for this reason the land application options are assessed as “general alignment”	

Planning Instrument	Provision	Assessment	Alignment
	(f) the objectives and policies of Chapters 2, 3, 6, 9 and 12 to the extent that they are relevant to the discharge.		🟧
	Policy 14-4: Options for discharges to surface water and land When applying for consents and making decisions on consent applications for discharges of contaminants into water or onto or into land, the opportunity to utilise alternative discharge options, or a mix of discharge regimes, for the purpose of mitigating adverse effects, applying the best practicable option, must be considered, including but not limited to: (a) discharging contaminants onto or into land as an alternative to discharging contaminants into water, (b) withholding from discharging contaminants into surface water at times of low flow, and (c) adopting different treatment and discharge options for different receiving environments or at different times (including different flow regimes or levels in surface water bodies)	• This policy supports discharges to land • This policy supports the mix and match options involving both discharges to land and to the Manawatū River including discharges to land when the River is at low flow	🟩
Overall alignment with the One Plan			🟩

Appendix 3: Marine/Coastal Receiving Environment Assessment

Assessment of a wastewater discharge to the coastal marine area and the installation of an ocean outfall in the coastal environment

Red text identifies key clauses and components of objectives and policies that have influenced the assessment

Planning Instrument	Provision	Assessment	Alignment
National Policy Statement for Freshwater Management 2020	2.1 Objective (1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises: (a) first, the health and well-being of water bodies and freshwater ecosystems (b) second, the health needs of people (such as drinking water) (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.	- The NPS-FM has been taken into account in assessing the options with discharges to marine waters because not discharging treated wastewater from the Manawatū River and discharging it to marine waters puts the health and well-being of freshwater first. However, the discharge is going to another water body – marine water and from previous experience with wastewater discharges to the CMA there are effects on the mauri of the wai and Rangitāne and Raukawa have signalled this clearly. This is the reason for classifying the alignment as “general alignment and not “good alignment” which is the classification for the discharge to land options.	
New Zealand Coastal Policy Statement 2010	Objective 1 To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by: • maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature; • protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and • maintaining coastal water quality and enhancing it where it has deteriorated from what would otherwise	- The ocean outfall will be 2.3km in length (including the diffuser) so the discharge will be located some 2 to 2.3km from the shore and at a depth of approximately 20m - The Cawthron report[9] concluded that there does not appear to be any taxa of particular ecological or conservation importance in the seabed around the outfall site. - The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceed the water quality target for chlorophyll-*a* in the One Plan and turbidity near the coast is higher than the national median and exceed the ANZECC guidelines - The Cawthron report indicates from the data available the Manawatū west coast is not of special importance for marine mammals and the coast is of low to moderate suitability to southern right whales and orcas	

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[9] Cawthron Report No 3598 Palmerston North Ocean Outfall Option: Assessment of Coastal Ecological Effects, January 2021

Planning Instrument	Provision	Assessment	Alignment
	be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.	and low suitability to Hector's dolphins • The Cawthron report concluded that the level of risk to the water body of further nutrient enrichment from the proposed discharge is negligible. • The Cawthron report concluded that given the low conservation and ecological value of benthic habitats the level of risk is considered negligible and effects on fish are also expected to be negligible. • The Cawthron report identifies that several species of bird have been recorded in the area that are listed in the New Zealand Threat Classification System as Threatened or At Risk • The Cawthron report identifies that without mitigation there are likely to be significant adverse effects on shore and sea birds and sand-dune habitats and the organisms living in them associated with the construction of the outfall. These could be mitigated through using a trenchless method of installing the pipeline through the foredune and beach zones. • While it could be argued that the receiving environment without the discharge is degraded and should be enhanced, Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is significantly less than the targets. However, there could be exceedances of some targets during peak wet weather flows based on the assumed relatively small mixing zone of 200m from the diffuser • Further work is required to confirm the position on the need to maintain or enhance the receiving waters. • Overall it is considered that the options would generally align with this objective.	🟧
	Objective 2	• Any effects on natural character, features and	🟩

Planning Instrument	Provision	Assessment	Alignment
	To preserve the natural character of the coastal environment and protect natural features and landscape values through: •recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution; •identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and •encouraging restoration of the coastal environment.	landscape values will primarily be from the installation of the ocean outfall and potentially the presence of a chamber at the shoreline. While it is likely the landward section of the outfall will be installed using trenchless technology, preparatory works such as vegetation clearance, earthworks, access tracks and equipment storage areas will be required. • The area under investigation for the location of the outfall includes the Foxtangi Dunes, Hokio Beach South Dune Fields and Santoft parabolic dunes. These dunes are listed but not mapped in Schedule G of the One Plan as Regionally Outstanding Natural Features. • The area under investigation for the location of the landward extent of the outfall is identified as an Outstanding Natural Landscape under Plan Change 65 to the Manawatu District Plan Outstanding Natural Features and Landscapes (the Coast including the foredune and adjacent dunelands) under the Horowhenua District Plan. The areas in the Manawatu District Plan have been mapped, but the areas in the Horowhenua District Plan have not been mapped. • The coastal land application areas could also potentially affects these features and landscapes. • The Cawthron report identifies the dune areas as ‘naturally uncommon ecosystems’. • The Cawthron reports states that the Manawatū coast has experienced some of the greatest loss of active dunes. • Appropriate trenchless technologies will minimise the effects of the installation of the pipeline on the landward side of the CMA thereby ensuring the protection natural character, features and landscape values. However, the preparatory works and storage of equipment will have short term effects	

Planning Instrument	Provision	Assessment	Alignment
		- There could be opportunities for restoration of dunes and vegetation - Given the installation of the landward side of the pipeline will occur in areas identified as Outstanding Natural Features and Landscapes it would be difficult to classify the options as strongly aligning with the objective. However, given the temporary nature of the constructions activities and that there should be no ongoing visual effects, the assessment is that there is "good alignment" with the objective.	🟩
	Policy 11 Indigenous biological diversity (biodiversity) To protect indigenous biological diversity in the coastal environment: (a) avoid adverse effects of activities on: (i) indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists; (ii) taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened; (iii) indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare; (iv) habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare; (v) areas containing nationally significant examples of indigenous community types; and (vi) areas set aside for full or partial protection of indigenous biological diversity under other legislation; and (b) avoid significant adverse effects and avoid, remedy or mitigate other	- This policy is an "avoid" policy - The Cawthron report concluded that there does not appear to be any taxa of particular ecological or conservation importance in the seabed around the outfall site. - The Cawthron report identifies that several species of bird have been recorded in the area that are listed in the New Zealand Threat Classification System as Threatened or At Risk - The Cawthron report identifies that without mitigation there are likely to be significant adverse effects on shore and sea birds and sand-dune habitats and the organisms living in them associated with the construction of the outfall. These could be mitigated through using a trenchless method of installing the pipeline through the foredune and beach zones. However, preparatory works such as vegetation clearance, earthworks, access tracks and equipment storage areas will be required which could affect birds and sand-dune habitats. - However, the preparatory works and storage of equipment are likely to have short term effects on these habitats and it is for these reasons that the assessment is that the options would generally align with this policy.	🟧

Planning Instrument	Provision	Assessment	Alignment
	adverse effects of activities on: (i) areas of predominantly indigenous vegetation in the coastal environment; (ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species; (iii) indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh; (iv) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes; (v) habitats, including areas and routes, important to migratory species; and (vi) ecological corridors, and areas important for linking or maintaining biological values identified under this policy.		🟧
	Policy 13 Preservation of natural character (1) To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development: (a) avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character; and (b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on natural character in all other areas of the coastal environment; including by:	• Cawthron report identifies the dunes as 'naturally uncommon ecosystems' and states that the Manawatū coast has experienced some of the greatest loss of active dunes. • The area under investigation for the location of the landward extent of the outfall is identified as an Outstanding Natural Landscape under Plan Change 65 to the Manawatu District Plan Outstanding Natural Features and Landscapes (the Coast including the foredune and adjacent dunelands) under the Horowhenua District Plan. The areas in the Manawatu District Plan have been mapped, but the areas in the Horowhenua District Plan have not been mapped.	🟩

Planning Instrument	Provision	Assessment	Alignment
	(c) assessing the natural character of the coastal environment of the region or district, by mapping or otherwise identifying at least areas of high natural character; and (d) ensuring that regional policy statements, and plans, identify areas where preserving natural character requires objectives, policies and rules, and include those provisions. (2) Recognise that natural character is not the same as natural features and landscapes or amenity values and may include matters such as: (a) natural elements, processes and patterns; (b) biophysical, ecological, geological and geomorphological aspects; (c) natural landforms such as headlands, peninsulas, cliffs, dunes, wetlands, reefs, freshwater springs and surf breaks; (d) the natural movement of water and sediment; (e) the natural darkness of the night sky; (f) places or areas that are wild or scenic; (g) a range of natural character from pristine to modified; and (h) experiential attributes, including the sounds and smell of the sea; and their context or setting.	• The coastal land application areas of Option 10 O+L could also potentially affects these features and landscapes • Given that only small areas of duneland remain that contribute to natural character, and that preparatory works and equipment storage will be required, it would be difficult to argue that the options strongly align with the policy. However, given the temporary nature of the construction activities and that there should be no ongoing visual effects, the assessment is that there is "good alignment" with the objective.	🟩
	<u>Policy 15 Natural features and natural landscapes</u> To protect the natural features and natural landscapes (including seascapes) of the coastal environment from inappropriate subdivision, use, and development: (a) avoid adverse effects of activities on outstanding natural features and	• The area under investigation for the location of the outfall and conveyance infrastructure includes the Foxtangi Dunes, Hokio Beach South Dune Fields and Santoft parabolic dunes. These dunes are listed but not mapped in Schedule G of the One Plan as Regionally Outstanding Natural Features. • The area under investigation for the location of the landward extent of the outfall is identified	🟩

Planning Instrument	Provision	Assessment	Alignment
	outstanding natural landscapes in the coastal environment; and (b) avoid significant adverse effects and avoid, remedy, or mitigate other adverse effects of activities on other natural features and natural landscapes in the coastal environment; including by: (c) identifying and assessing the natural features and natural landscapes of the coastal environment of the region or district, at minimum by land typing, soil characterisation and landscape characterisation and having regard to: (i) natural science factors, including geological, topographical, ecological and dynamic components; (ii) the presence of water including in seas, lakes, rivers and streams; (iii) legibility or expressiveness—how obviously the feature or landscape demonstrates its formative processes; (iv) aesthetic values including memorability and naturalness; (v) vegetation (native and exotic);	as an Outstanding Natural Landscape under Plan Change 65 to the Manawatu District Plan Outstanding Natural Features and Landscapes (the Coast including the foredune and adjacent dunelands) under the Horowhenua District Plan. The areas in the Manawatu District Plan have been mapped, but the areas in the Horowhenua District Plan have not been mapped. • The coastal land application areas could also potentially affects these features and landscapes • Appropriate trenchless technologies will minimise the effects of the installation of the pipeline on the landward side of the CMA thereby ensuring the protection natural character, features and landscape values. However, the preparatory works and storage of equipment are likely to have short term effects • There could be opportunities for restoration of dunes and vegetation • Given the installation of the landward side of the pipeline will occur in areas identified as Outstanding Natural Features and Landscapes it would be difficult to classify the options as strongly aligning with the objective. However, given the temporary nature of the constructions activities and that there should be no ongoing visual effects, the assessment is that there is "good alignment" with the objective.	🟩
	<u>Policy 23 Discharge of contaminants</u> (1) In managing discharges to water in the coastal environment, have particular regard to: (a) the sensitivity of the receiving environment; (b) the nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving	• Clause 2 of this policy directly relates to the discharge of human sewage • All wastewater to be discharged to the CMA will be treated • The Wastewater BPO project involves a comprehensive and extensive investigation of alternative methods and receiving environments • Council is working collaboratively with Rangitāne, Raukawa and other iwi and hapū on the Wastewater BPO project and through this	🟩

Planning Instrument	**Provision**	**Assessment**	**Alignment**
	environment, and the risks if that concentration of contaminants is exceeded; and (c) the capacity of the receiving environment to assimilate the contaminants; and: (d) avoid significant adverse effects on ecosystems and habitats after reasonable mixing; (e) use the smallest mixing zone necessary to achieve the required water quality in the receiving environment; and (f) minimise adverse effects on the life-supporting capacity of water within a mixing zone. (2) In managing discharge of human sewage, do not allow: (a) discharge of human sewage directly to water in the coastal environment without treatment; and (b) the discharge of treated human sewage to water in the coastal environment, unless: (i) there has been adequate consideration of alternative methods, sites and routes for undertaking the discharge; and (ii) informed by an understanding of tangata whenua values and the effects on them. (3) Objectives, policies and rules in plans which provide for the discharge of treated human sewage into waters of the coastal environment must have been subject to early and meaningful consultation with tangata whenua.	collaboration has an understanding of tangata whenua values and the effects on them • The other matters addressed in the policy would be taken into account in deciding the location of the discharge and mitigation measures.	🟩
Overall alignment with the NZCPS			
One Plan Regional Policy Statement			

Planning Instrument	Provision	Assessment	Alignment
Chapter 2 Te Ao Māori	Policy 2-4: Other resource management issues The specific issues listed in 2.2 which were raised by hapū and iwi must be addressed in the manner set out in Table 2.1 below. Table 2.1 highlights issues of significance to the Region's hapū and iwi, provides explanations in the context of Māori belief and demonstrates how the Regional Council must address these matters. Table 2.1 Resource management issues of significance to hapū and iwi (h) Sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred	- Policy 2-4 requires that the Regional Council must address the issues raised by iwi and hapū - This Policy specifically identifies Objective 5-2 and Policy 5-11 as how the One Plan has addressed this issue. - Policy 8-6 applies Policy 5-11 (human sewage discharges) to the CMA as if any reference to water in those policies is a reference to water in the CMA	Policy 2-4 has been included for context. It does not require assessment
Chapter 8 Coast	Objective 8-3: Water quality Water quality in the CMA is managed in a manner that has regard to the Values set out in Schedule I: Part C so that: (a) water quality is maintained in those parts of the CMA where the existing water quality is sufficient to support the water management Values of the relevant area in the CMA set out in Tables I.2 and I.3 and the water quality targets in Tables I.4 to I.7 of Schedule I, and (b) water quality is enhanced in those parts of the CMA where the existing water quality is not sufficient to support the water management Values of the relevant area in the CMA set out in Tables I.2 and I.3 and the water quality targets in Tables I.4 to I.7 of Schedule I.	- The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceeds the water quality target for chlorophyll-*a* in the One Plan (Table 1.7) and turbidity near the coast is higher than the national median and exceeds the ANZECC guidelines - While it could be argued that the receiving environment without the discharge is degraded and should be enhanced, Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is significantly less than the targets. However there could be exceedances of some targets during peak wet weather flows. - Further work is required to confirm the position on the need to maintain or enhance the receiving waters. In the interim the assessment is that the options would generally align with this policy.	🟧

Planning Instrument	Provision	Assessment	Alignment
	Policy 8-4: Appropriate use and development Any use or development in the CMA must: (a) have a functional necessity to be located in the CMA, (b) facilitate restoration or rehabilitation of natural features where reasonably practicable, and (c) avoid, as far as reasonably practicable, any adverse effects on the following important values: (i) any characteristic listed in Table I.1 in Schedule I: Part B for each Protection Activity Management Area (ii) elements and processes that contribute to the natural character and open space characteristics of the CMA (iii) the landscape and seascape elements that contribute to the natural character of the CMA (iv) areas of significant indigenous vegetation and significant habitats of indigenous fauna, and the maintenance of indigenous biological diversity (v) the intrinsic values of ecosystems (vi) the natural integrity and functioning of physical processes (including recognition of sea level rise) (vii) historic heritage. When avoidance is not reasonably practicable, the adverse effects must be remedied or mitigated.	• The ocean outfall has a functional need to be located in the CMA • There could be opportunities for restoration of dunes and vegetation associated with the installation of the ocean outfall • The location options for the ocean outfall and discharge do not affect any Protection Management Area • The area under investigation for the location of the outfall includes the Foxtangi Dunes, Hokio Beach South Dune Fields and Santoft parabolic dunes. These dunes are listed but not mapped in Schedule G of the One Plan as Regionally Outstanding Natural Features. • The area under investigation for the location of the landward extent of the outfall is identified as an Outstanding Natural Landscape under Plan Change 65 to the Manawatu District Plan Outstanding Natural Features and Landscapes (the Coast including the foredune and adjacent dunelands) under the Horowhenua District Plan. The areas in the Manawatu District Plan have been mapped, but the areas in the Horowhenua District Plan have not been mapped. • The Cawthron report identifies that several species of bird have been recorded in the area that are listed in the New Zealand Threat Classification System as Threatened or At Risk • Appropriate trenchless technologies will minimise the effects of the installation of the pipeline on the landward side of the CMA should ensure the protection natural character, features and landscape values and effects on shore and sea birds and sand-dune habitats and the organisms living in them. However, the preparatory works and storage of equipment are likely to have short term effects on these values and habitats and it is for these reasons that the assessment is that the options	

Planning Instrument	Provision	Assessment	Alignment
		would generally align with this policy.	
	<u>Policy 8-6: Water quality</u> For the purposes of maintaining or enhancing water quality, the CMA is divided into a Seawater Management Zone and various Estuary Water Management Subzones which are described in Schedule I: Part C and shown in Part A. Water in the CMA must be managed in a way which: (a) has regard to the Values and water quality targets for the Seawater Management Zone and Estuary Water Management Sub-zones, as set out in Schedule I: Part C (b) applies Policies 5-3 (ongoing compliance where water quality targets are met), 5-4 (enhancement where water quality targets are not met), 5-9 (point source discharges to water) and 5-11 (human sewage discharges) to the CMA as if any reference to water in those policies is a reference to water in the CMA.	• The options are located in the Seawater Management Zone • The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceeds the water quality target for chlorophyll-*a* in the One Plan (Table 1.7: Seaward Management Zone Water Quality Targets) • Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is significantly less than the targets. However, there could be exceedances of some targets during peak wet weather flows. • Given that clause (a) of this policy requires that regard be had to the water quality targets rather than the water quality targets must be met the assessment is that the options would generally align with this policy.	
Chapter 5 Water	<u>Policy 5-3: Ongoing compliance where water quality targets are met</u> (a) Where the existing water quality meets the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality must be managed in a manner which ensures that the water quality targets continue to be met beyond the zone of reasonable mixing (where mixing is applicable).	• Policy 8-6 applies this policy to the CMA • The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceeds the water quality target for chlorophyll-*a* in the One Plan Table 1.7) and turbidity near the coast is higher than the national median and exceeds the ANZECC guidelines • While it could be argued that the receiving environment without the discharge is degraded and should be enhanced, Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is	

Planning Instrument	Provision	Assessment	Alignment
		significantly less than the targets. However, there could be exceedances of some targets during peak wet weather flows. • Further work is required to confirm the position on the need to maintain or enhance the receiving waters. In the interim the assessment is that the options would generally align with this policy.	🟧
	Policy 5-4: Enhancement where water quality targets are not met (a) Where the existing water quality does not meet the relevant Schedule E water quality targets within a Water Management Sub-zone, water quality within that sub-zone must be managed in a manner that enhances existing water quality in order to meet: (i) the water quality target for the Water Management Zone in Schedule E, and/or (ii) the relevant Schedule B Values and management objectives that the water quality target is designed to safeguard.	• Policy 8-6 applies this policy to the CMA • The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceeds the water quality target for chlorophyll-*a* in the One Plan Table 1.7) and turbidity near the coast is higher than the national median and exceeds the ANZECC guidelines • While it could be argued that the receiving environment without the discharge is degraded and should be enhanced, Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is significantly less than the targets. However, there could be exceedances of some targets during peak wet weather flows. • Further work is required to confirm the position on the need to maintain or enhance the receiving waters. In the interim the assessment is that the options would generally align with this policy.	🟧
	Policy 5-11: Human sewage discharges Notwithstanding other policies in this chapter: (a) before entering a surface water body all new discharges of treated human sewage must: (i) be applied onto or into land, or (ii) flow overland, or	• Policy 8-6 applies this policy to the CMA • Policy 2-4 identifies Policy 5-11 as addressing the issue raised by iwi and hapū that sewage disposed to water, in treated form or otherwise, is culturally abhorrent. Land-based treatment is preferred • Both options do not include wetlands / land passages and overland flow components prior	🟥

Planning Instrument	Provision	Assessment	Alignment
	(iii) pass through an alternative system that mitigates the adverse effects on the mauri of the receiving water body, and	to discharge to the ocean. It is for these reasons that a "fails to align" assessment has been applied.	🟥
One Plan Regional Plan			
Chapter 18 Activities in the Coastal Marine Area	Objective 18-2: Water quality in the CMA Water quality in the CMA is managed in a manner that sustains its life-supporting capacity and has regard to the Values, management objectives and the water quality targets set out in Schedule I: Part C.	• The options are located in the Seawater Management Zone • Outside a zone of reasonable mixing the discharge should meet the management objectives except those relating to enhancing mauri and maintaining sites of significance for cultural values	🟧
	The relevant management objectives relate to: • Supporting health aquatic life / ecosystems • Maintaining or enhancing sites of significance for indigenous biodiversity • Suitable for contact recreation • Maintaining or enhancing amenity values	• The Cawthron report identifies that the concentration of chlorophyll-*a* in the South Taranaki Bight exceeds the water quality target for chlorophyll-*a* in the One Plan (Table 1.7: Seaward Management Zone Water Quality Targets) • Table 7 in the Cawthron report demonstrates that the receiving environment with the discharge, after reasonable mixing does not exceed the Schedule I targets in the One Plan for typical flows and in a number of cases is significantly less than the targets. However, there could be exceedances of some targets during peak wet weather flows.	🟧

Planning Instrument	Provision	Assessment	Alignment
	- Maintaining or enhancing mauri - Suitable for shellfish harvesting - Maintaining sites of significance for cultural values - Assimilative capacity is not exceeded	- The Rangitāne CVS states that "discharge of wastewater to the moana will transfer the rāhui on bathing and kai gathering from the awa to the coastal area for Rangitāne. This will create widespread uncertainty about where and when it is safe to swim and collect kai. There is a high risk whānau will abandon traditional kai gathering grounds due to the tapu nature of wastewater."[10] - Note that the policy requires that regard be had to the management objectives and the water quality targets rather than the water quality targets must be met - Although many of the values are likely to be met, given the position of Rangitāne the assessment is one of general alignment	
	<u>Policy 18-12: Consent decision-making for discharges into the CMA</u> When making decisions on resource consent applications and setting consent conditions for discharges into the CMA, the Regional Council must have regard to: (a) the Regional Policy Statement, particularly all the objectives and policies of Chapters 2 and 8, Objective 3-1 and Policies 3-1, 3-2, 3-3, 3-6 and 3-7, Objective 6-2 and Policy 6-6, Objective 9-1 and Policies 9-3 to 9-5 and any relevant policies in the NZCPS; (b) the applicable Water Management Zone or Sub-zone and the relevant water quality Values and targets in Schedule I; (c) restricting the use of hazardous substances in any estuary or river (including stream) in the CMA to those necessary to control pest plants or marine fauna identified	- This policy related to matters decision makers must have regard to when considering discharge applications - A number of these matters have been assessed above - Outside a zone of reasonable mixing there should not be adverse effects on amenity values, recreational values and public health and safety and should not result in any of the effects set out in clause (e) - Because the references in clause (a) bring the RPS Policy 5-11: Human sewage discharges (noting that Policy 8-6 in Chapter 8 applies Policy 5-11 to the CMA) into consideration assessment is that the options would generally align with this policy	

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[10] Rangitāne o Manawatū Cultural Values Assessment page 23

Planning Instrument	Provision	Assessment	Alignment
	pursuant to a pest management strategy prepared under the Biosecurity Act 1993; (d) tikanga Māori, amenity values, recreational values and public health and safety, and ensuring any adverse effects are avoided as far as reasonably practicable. Where avoidance is not reasonably practicable, the adverse effects must be remedied or mitigated; and (e) ensuring that any discharge, after reasonable mixing, must not result in: (i) the production of any conspicuous oil or grease films, scums or foams; (ii) floatable or suspended materials; (iii) any conspicuous change in the colour or visual clarity of water in the coastal marine area; or (iv) any emission of objectionable odour, or any significant adverse effects on aquatic life.		
	Policy 18-13: Consent decision-making for sewage discharges When making decisions on resource consent applications and setting consent conditions for sewage discharges into the CMA, the Regional Council must have regard to: (a) the Regional Policy Statement, particularly all the objectives and policies of Chapters 2 and 8, Objective 3-1 and Policies 3-1, 3-2, 3-3, 3-6 and 3-7, Objective 6-2 and Policy 6-6, Objective 9-1 and Policies 9-3 to 9-5 and any relevant policies in the NZCPS; (b) the applicable Water Management Zone or Sub-zone and the relevant water quality targets in Schedule I;	• This policy related to matters decision makers must have regard to when considering sewage discharges • The matter regarding water quality targets has been assessed above • The discharges will not be to any river (except on the highest 3% of days by WWTP flow), stream or estuary in the CMA or to any Protection Activity Management Area • The BPO Review is comprehensively considering a wide range of alternatives including discharging to land • The BPO Review involves extensive consultation with tangata whenua • Because the references in clause (a) bring the RPS Policy 5-11: Human sewage discharges (noting that Policy 8-6 in Chapter 8 applies Policy 5-11 to the CMA) into consideration the assessment is that the options	

Planning Instrument	Provision	Assessment	Alignment
	(c) avoiding any discharge within any river (including stream) or estuary in the CMA or within any Protection Activity Management Area identified in Schedule I; (d) the extent to which any alternatives have been considered, including discharging to land; and (e) considering the views and concerns of tangata whenua in the decision-making process.	can only generally align with this policy	
Overall alignment with the One Plan			

Palmerston North Wastewater
Best Practicable Option (BPO) Review

APPENDIX I: BPO Scoring Workshop Discussion

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

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Report Details

Prepared by:	Melaina Voss / Paula Hunter	4/08/2021
Checked by:	Jim Bradley	10/08/2021
Reviewed by:	Client / Jim Bradley / Simpson Grierson	12/08/2021
Approved & Issued by:	Roger Hulme	12/08/2021

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1 Overview

1.1 Overview of Assessment Process

An assessment of the short list options has been undertaken to determine levels of alignment for each option, with Best Practicable Option (BPO) Criteria developed from Condition 23B of the Discharge Permit 101829. This assessment has been undertaken to help inform the process of determining the BPO for the Palmerston North City wastewater management solution. Figure 1 below illustrates how the seven assessments and processes involved in determining the BPO.

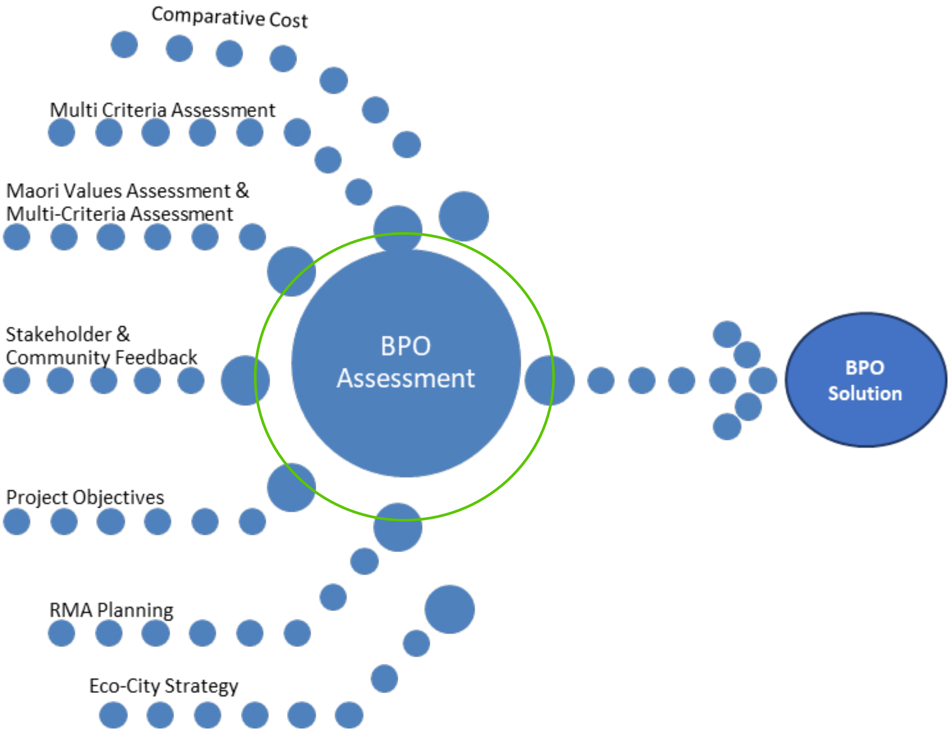

Figure 1 BPO Assessment Process

1.1.1 Shortlist Options

The following table lists the shortlist options. Further details of the shortlist options are provided in the Shortlist Options Summary Report, August 2021.

Table 1 Options Description / Reference

	Option Description	Treatment Level
1	**Option 1: R2(b) River discharge with enhanced treatment**	4
2	**Option 1: R2 (b-2) 75% ADWF to land / River discharge with enhanced treatment**	4
3	**Option 2: Dual R+L (b) 75% of the time application to Land / two River discharge points**	2
4	**Option 3: L+R (a) 97% of the time to Land (inland)**	1
5	**Option 3b: L+R (b) 97% of the time to Land (coastal)**	3
6	**Option 4: L+R (d-1) to land <80m³/s / 53% of the time to Land (inland)**	2
7	**Option 4: L+R (d-2) to land <62M³/s / 43% of the time to Land (inland)**	2
8	**Option 4: L+R (e-1) to land <80m³/s / 53% of the time to Land (coastal)**	2
9	**Option 4: L+R (e-2) to land <62m³/s / 43%of the time to Land (coastal)**	2
10	**Option 6: O+L / ocean with Land**	1
11	**Option 6: Ocean discharge only / Ocean**	1

1.1.2 Supporting Project Information

The following technical documents, developed to inform the shortlist options development and assessment process to date includes:

- Wastewater BPO Shortlist Options Report, July 2021
- Wastewater BPO Treatment Options Report, July 2021
- Wastewater BPO Treatment Shortlist Addendum Report August 2021
- Wastewater BPO MCA Comparative Assessment Report & Appendices, November 2020
- Wastewater BPO RMA Assessment Report, August 2021
- Wastewater BPO Eco-City Strategy Assessment, August 2021
- Wastewater BPO Project Objectives Assessment, August 2021
- Wastewater BPO Iwi Values/MCA Assessment, August 2021
- Wastewater BPO Comparative Cost Assessment, August 2021
- Wastewater BPO Stakeholder & Community Engagement Assessment, August 2021
- Wastewater BPO Shortlist Options Summary Report – August 2021

1.2 Purpose of this Report

This report is an Appendix to the main BPO Assessment Report and includes the options scoring against BPO Criteria, including key reasons for the basis of the applied scores. This was determined over a series of workshops held in August with Project technical experts, Council's Chief Engineer, Project Manager and Project Steering Group Chairperson.

2 Assessment Criteria & Principles

2.1 Assessment Principles

The following assessment principles were applied by experts, prior to undertaking the scoring process:

- Take a precautionary approach to the assessment, especially where there are uncertainties
- In assessing “receiving environment sensitivity” and “comparison of effects on the environment” adopt the RMA definition of effects which includes social, economic and cultural effects as well as effects on the natural environment
- RMA definition of effects include future effects, cumulative effects and effects of a low probability which have a high potential impact
- These are comparative assessments - not being asked to carry out a quantitative assessment. Need to identify if the assessment is ranking the options from 1-5 or an objective assessment that does not all the 1-5 scores
- For the scoring 1 is the worst and 5 is the best. One is not a fatal flaw it is just a low score when compared with the other options
- Need to take into account proposed treatment levels in the “receiving environment sensitivity” assessment

2.2 Matters for Consideration

Examples of matters to take into consideration when undertaking the comparative effects assessment

Noting that the starting point for the effects assessment is the exceedance assessments which relate primarily to the natural environment**.** The comparative effects assessment takes into account matters not assessed in the exceedance assessments.

Economic	**Social**
• Effects on productive land – including potential land use changes in land use • Long term effects on the land resource for productive use • Climate change effects on flooding and water logged ground • Available markets • Aquaculture, fishing, eel farming • Tourism • Provision of alternative drinking water supplies • Crop production less than modelled	• Effects on drinking water sources • Effects on property owners – loss of property • Recreational effects • Food gathering • Public health risk • Aerosol drift • Odour
Cultural	**Natural Resources**

• Effects on mauri of water bodies
• Effects on wāhi tapu – taonga and significant cultural sites
• Protection of the wairua, health and well-being of whānau
• Effects on kaitiakitanga
• Effects on cultural health of coastlines
• Effects on wetland and sand dunes
	• Failure to achieve nutrient uptake from land application because of operational issues
	• As defined by technical experts throughout comparative assessment reporting, in brief:
	  • Surface and groundwater quality
	  • Ecological (aquatic)
	  • Land contamination

3 BPO Criteria

Table 2 BPO Assessment Criteria (Condition 23B) and Scoring Criterion

BPO Source	Ref	Criterion	Description	1	2	3	4	5
RMA BPO definition (a)	RE1	Receiving environment sensitivity	What is the nature of the discharge, and how sensitive is the likely receiving environment (social, economic, cultural, natural) to adverse effects?	Very high	High	Moderate	Low	None
RMA BPO definition (b)	CEE1	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Social environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE2	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Economic environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE3	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Cultural environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE4	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Natural environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
RMA BPO definition (b)	F1	Comparative financial implications	How do the cost (capital, operational, whole of life) implications of each of option compare with the other options ?	Very high	High	Moderate	Low to Moderate	Low
RMA BPO definition (c)	TK1	Technical Knowledge	Can the options be successfully implemented e.g. how complex is each option to construct and operate when compared with the other options ?	Highly Complex	Moderate to Highly Complex	Moderately Complex	Low to Moderately Complex	Low Complexity
	TK2	Technical Knowledge	Are the technologies reliable / proven ?	Unproven or Emerging	Proven, Int: (Limited), NZ (Not in use)	Proven, Int (Common), NZ (Limited)	Proven, Int (Common), NZ (Increasing)	Proven, Common Use
	TK3	Technical Knowledge	How resilient is each option to natural hazards and climate change ?	High	Moderate to High	Moderate	Low to Moderate	Low
Condition 23B b. and c	S1	Exceedances of standards, limits or targets	Is it expected that each option will minimise the frequency, magnitude and duration of exceedances of relevant standards, limits or targets?	Very High	High	Medorate	Low	Negligible
	S2	Exceedances of standards, limits or targets	Is the option directed at preventing or minimising any adverse effects of the discharge on the life supporting capacity of the Manawatū River?	Very High	High	Medorate	Low	Negligible
	S3	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects of growth of cyanobacteria and excessive periphyton?	Very High	High	Medorate	Low	Negligible
	S4	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects of changes to the structure and/or composition macroinvertebrate communities?	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	S5	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects on the migration and habitat of trout and native fish?	Very High	High	Medorate	Low	Negligible
Condition 23B c.		RMA Part 2 and Section 104, 105 and 107 considerations	Broadly, how does each option align with the principles of Part 2 of the RMA (including enabling people and communities to provide for their social, economic, and cultural well-being and for their health and safety) and the considerations contained in sections 104, 105 and 107 of the RMA	Fails to align	Weak alignment	General alignment	Good alignment	Strong alignment

4 Scoring

4.1 Receiving environment sensitivity

#	Option	RE1 SCORE	Commentary / Reasons
1	R2(b)	1.0	- Manawatū River considered to be the most sensitive receiving environment – therefore the options (1 and 2) which have significant discharge to the River have scored worst. - Although option 3 has a significant discharge to the River it is a dual discharge, and the downstream discharge avoids the most sensitive reaches of the Manawatū River so it scores better than options 1 and 2. - The ocean is considered to be the least sensitive receiving environment – therefore option 11 scores best. - Option 10 scores well but because of the land component and potential risk of indirect discharges to coastal lakes it does not score as well as option 11 - Land receiving environment is considered to have moderate sensitivities, mainly associated with potential indirect discharges to groundwater, coastal lakes and local streams. Therefore options 4 to 9 score moderate noting that options 6, 7, 8 and 9 also have discharges to the River - No differences between inland and coastal land receiving environments as similar mitigation is proposed with adequate controls
2	R2(b) (75% DWF land)	2.0	
3	Dual R+L(b) (75% DWF to land)	3.0	
4	L+R(a)	3.0	
5	L+R(b)	3.0	
6	L+R(d-1) 80m3/s trigger	3.0	
7	L+R(d-2) 62m3/s trigger	3.0	
8	L+R(e-1) 80m3/s trigger	3.0	
9	L+R(e-2) 62m3/s trigger	3.0	
10	O+L	4.0	
11	O no Land	5.0	

Notes

- Environment sensitivity has been defined as the sensitivity of the natural, social, economic and cultural environment
- Assessed in the context of the receiving environments that the options discharge to i.e. direct discharges to the Manawatū River, to land and to the ocean. Potential indirect discharges to groundwater, coastal lakes and local streams
- This is a comparative assessment so the full range of the scores have been used

4.2 Comparison of effects on the environment

Social, Environmental, Natural, Built, Economic and Cultural environment has been considered within the "Effects on the Environment" criteria

#	Option	CEE1	CEE2	CEE3	CEE4	SCORE	Commentary / Reasons
1	R2(b)	5	4.0	2	1	3.0	- Option 1 scored the worst of the options with River discharges because it does not fully address the issue of periphyton growth - Option 2 did not score well as it is a significant discharge to the River. Option 3 scored better as while it is a significant discharge to the River it is a dual discharge, and the downstream discharge avoids the most sensitive reaches of the River - Options 3 and 4 had moderate scores primarily because the discharge is removed from the River, but there could be effects on soil and potential indirect discharges to groundwater, coastal lakes and local streams, particularly as this is a continuous discharge - Options 6,7,8 and 9 scored well because they discharge to land under good conditions (dry) and the River under good conditions (high flows). Minor potential effects on soil and groundwater and some unknowns about coastal lakes, however mitigations have been applied - Option 11 scored best as there is no discharge to the River and no potential effects groundwater, coastal lakes and local streams - Option 10 did not score as well as Option 11 because of the land component and some unknowns about coastal lakes and dune areas, however mitigations have been applied
2	R2(b) (75% DWF land)	2	3.5	5	2	3.1	
3	Dual R+L(b) (75% DWF to land)	2	2.0	4	1	2.3	
4	L+R(a)	1	1.0	1	2	1.3	
5	L+R(b)	3	2.0	2	4	2.8	
6	L+R(d-1) 80m3/s trigger	1	2.5	2	4	2.4	
7	L+R(d-2) 62m3/s trigger	1	2.5	2	5	2.6	
8	L+R(e-1) 80m3/s trigger	3	3.5	2	2	2.6	
9	L+R(e-2) 62m3/s trigger	3	3.5	2	2	2.6	
10	O+L	3	3.5	3	1	2.6	
11	O no land	4	5.0	4	1	3.5	

Notes

- This is a comparative assessment so the full range of the scores have been used

4.3 Comparative Financial Implications

#	Option	Score	Commentary / Reasons
1	R2(b)	5.0	- Scores follow cost banding approach based on NPV (Net Present Value) as set out in Appendix I - Comparative Cost Assessment - NPV based on the P50 indicative comparative capital cost estimates and 35 year operating and maintenance costs - Option 1 scored the best being the lowest NPV cost falling below $350M cost band at $337M - Options 5, 8 and 9 scored the lowest with Option 5 being the highest cost in this cost band of over $650M with a NPV at $836M, followed by Option 8 $786M and Option 7 $730M - Option 3 is the second lowest cost at $419M followed by third lowest Option 11 $480M and fourth lowest Option 2 $496M
2	R2(b) (75% DWF land)	3.0	
3	Dual R+L(b) (75% DWF to land)	4.0	
4	L+R(a)	2.0	
5	L+R(b)	1.0	
6	L+R(d-1) 80m3/s trigger	3.0	
7	L+R(d-2) 62m3/s trigger	4.0	
8	L+R(e-1) 80m3/s trigger	1.0	
9	L+R(e-2) 62m3/s trigger	1.0	
10	O+L	1.0	
11	O no land	2.0	

Notes:

- For the purpose of the comparative cost/affordability assessment NPV (Net Present Value) was considered to provide an appropriate approach as it brings in both capital and annual operating and maintenance costs.
- The P50 estimate represents a cost that is likely to have equal changes of being under or over this value.

4.4 Technical Knowledge

#	Option	TK1	TK2	TK3	SCORE	Commentary / Reasons
1	R2(b)	4.0	4.0	5.0	4.3	• Option 1 scored the best as it is the most contained and compact system as does not involve long transmission pipelines, irrigation equipment, pumping stations etc. and seismic risk • Options 2 and 3 scored well, but not as good as option 1 because the options will involve some piping and pumping and irrigation equipment but not to the extent of the large land options and those to the coast • Options 4 and 5 and 8 and 9 did not score well because of seismic risk associated with long transmission pipelines, number of pump stations and the scale of irrigation equipment. Also flooding issue with large inland areas and forest fires with large coastal areas and forestry • Options 6 and 7 scored medium as the land areas are not as large, but there are seismic risks associated with piping, pumping and irrigation equipment and some flooding risks • Option 11 scored well but the main risk is the seismic risk associated with the long transmission pipeline • Option 10 has similar issue to option 11 but more risks associated with the land component and forest fires • Option 1 scored the best as it is the least complex option from an operational perspective. It involves only one receiving environment and there are no long transmission lines, pumping stations, irrigation equipment etc • Option 2 scored well as it has a small land requirement, and it is assumed this land would be located in proximity to the WWTP. Option 3 did not score as well as option 2 as it involves three receiving environments • Options 4 and 5 scored the worst because of the very large areas required for irrigation, the potential for these areas not to be contiguous, long transmission lines, pumping stations, irrigation equipment etc. Also potential operational problems during wet weather as unlike the other land options there is no ability to discharge to the River • Options 6, 7, 8, 9 and 10 have similar risks to options 4 and 5 but scored slightly better because of the ability to discharge to the River during wet weather conditions and for Option 10 to the ocean • Options 11 scored well, but there are some pumping risks with the long transmission lines.
2	R2(b) (75% DWF land)	3.0	3.0	4.0	3.3	
3	Dual R+L(b) (75% DWF to land)	3.0	4.0	3.0	3.3	
4	L+R(a)	1.0	1.0	1.0	1.0	
5	L+R(b)	1.0	1.0	1.0	1.0	
6	L+R(d-1) 80m3/s trigger	2.0	2.0	2.0	2.0	
7	L+R(d-2) 62m3/s trigger	2.0	2.0	2.0	2.0	
8	L+R(e-1) 80m3/s trigger	1.0	1.0	1.0	1.0	
9	L+R(e-2) 62m3/s trigger	1.0	1.0	1.0	1.0	
10	O+L	2.0	2.0	1.0	1.7	
11	O no land	4.0	5.0	1.0	3.3	

Notes

- Technical knowledge involves consideration of the option being able to be implemented, its complexity, how reliable and proven and resilient to natural hazards and climate change

4.5 Exceedance of standards, limits or targets

Note that this assessment relates to the Manawatū River only.

#	Option	S1	S2	S3	S4	S5	SCORE	Commentary / Reasons
1	R2(b)	3.0	2.0	1.0	1.0	3.0	2.0	• Option 1 has a moderate risk of not meeting One Plan targets (periphyton, macro-invertebrates) at times and within some reaches of the River • Option 2 has a low risk of not meeting One Plan targets (periphyton, macro-invertebrates?), but less often and within a shorter reach of the River than Option 1 • Options 4 and 5 have no discharges to the River (other than the 3% exceptional circumstances), but potential risk of not meeting One Plan requirements for local streams and for Option 5 coastal lakes because of very large land areas. Designed to meet leaching targets • Options 6, 7, 8 and 9 have been designed to meet One Plan targets but small potential risks with local streams and coastal lakes for Options 8 and 9. • Option 11 scores best as it there is no discharge to the River. Outside the mixing zone the discharge meets the One Plan requirements in typical flows but could be some exceedances in peak wet weather flows • Option 10 scores well as it there is no discharge to the River but small potential risks with and coastal lakes from the land application component • Option 2 has a low risk of not meeting One Plan targets (periphyton, macro-invertebrates), but less often and within a shorter reach of the River than option 1 • Options 4, 5 and 10 and 11 have no discharges to the River (other than the 3% exceptional circumstances), and score best • Options 6, 7, 8 and 9 have been designed to meet One Plan targets for the Manawatū River.
2	R2(b) (75% DWF land)	4.0	3.0	2.0	2.0	4.0	3.0	
3	Dual R+L(b) (75% DWF to land)	4.0	4.0	3.0	3.0	4.0	3.6	
4	L+R(a)	3.0	4.0	5.0	5.0	5.0	4.4	
5	L+R(b)	3.0	5.0	5.0	5.0	5.0	4.6	
6	L+R(d-1) 80m3/s trigger	3.0	4.0	4.0	4.0	5.0	4.0	
7	L+R(d-2) 62m3/s trigger	3.0	4.0	4.0	4.0	5.0	4.0	
8	L+R(e-1) 80m3/s trigger	3.0	4.0	4.0	4.0	5.0	4.0	
9	L+R(e-2) 62m3/s trigger	3.0	4.0	4.0	4.0	5.0	4.0	
10	O+L	4.0	5.0	5.0	5.0	5.0	4.8	
11	O no land	5.0	5.0	5.0	5.0	5.0	5.0	

Notes

- Receiving environments is already compromised. The Manawatū River does not meet the One Plan targets currently, irrespective of the impacts of the wastewater discharge.
- This is not a comparative assessment

4.6 RMA Part 2, s104, 105 and 107

#	Option	S104	S105	S107	Part2	SCORE	Commentary / Reasons
1	R2(b)	2	2	3	3	2.5	• All options provide for community's social and economic well-being and for health and safety in terms of providing safe and reliable wastewater services • Options 1, 2 and 3 which have significant discharges to the Manawatū River have significant issues for Rangitāne and Raukawa • Options 4, 5, 8 and 9 and 10 have a weak alignment with Part 2 of the RMA because of adverse effects on the natural environment and on the social, economic and cultural well-being and these effects significantly outweigh positive effects/benefits. There are also potential effects on indigenous biodiversity and heritage (archaeological) • Options 1, 2, 3, 6, 7 and 11 have a "general" alignment with Part 2 of the RMA having a mix of both "strong alignment" and "weak alignment" with the provisions of Part 2 of the RMA. That is they have some positive (benefits) and some negative/adverse effects • Section 107 of the RMA relates to the discharge of contaminants that will give rise to a range of stated adverse effects • Option 1 with 100% of the time discharge to the Manawatū River has a "medium risk" of not meeting Section 107 • Options 8 and 9 also have a "medium risk" of not meeting Section 107 because of the uncertainty regarding effects on coastal streams and lakes • Option 2 has a "low risk" of not meeting Section 107 in terms of effects on periphyton and macroinvertebrates • Options 3, 4, 5, 6, 7, 10 and 11 have been assessed as meeting Section 107. • Options 1, 2 and 3 have with significant discharges to the Manawatū River have a "weak alignment" with the objectives and policies of National Policy Statement – Freshwater Management (NPS-FM) • Options 1, 2 and 3 "general alignment" with the provisions of the One Plan in terms of meeting targets although Option 1 may not fully meet all the targets all of the time. • All options with discharges to the Manawatū River (Options 1, 2, 3, 6, 7, 8 and 9) include wetlands before river discharge therefore "on its face" Policy 5-11 of the One Plan can be met. However, in view of Rangitāne's position that wetlands will not restore the mauri of the wastewater and protect the River they have been assessed as "general alignment" • Options 6, 7, 8 and 9 with 43% and 53% of the year discharging to the land have "general alignment" with objectives and policies of the NPS-FM and the One Plan • The Ocean discharge Options 10 and 11 have "good alignment" with the NPS-FM and NZCPS but weak alignment with the One Plan objectives and policies. They are both opposed by Rangitāne and Raukawa.
2	R2(b) (75% DWF land)	2	2	4	3	2.8	
3	Dual R+L(b) (75% DWF to land)	2	2	5	3	3.0	
4	L+R(a)	4	4	5	2	3.8	
5	L+R(b)	4	4	5	2	3.8	
6	L+R(d-1) 80m3/s trigger	3	3	5	3	3.5	
7	L+R(d-2) 62m3/s trigger	3	3	5	3	3.5	
8	L+R(e-1) 80m3/s trigger	3	3	3	2	2.8	
9	L+R(e-2) 62m3/s trigger	3	3	3	2	2.8	
10	O+L	4	3	5	2	3.5	
11	O no land	4	2	5	3	3.5	

Notes

Palmerston North Wastewater
Best Practicable Option (BPO) Review

DRAFT Interim BPO Assessment & Recommendation

August 2021

Prepared for Palmerston North City Council by:

Stantec

QUALITY STATEMENT

Project Details

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Report Details

Prepared by:	Melaina Voss	10/08/2021
Checked by:	Jim Bradley/Melaina Voss	12/08/2021
Reviewed by:	Jim Bradley / Client / Simpson Grierson	12/08/2021
Approved & Issued by:	Roger Hulme	12/08/2021

Executive Summary

This Report has been prepared to assist the Council in identifying options that may be considered as the final Best Practicable Option (BPO). This Report includes the following:

- Overview of the BPO Review process since 2017
- Methodology for the final assessment phase, including:
    - The outcome of 7 assessments and technical recommendation for assessment weighting
    - The BPO Assessment of options against Condition 23B criteria.
- Wider considerations in deciding on a BPO solution
- Overall technical recommendation for the BPO

The Project Team[1] has worked collaboratively since 2017 to develop and refine the shortlist options. At each stage, this has progressed to a level that assures a robust assessment process can be undertaken. This has been peer reviewed by legal counsel and technical experts at key stages of the Project since 2017.

Rangitāne o Manawatū are Mana Whenua in Palmerston North and provide both governance and technical leadership on this Project. The Commitment of Iwi[2] to contribute throughout this process has been integral to the Projects progress and ultimately.

Ultimately, this Report provides the Council with an overview of the assessment outcomes and has been prepared to allow Council to make an informed decision on a preferred BPO. This will subsequently be reported to Horizons Regional Council as a requirement of the existing resource consent Permit 101829. Following this decision, the Council must progress to the lodgement of resource consent by 1 June 2022.

RMA Requirements

The RMA requires an assessment of alternatives (options) to be undertaken for specific circumstances. On the basis the BPO will be applied for as a new Resource Consent from the Regional Council (Horizons), an Assessment of Environmental Effects (AEE) is required.

Best Practicable Option Process

The BPO process has involved three major options evaluation process since 2017, requiring commitment from the Council over two terms to provide direction and ultimately a decision on the BPO. The process has required technical expertise, Iwi involvement, Stakeholder feedback and peer review throughout this time. At the final phase of the assessment, it is critical that any option being considered, will meet the requirements of Condition 23B of Permit 101829.

Technical Recommendation

It is recommended that an Option is confirmed with the highest treatment level (Level 4) with a combined discharge to River and Land. The Land component of the solution will be implemented over time. This represents a combination of Options 2, 6 and 7. By adopting this as the BPO, Council may continue to work with Rangitāne and Iwi in the Region in partnership in consenting a successful BPO solution. This will also contribute to meeting several key messages from the community and stakeholders.

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[1] Made up of Councils Project Manager, Chief Engineer, Project Chairperson and leading technical experts appointed to deliver the technical recommendation for a BPO

[2] Refers to multiple Iwi. Iwi involved in the process is included in Section 2.3 of this Report.

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APPENDICES

1 Introduction

1.1 Purpose

The purpose of this report is to summarise the process that was followed to assist Palmerston North City Council in determining a recommended Best Practicable Option (BPO) for managing the future of the city's wastewater. The BPO is required to be determined in 2021 and a new resource consent applied for by June 2022 (HRC Permit 101829).

This Report captures the following:

- Project background, including a brief overview of the methodology adopted to establish a long list through to the current short list of options, Iwi and community involvement contributing to the process.
- The methodology used to assess the shortlist options including methodology, assessment outcomes and assessment of options under the BPO Test Criteria (Condition 23B of Permit 101829).
- The outcome of engagement (to date) with Iwi within this assessment process.
- To Be Confirmed - The outcome of Council Meeting (18th August 2021) to inform the BPO Recommendation.
- To Be Confirmed - Recommendation for the BPO.

This report has been prepared in two phases. The first phase is to present the outcome of 7 BPO assessments and the methodology for determining options to progress into the BPO Assessment Criteria. At this point, the Report will be presented to the Council at a meeting on the 18th of August 2021. The intention is to work through technical and recommended 'weightings' scenarios and the assessment of options through BPO Criteria. It is not clear if Council will be in a position on 18 August to agree on a recommended BPO and therefore, the Final BPO Recommendation (Phase 2), will be made on the 1st of September for Council to confirm a decision. Following this, the BPO will be confirmed with Horizons Regional Council (HRC).

1.2 Background

Technical reports (refer Section 1.4) and the involvement of experts through a series of workshops has been undertaken throughout this final phase of the BPO Review and assessment process. Their involvement includes MS Teams workshops, iterative scoring and review, technical support and drafting of advice, and attendance at the Council Meeting on the 18th of August 2021.

Engagement with Iwi throughout the Manawatū Region as occurred throughout the BPO Review Process. Rangitāne o Manawatū are mana whenua in Palmerston North and have maintained strong leadership within the Project Steering Group and in terms of input into all technical aspects of the Project since 2018. Iwi within the wider Region, including Ngāti Apa, Muaupoko and hapū leaders representing Ngāti Raukawa, have been involved in the review of technical information, preparation of cultural values assessments and undertaking an independent MCA.

Multiple phases of engagement with community and stakeholders has been undertaken by Council since 2018. This has included two phases of extensive community feedback sought in

2020 and 2021, working around the impact of COVID-19 lockdown in early 2020 and ongoing. Direct engagement with key stakeholders in the rural sector, businesses, trade waste customers and environmental interest groups within the community and wider region, has also continued throughout the Project.

Figure 1 below illustrates the high-level Project Programme, including milestone dates for the BPO decision and Lodgement of the Resource Consent. It should be noted that a delay to the BPO decision was acceptable by Horizons Regional Council on the basis the decision was delayed due to the impact of COVID lockdown and the consultation on the Long-Term Plan process in early 2021, which Council sought alignment with the decision on the BPO. The BPO decision must be made no later than the 1st of September 2021.

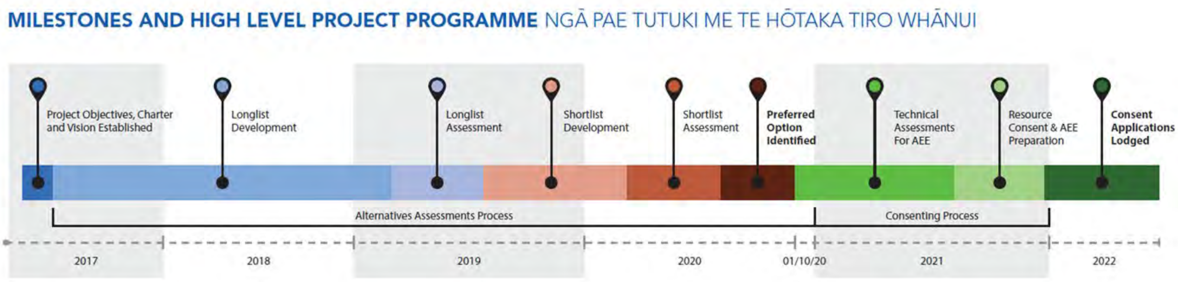

Figure 1 BPO Project Programme

1.3 BPO Shortlist Options

The overall approach to identifying options in the first instance was developed in early 2019 and is documented in the *Longlist Assessment Approach & Conceptual Options*, *Final* July 2019

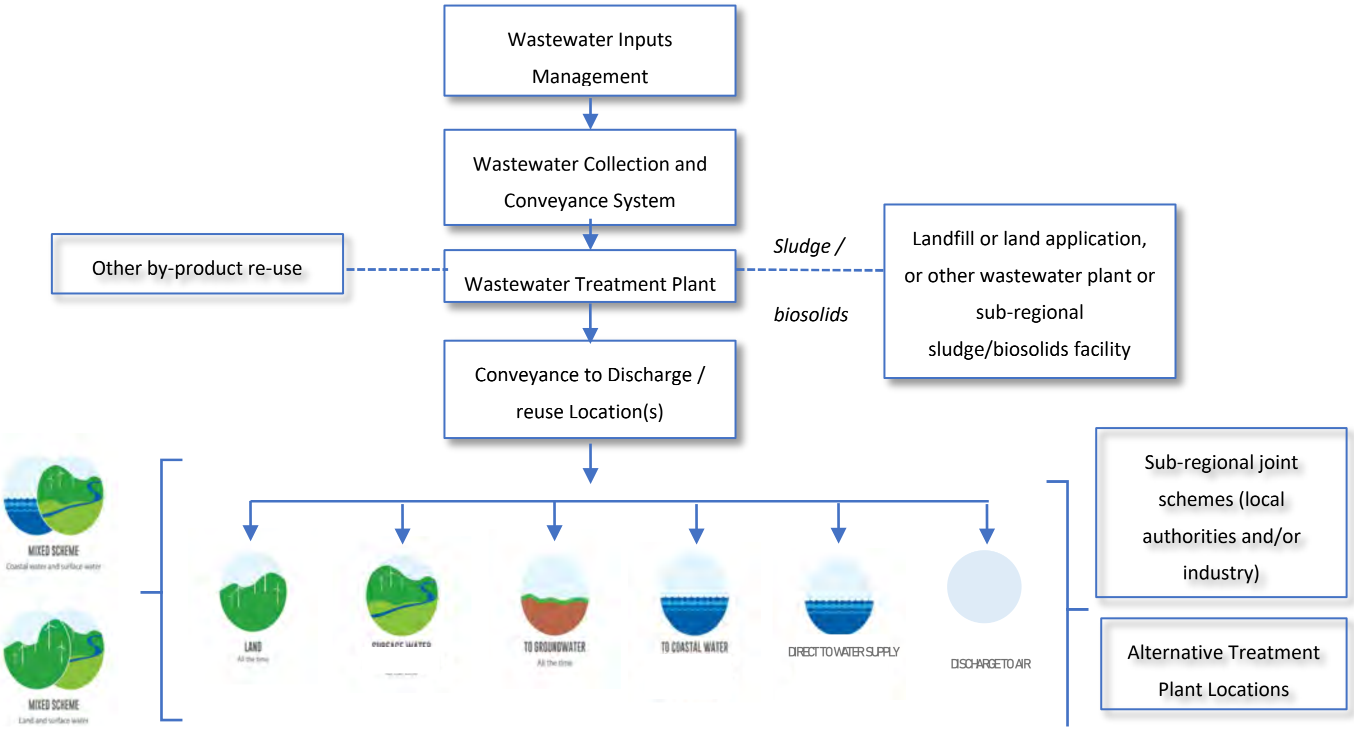

Figure 2 Components of the potential BPO Wastewater Scheme

Report. Figure 2 illustrates the components considered in the overall wastewater scheme being developed for Council in conjunction with the potential receiving environments.

Following the development of the conceptual options in July 2019, technical investigation was undertaken by the Council's Project Team[3] to develop the conceptual shortlist to a defined set of options, including proposed treatment regimens and cost estimates. Independent Peer Review was undertaken at key stages of the Project, as outlined in Figure 3 below.

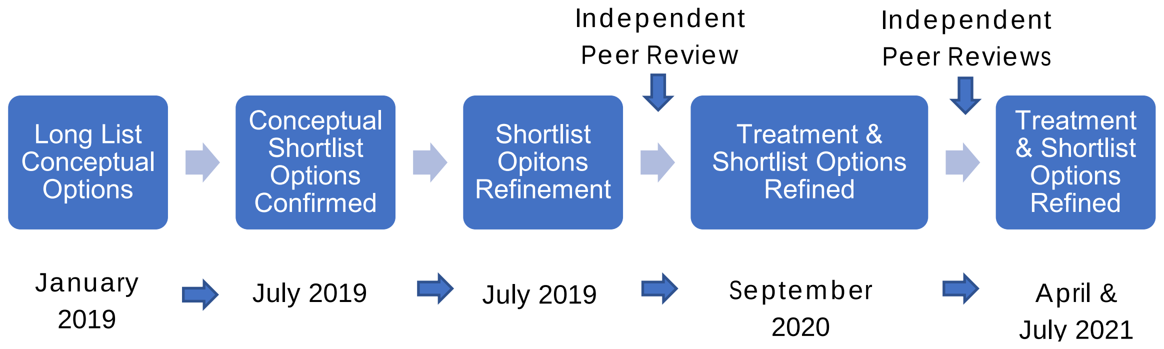

Figure 3 Shortlist Development and Refinement process, including Peer Review input

In September 2020 the Shortlist was refined to enable Council's Project Team experts to complete the Multi-Criteria Assessment (MCA). Table 1 below lists the shortlist options assessed at the MCA in November 2020, the 6 other assessments forming this process and BPO Assessment (this Report). Technical details of each of the shortlist options are provided in the Shortlist Options Summary Report, July 2021 (Appendix A).

Table 1 Options Description / Reference

Option	Option Summary Description
1	**R2(b) River discharge with Enhanced Treatment**
2	**R2(b) River discharge with Enhanced Treatment, 75% ADWF to Land at low River flow**
3	**Dual R+L(b) Two River discharge points with 75% ADWF to Land at low River flow**
4	**L+R (a) 97% of the time to Land (inland)**
5	**L+R (b) 97% of the time to Land (coastal)**
6	**L+R (d-1) to Land <80m³/s / 53% of the time to Land (inland)**
7	**L+R (d-2) to Land <62m³/s / 43% of the time to Land (inland)**
8	**L+R (e-1) to Land <80m³/s / 53% of the time to Land (coastal) TN = 35 mg/L**
9	**L+R (e-2) to Land <62m³/s / 43% of the time to Land (coastal) TN = 35 mg/L**
10	**O+L / Ocean with Land (coastal)**
11	**Ocean discharge**

It is noted that all options have the potential to include wastewater management, conveyance and treatment innovation components. These components are identified within

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[3] Project Team consists of PNCC Project Manager and Chief Engineer, Independent Chairperson, Technical Consultants appointed by PNCC.

the current shortlist for consideration within the final BPO decision and play a key part of the Assessment of options under the Eco-City Strategy (Appendix G) These components include:

- Options to Reduce Wastewater Generation
- Wastewater Collection Options
- Beneficial Re-use of Treated Wastewater Options
- Residuals Management Options
- By Product and Alternatives Waste Stream Beneficial Reuse Options
- Options for other Innovations

1.4 Supporting Project Information

The following technical documents have been referred to, to inform this assessment:

- Wastewater BPO Shortlist Options Report July 2021
- Shortlist Summary Report July 2021 (Appendix A)
- Wastewater BPO Treatment Options Report April 2021 and Addendum Report, August 2021
- BPO Assessment Reports:
  - Comparative Cost Report, August 2021 (Appendix B)
  - Multi-Criteria Assessment, August 2021 (Appendix C)
  - Maori Values / MCA Assessment Report, August 2021(Appendix D)
  - Stakeholder & Community Engagement Assessment, August 2021(Appendix E)
  - Objectives Assessment, August 2021(Appendix F)
  - Eco-City Strategy Assessment, August 2021(Appendix G)
  - RMA Planning Assessment, August 2021(Appendix H)
- Resource Consent Permit 101829, Condition 23B

2 Background

2.1 Underlying Legislative Requirements

2.1.1 RMA Requirements & Consideration of Alternatives

The RMA requires an assessment of alternatives (options) to be undertaken for specific circumstances. On the basis the BPO will be applied for as a new resource consent from the Regional Council (Horizons), an Assessment of Environmental Effects (AEE) is required. This AEE will need to address alternative methods of the discharge and locations, and there are specific matters to be addressed under s105 of the Resource Management Act (RMA).

A proven tool used by authorities on major projects, equivalent in potential adverse effects and complexity as the BPO Project, is a Multi-Criteria Assessment (MCA). The MCA process applied to this project has been done so to ensure the analysis of alternatives is transparent and replicable. The process has also been undertaken in consideration of caselaw.[4]

The Wastewater BPO is highly complex with the potential to have adverse effects on a wide-reaching number of parties including Iwi, community, industry, agricultural sectors, individuals, and other stakeholders. Accordingly, the alternatives assessment that has been developed for the Council has carefully considered the scale of potential adverse effects through technical advice, proven assessment methodologies, Iwi involvement, and community and stakeholder engagement.

An MCA has been applied in two ways through this final phase of assessment, including:

- Full MCA on Shortlist Options (Appendix C); and
- An MCA scoring and weighting approach has applied to the evaluation of the 7 assessments, to compare the output of options from each assessment consistently and determine an overall combined ranking of the options.

2.1.2 Existing Resource Consent (Permit 101829)

A change of conditions to the existing consent (Permit 101829) arose out of an agreement reached between the Council and Horizons Regional Council (Horizons), following a review to address the effects of the WWTP discharge on the life supporting capacity of the Manawatū River. This adverse effect was determined to be arising from excessive periphyton growth downstream of the WWTP.

As part of the agreement, Council agreed to carry out a Best Practicable Option (BPO) review in relation to wastewater treatment and disposal options and to apply for a new consent by June 2022. A number of Conditions were amended, while new conditions were included in the Consent. In relation to a BPO, Condition 23B was included, which reads as follows:

> *Condition 23B. During the 14th year following the commencement of this Permit, the Permit Holder shall initiate a review process (the BPO Review) to determine the best practicable option for treating and disposing of wastewater (including land disposal systems) and give effect to the milestones, as listed in Condition 23C below.*

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[4] Basin Bridge Decision: NZ Transport Agency v Architectural Centre [2015] NZHC 1991. Also known as the Basin Bridge decision, at [175] – [198]

a. *For the purposes of this condition, the Best Practicable Option, in relation to a discharge of wastewater from the Palmerston North Wastewater Treatment Plant, means the best method for preventing or minimising the adverse effects on the environment of that discharge having regard, among other things, to -*

   i. *The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*

   ii. *The financial implications, and the effects on the environment, of that option when compared with other options; and*

   iii. *The current state of technical knowledge and the likelihood that the option can be successfully applied.*

b. *The Best Practicable Option shall be directed at preventing or minimising any adverse effects of the discharge on the life supporting capacity of the Manawatū River and in particula,r at minimising any adverse effects in relation to each of the following:*

   i. *Growth of cyanobacteria and excessive periphyton;*

   ii. *Changes to the structure and/or composition of macro-invertebrate communities; and*

   iii. *The migration and habitat of trout and native fish.*

c. *In determining the Best Practicable Option, the Permit Holder shall have regard to minimising the frequency, magnitude and duration of any exceedances of applicable standards, limits or targets in National Policy Statements, National Environmental Standards and any relevant Regional Plan, caused by the discharge.*

Based on condition 23B, a BPO assessment forms the final phase of the assessment process before a recommendation is made to Council. Condition 23B has been translated into 'BPO Criteria', which have been used to assess each option's 'level of alignment' with each specific criterion. The BPO Criteria and assessment is discussed in Section 5 of this Report.

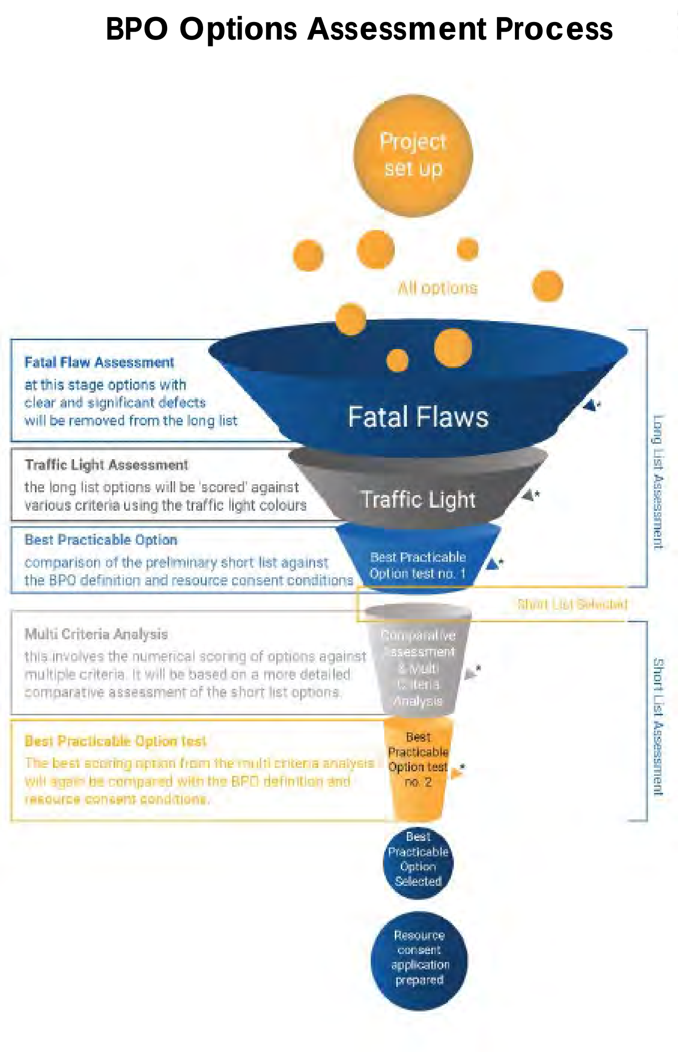
2.2 Overview of BPO Review

The Resource Management Act (RMA) is the overall framework within which the BPO Review is being undertaken. Therefore, the approach to undertaking each of the assessments used throughout the Review, focus on the environmental effects of the proposed wastewater discharge (including treatment levels), on the receiving environment. As the Project has progressed and options have been refined, the level of technical detail of each shortlist option and the potential for adverse effects on the receiving environment, is progressively further defined by each of the technical experts involved in the Project.

In the development of the shortlist options, each treatment solution and option must aim to achieve relevant Standards, Targets and Rules of environmental legislation. These primarily sit within the Horizons Regional Council One Plan (the One Plan) and National Policy Statement for Freshwater Management (NPSFM). A Complete Planning Assessment was undertaken for the Project in early 2019, which sets out the relevant criteria for each of the shortlist options under consideration.

Assessment phases have consistently included cultural, social and economic criteria. Where options have not met criteria to the extent that this is considered a fatal flaw, these options have been removed.

An iterative approach has been developed for the development and assessment of options. Figure 4 illustrates the assessment process adopted from the project inception in 2017 through to the current recommendation process (this Report). The ‘Multi-Criteria Assessment’ and the Best ‘Practicable Options Test’ form the final part of the assessment process before making recommendation for a BPO. The scope of this final phase also includes the 7 assessments (including the MCA), before progressing to the BPO Test, which are addressed entirely within this Report.



BPO Options Assessment Process

Fatal Flaw Assessment
at this stage options with clear and significant defects will be removed from the long list

Traffic Light Assessment
the long list options will be 'scored' against various criteria using the traffic light colours

Best Practicable Option
comparison of the preliminary short list against the BPO definition and resource consent conditions

Multi Criteria Analysis
this involves the numerical scoring of options against multiple criteria. It will be based on a more detailed comparative assessment of the short list options.

Best Practicable Option test
The best scoring option from the multi criteria analysis will again be compared with the BPO definition and resource consent conditions.

Figure 4 BPO Options Review Process

2.3 Iwi Involvement

Iwi involvement in the BPO Process has varied since 2017, largely dependent on the level of information available from Council to allow meaningful engagement to occur. This included an introduction to the project, followed up with invitation to meet with Council. The following section describes the engagement with Iwi who have progressively become involved in the options review and assessment processes contributing to the BPO recommendation.

2.3.1 Rangitāne o Manawatū

From the outset of the Project, Council adopted a Project Governance structure that enabled the partnership with Rangitāne o Manawatū to be recognised at a governance level. Rangitāne o Manawatū are Mana Whenua to Palmerston North[5] and midway through the BPO Process, in 2019, the Council and Rangitāne formalised their partnership through a Memorandum of Understanding (MoU).

In 2017, the Project Steering Group (PSG) was established for the BPO Review. The PSG is made up of three representatives of Rangitāne o Manawatū, elected members and senior Council Officers. The involvement of Rangitāne in the BPO Process has included extensive technical input into the options development and assessment processes, consideration of wetland and land passage options and preparation of a Cultural Values Assessment (refer Appendix D).

Figure 5 Rohe of Rangitāne o Manawatū

2.3.2 Muaūpoko Tribal Authority & Ngāti Apa

Because the BPO has the potential to impact on multiple Iwi within the Manawatū Region, the Council engaged with Iwi with connection to the Manawatū River, downstream of Palmerston North and out to the west coast (Horowhenua and Rangitikei Districts). This has included Muaūpoko Tribal Authority and Ngāti Apa. Figures 6 and 7 show the boundaries of each rohe.

Engagement varied depending on the stage of the Project and ability for the Iwi to be involved meaningfully at each stage. Early on, engagement consisted of an informing process, where Council began to progressively reach out to iwi groups who might have an interest in the outcome. Throughout 2020 to present, the engagement has become an involved process, whereby Iwi have worked with Council to review and provide feedback on technical deliverables. This has occurred with Muaūpoko and Ngāti Apa through several joint hui lead by Rangitāne o Manawatū and attended by various technical experts depending on the stage of the Project and specific technical aspects requiring input.

Figure 6 Rohe of Ngāti Apa

Figure 7 Rohe of Muaupoko

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[5] Figures sourced from www.tkm.govt.nz/iwi

2.3.3 Ngāti Raukawa

As described in Section 2.3.2, engagement varied depending on the stage of the Project and ability for Ngāti Raukawa to be involved meaningfully at that stage. Early on, engagement consisted of an informing process, where Council initially reached out to the Iwi, which at this early time was represented through Te Rūnanga o Raukawa. Commitment was given by Council to progress in a collaborative way through the options development and assessment phases with representatives. The boundary that applies to Ngāti Raukawa's rohe is shown in Figure 8.

Figure 8 Rohe of Ngāti Raukawa

Hapū Representation

Since early 2020, engagement with Ngāti Raukawa has strengthened with Council for the BPO Project. Through the Iwi's internal governance, representation of a majority of the hapū of Ngāti Raukawa, was confirmed by the CEO of Te Rūnanga. This leadership was established by Ngāti Tūranga and Council ensured the views of the hapū were given weight in the final options assessment process. This is captured in Appendix D of this Report.

Council's Project Team have worked collaboratively to provide technical information, allowing the Iwi to carry out an independent Cultural Values Assessment and MCA process on an informed basis. Technical consultants were appointed by the hapū leaders, to provide support in carrying technical review and MCA processes, ensuring trusted and independent advice to the Iwi.

Ngāti Whakatere

Ngāti Whakatere are a hapū of Ngāti Raukawa and the only marae located on the banks of the Manawatū River, immediately downstream of Palmerston North. In 2019 engagement and a hui led by Ngāti Whakatere, with public attendance, occurred in Shannon. Following this meeting, hui have occurred directly with the hapū and it was confirmed in 2020 and 2021 that the hapū would represent their hapū independently of Te Rununga and the representation lead by Ngāti Turanga (see above).

In April 2021, a draft letter that confirmed the approach between Council and the hapū was prepared by the Project's Chairperson. An MoU was requested by the hapū, however the Council elected to continue with the involvement of the hapū under a less formalised agreement. The outcome of the MoU is yet to be confirmed despite follow up by the Project Manager.

2.4 Community & Stakeholder Involvement

Between 2019 and 2021 there were three major engagement phases for the Project. These focused on an awareness campaign in late 2019, the June 2020 feedback period and the May 2021 feedback period. Outside of these time periods Council also provided public updates.

Stakeholder engagement was targeted with key groups, including rural sector, environmental sector, specific trade waste customers, neighbouring Councils and communities in Levin, Rangiotu, Foxton and Feilding. The feedback from both engagement phases in 2020 and 2021 is captured in the stakeholder assessment Report (Appendix E).

3 Methodology for this Assessment

3.1.1 Overview

A total of 7 technical assessments have been undertaken to help inform the process of determining the Best Practicable Option (BPO) for the Palmerston North City wastewater management solution. Figure 9 below shows the assessment process from the assessment stage to the final BPO Test and identifying the BPO.

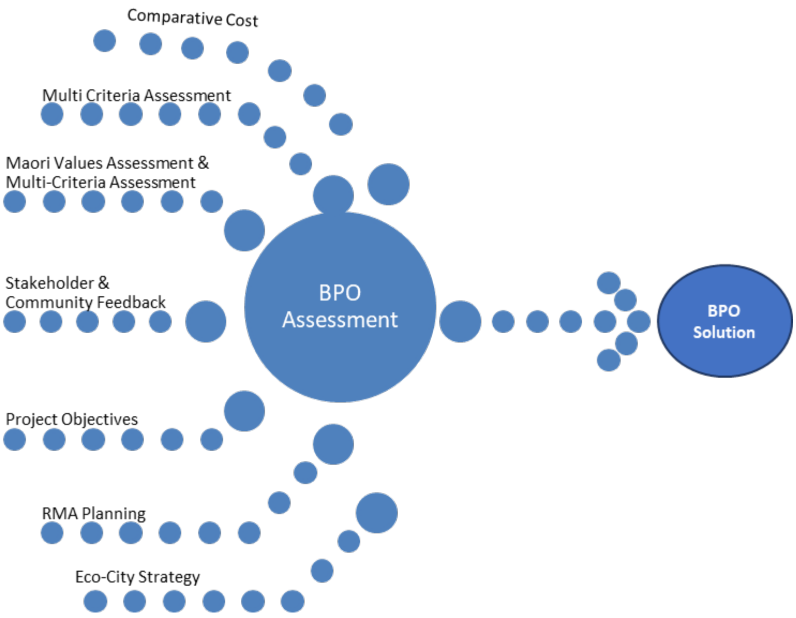
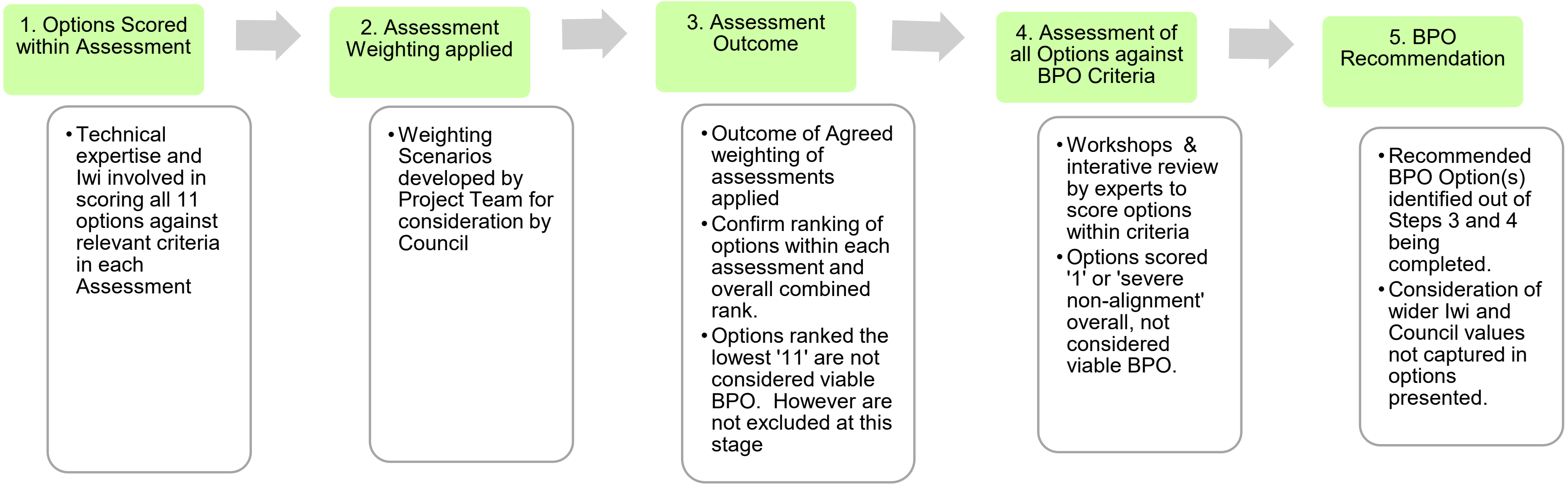


Figure 9 BPO Assessments & BPO Assessment Process

Figure 10 defines the process for refining options through the two key assessment phases before determining the BPO Recommendation.



1. Options Scored within Assessment

- Technical expertise and Iwi involved in scoring all 11 options against relevant criteria in each Assessment

2. Assessment Weighting applied

- Weighting Scenarios developed by Project Team for consideration by Council

3. Assessment Outcome

- Outcome of Agreed weighting of assessments applied
- Confirm ranking of options within each assessment and overall combined rank.
- Options ranked the lowest '11' are not considered viable BPO. However are not excluded at this stage

4. Assessment of all Options against BPO Criteria

- Workshops & interative review by experts to score options within criteria
- Options scored '1' or 'severe non-alignment' overall, not considered viable BPO.

5. BPO Recommendation

- Recommended BPO Option(s) identified out of Steps 3 and 4 being completed.
- Consideration of wider Iwi and Council values not captured in options presented.

Figure 10 Stages in this assessment process to determine BPO

3.1.2 Application of Criteria & Scoring

Each of the assessments considers each of the short list options comparatively across criteria specific to the assessment focus. These assessments have been completed with technical expertise from the Project Team and Council Officers. The methodology used to undertake these assessments is consistent in approach and provided in detail within each of the assessments appended to this Report. In summary, the following scale (Table 2) has been applied across the 7 assessments, however the definition of the alignment is refined to reflect the specific assessment:

Table 2 Scoring Criteria

Level of alignment	**Score**
Strong alignment	5
Good alignment	4
General alignment	3
Weak alignment	2

Fails to align	1

3.1.3 Application of Weighting and Sensitivity Analysis

Consideration of weighting the assessments has been proposed by the Council's Project Team for the following reasons:

- Council may consider the importance of one or more assessments as having higher importance and alignment to the Councils agreed values.
- Ensuring the process is robust is of key importance if the Council is to meet its statutory obligations under the RMA Alternative's Assessment. Therefore, a technical recommendation is necessary to guide the Council in its decision-making process.
- Assessments where the information is considered to have less rigor behind it is considered less reliable, and therefore, a low weighting has been applied.

The Council's Project team sought guidance from the Council at a workshop held in July 2021. The outcome of this workshop was consensus that the Council would prefer a technical recommendation be made by the Project Team, allowing the Council to debate the options in a transparent forum, publicly.

As such, this report includes the recommended technical weighting scenario and several alternative weightings to allow for appropriate sensitivity analysis to occur. These scenarios are to be considered at the Council Meeting on the 18th of August 2021. Figure 11 illustrates the Technical weighting by proportion.

Upon agreement on the weighting of the assessment arms, an overall score and ranking will be applied each option. Options that have ranked 9, 10 or 11, 'worst' are be considered low alignment to the assessments and therefore, are not going to proceed through to a recommended BPO option.

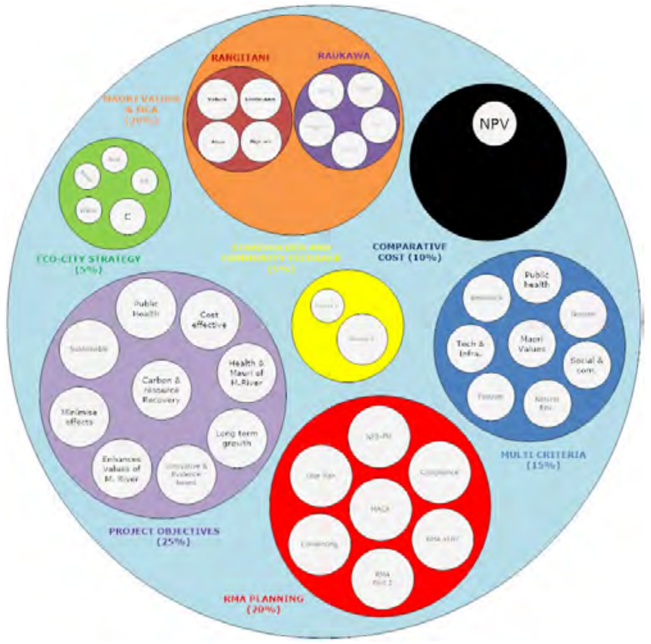


Figure 11 Illustration of weightings applied to each Assessment

3.1.4 BPO Assessment Principles

The final test for the options, is if the options will meet the BPO Criteria developed under Condition 23B of Permit 101829. A consistent scoring approach has been applied to scoring options under BPO Criteria, which aligns with the 7 assessments (refer Table 2). This method is consistent with a MCA methodology, a tool used to assign numbering to qualitative information and complex projects. A workshop process was used to determine scores, involving Councils technical experts, Chief Engineering, PSG Chairperson and Project Manager. Upon completion of the scoring, review of the options to identify criteria that has no alignment ie scored 1, will be excluded from potential recommendation of a BPO.

The following Principles were applied to the assessment of options by experts in the scoring of the criteria:

- Take a precautionary approach to the assessment, especially where there are uncertainties.
- In assessing "receiving environment sensitivity" and "comparison of effects on the environment" adopt the RMA definition of effects which includes social, economic and cultural effects as well as effects on the natural environment.
- RMA definition of effects include future effects, cumulative effects and effects of a low probability which have a high potential impact.
- These are comparative assessments - not being asked to carry out a quantitative assessment
- For the scoring 1 is the worst and 5 is the best. One is not a fatal flaw, it is just a low score when compared with the other options.
- Need to take into account proposed treatment levels in the "receiving environment sensitivity" assessment.

Examples of matters to take into consideration, when undertaking the comparative effects assessment, were also provided (refer Appendix I).

Noting that the starting point for the effect's assessment is the exceedance assessments, which relate primarily to the natural environment**.** The comparative effects assessment considers matters not assessed in the exceedance assessments.

4 Assessment Outcomes

4.1 Options Scoring & Ranking

Scoring of each option against assessment criteria, is included in the assessments attached to this Report (Appendix B, C, D, E, F, G, H). These scores have been compiled and a total score and rank allocated to each option within the criteria. The options score is then ranked in order from highest '1' to lowest '11', as outlined in Table 3 below. In Table 4 below, no weighting has been applied to any of the assessments. The methodology applied to removing options for consideration through the BPO test is conservative. We recommend the options tanked '11', the worst within any one of the assessments, is not recommended as a BPO (refer Section 4.3).

Table 3 Options ranking across 7 assessments

Option	Ranking of Option within each Assessment							Overall Ranking
	MCA	Maori	Stakeholder	Objectives	Planning	EcoCity	Comparative Cost	
Weight scenario	Combined				.			
1: R2 (b) (Level 4)	5	7	3	3	2	5	1	1
2: R2 (b) (75% DWF land): 760 ha. (Level 4)	8	8	3	2	3	6	5	4
3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	4	9	11	6	6	11	2	10
4: L+R(a): 3760 ha. (Level 1)	3	1	9	7	6	7	5	7
5: L+R(b): 2570 ha. (Level 3, TN=10)	7	4	10	5	1	1	9	5
6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	6	2	5	10	3	9	2	5
7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	2	2	5	10	3	10	2	3
8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	5	5	8	9	2	9	9
9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	5	5	8	9	3	9	11
10: O+L: 1470 ha. (Level 1)	9	10	1	4	11	4	8	8
11: O no land (Level 1)	1	11	1	1	2	8	5	2

4.2 Recommended Weighting Scenario

To provide confidence in the final BPO decision, options recommended to be proceed to assessment through the BPO Criteria are proposed to be those with strong or medium level alignment to the criteria assessed. As part of the assessment process, the Council requested the Project's Technical advisors provide a technical recommendation for the assessment weighting. Table 4 below outlines the recommended technical weighting. The basis for this weighting is the following:

- The highest weighting is applied to the Project Objectives. This has been done on the basis the Project Objectives were established in 2017 by the Council and have set the underlying framework for options development and assessments over time. The Objectives have been considered at the fatal flaw and traffic light assessment phases of the Project, however no specific assessment of the shortlist options against the Project Objectives has been completed until this phase of assessment. As Council will progress to resource consent and potentially a designation process, it is important to select an option that meets the Project Objectives as these are expected to be considered through the regulatory processes.
- The RMA Planning Assessment and Māori Values & MCA are weighted highly because:
  - The partnership between Council and Rangitāne o Manawatū should be recognised of high importance, as with recognising the value Iwi place on the Region's natural environment.
  - The risks of consenting an option, which is broader than the BPO criteria alone, are considered of high importance. This is due to the potential for options to be either be consented or not based on meeting relevant statutory documents.
- The MCA is a proven tool used for complex projects like the BPO Project. Accordingly, the MCA is weighted with a medium level of importance to ensure the assessment work completed to date, through a robust process, continues to be considered in the overall decision.

Octopus Arm	Weighting	Proportion
Multi Criteria Assessment	4.5	15.0%
Maori Values & MCA	6.0	20.0%
Stakeholder & Community Feedback	1.5	5.0%
Project Objectives	7.5	25.0%
RMA Planning	6.0	20.0%
Eco-City Strategy	1.5	5.0%
Comparative Cost	3.0	10.0%

Table 4 Technical Recommendation for weighting assessments

- The Eco-City Strategy is scored of lower importance. This is because it is important to factor in the Council's vision and objectives for environmental sustainability, particularly carbon and waste reduction. All options will be developed with sustainability and re-use as part of managing the wastewater system. The Strategy is focused on activities within the Council's control and not a wider consideration of neighbouring Council areas, where options will potentially impact.
- The stakeholder and community feedback has been scored lowest. This is due to the low level of confidence across the feedback received. While there has been extensive engagement over the life of the Project, we do not consider the collective information is entirely representative of all community and stakeholder views.

4.3 Alternative Weighting Scenarios

Alternative weighting scenarios have been explored to guide Council in potential variations to the technical recommendation and to provide relative sensitivity analysis. The alternatives included a higher percentage and focus on key values that have been highlighted throughout the BPO Process to date in Council. The alternatives are: Equal weighting (Table 5), and increased weighting for Māori Values (Table 6), Community & stakeholder values (Table 7), and cost (Table 8). Technical experts have referred to prior assessments reasoning and applied alternative weighting scenarios, accounting for feedback received from Council led workshops held throughout the Project and the need to adequately carry out a sensitivity analysis.

Table 5 Equal Weighting Scenario

Octopus Arm	Weighting	Proportion
Multi Criteria Assessment	4.3	14.3%
Maori Values & MCA	4.3	14.3%
Stakeholder & Community Feedback	4.3	14.3%
Project Objectives	4.3	14.3%
RMA Planning	4.3	14.3%
Eco-City Strategy	4.3	14.3%
Comparative Cost	4.3	14.3%

- An equal weighting scenario is provided as a baseline to understand the outcome of options ranking if all assessments are considered equal.
- The 'Equal scenario' shows there is little variation in the ranking when compared to the overall rank (with no application of weighting).

Table 6 Maori Values Focus for Weighting Scenario

Octopus Arm	Weighting	Proportion
Multi Criteria Assessment	3.0	10.0%
Maori Values & MCA	15.0	50.0%
Stakeholder & Community Feedback	1.5	5.0%
Project Objectives	3.0	10.0%
RMA Planning	3.0	10.0%
Eco-City Strategy	1.5	5.0%
Comparative Cost	3.0	10.0%

- During the MCA in November 2020, the Council agreed that Māori Values should be considered one of the highest values, in conjunction with other values discussed, therefore this scenario has been considered.

Table 7 Community & Stakeholder Values Focus for Weighting Scenario

Octopus Arm	Weighting	Proportion
Multi Criteria Assessment	3.0	10.0%
Maori Values & MCA	6.0	20.0%
Stakeholder & Community Feedback	10.5	35.0%
Project Objectives	3.0	10.0%
RMA Planning	3.0	10.0%
Eco-City Strategy	1.5	5.0%
Comparative Cost	3.0	10.0%

- Higher weighting is placed on community and stakeholder feedback as the Council has continuously raised the desire to meet community and stakeholder aspirations.
- The weighting is not considered as high as Scenarios focusing on Māori Values and Cost as the engagement feedback is not considered to be clearly representative of the Palmerston North Community.

Table 8 Cost Focus for Weighting Scenario

Octopus Arm	Weighting	Proportion
Multi Criteria Assessment	3.0	10.0%
Maori Values & MCA	6.0	20.0%
Stakeholder & Community Feedback	1.5	5.0%
Project Objectives	3.0	10.0%
RMA Planning	3.0	10.0%
Eco-City Strategy	1.5	5.0%
Comparative Cost	12.0	40.0%

- High cost weighting has been considered, with medium level weighting to Iwi values in this scenario. This is to reflect the rationale behind Council selecting a more affordable option, while maintaining support for Iwi values in the overall consideration.
- Cost has also been highlighted as a concern by the community and Council previously.

4.4 Options Ranking including weighting scenarios

Based on the scenarios noted in Section 4.3 above, Table 9 shows the composite score for the options ranked across all the assessments. Recommended Options to progress to BPO Assessment are highlighted in green within Table 9. In summary, the scenarios show:

- Options consistently scoring the lowest are options including large areas of coastal lands (Options 5, 8, 9 and 10)
- Options scoring consistently high include the Ocean discharge (Option 11) and options that minimise adverse effects on the Manawatū River, which includes the highest treatment level with a proportion to land (Option 2) and the 43-53% discharge to inland soils and River (Options 6 and 7).
- While the ranking for the technical recommendation has identified Option 11 is '1', Iwi are completely opposed (Appendix D) and as discussed in Section 6.2 below, is not recommended for a final BPO.

Table 9 Comparison of Ranked Options across weighting scenarios

Option	Rank across all Assessments	Technical Recommendation	Focus: Maori Values	Focus: Stakeholder	Focus: Cost	Focus: Equal
1: R2 (b) (Level 4)	6	6	7	6	1	5
2: R2 (b) (75% DWF land): 760 ha. (Level 4)	2	2	5	5	7	2
3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	9	9	9	9	4	9
4: L+R(a): 3760 ha. (Level 1)	5	3	1	4	6	6
5: L+R(b): 2570 ha. (Level 3, TN=10)	8	8	6	7	9	8
6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	4	5	3	2	3	3
7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	3	4	2	1	2	4
8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	10	10	10	10	10
9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	11	11	11	11	11
10: O+L: 1470 ha. (Level 1)	7	7	8	8	8	7
11: O no land (Level 1)	1	1	4	3	5	1

4.5 Recommended Options to Progress to BPO Assessment

To recommend options for assessment through the BPO Criteria and provide confidence in the final BPO decision, options with the highest alignment to the range of assessments completed in this process are recommended for further assessment and consideration. In addition to this, options considered 'mid-range' are also recommended to progress. Any option that is consistently scoring low across the weighting scenarios, should be removed from further assessment and consideration. These are options with a ranking of a '9', '10' or '11' within Table 9.

It should be noted that across the range of weighting scenarios, there are several options that consistently have low alignment across several the assessments to date (Table 3). Options that are ranked the lowest '11' are considered 'flawed', as they fail to align with multiple assessment criteria. For example, Options 10 and 11 are not considered acceptable to Iwi within the Maori Values Assessments. It is therefore recommended that Options that rank 11 within an assessment, are not considered as a potential BPO solution. These options have not been removed at this stage of the process and is further discussed in Section 6 'Recommendation' below.

The following options <u>are not considered</u> by Council as a final BPO solution because of the non-alignment (refer Table 9):

- Option 3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)
- Option 5: L+R(b): 2570 ha. (Level 3, TN=10)
- Option 8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)
- Option 9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)
- Option 10: O+L: 1470 ha. (Level 1)

The following are considered for further assessment through the BPO criteria and potential consideration as a BPO solution:

- **Option 1: R2 (b) (Level 4)**
- **Option 2: R2 (b) (75% DWF land): 760 ha. (Level 4)**
- **Option 4: L+R(a): 3760 ha. (Level 1)**
- **Option 6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)**
- **Option 7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)**
- **Option 11: O no land (Level 1)**

5 BPO Criteria Assessment

Table 4 below outlines the agreed BPO Criteria. This Criteria have been developed with the involvement of Technical experts, Council's legal advisors, Chief Engineer, Project Chairperson and Project Manager.

Table 10 BPO Assessment and Scoring Criterion

BPO Source	Ref	Criterion	Description	1	2	3	4	5
RMA BPO definition (a)	RE1	Receiving environment sensitivity	What is the nature of the discharge, and how sensitive is the likely receiving environment (social, economic, cultural, natural) to adverse effects?	Very high	High	Moderate	Low	None
RMA BPO definition (b)	CEE1	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Social environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE2	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Economic environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE3	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Cultural environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	CEE4	Comparison of effects on the environment	How do the effects of each of option compare with the other options in terms of the Natural environment	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
RMA BPO definition (b)	F1	Comparative financial implications	How do the cost (capital, operational, whole of life) implications of each of option compare with the other options ?	Very high	High	Moderate	Low to Moderate	Low
RMA BPO definition (c)	TK1	Technical Knowledge	Can the options be successfully implemented e.g. how complex is each option to construct and operate when compared with the other options ?	Highly Complex	Moderate to Highly Complex	Moderately Complex	Low to Moderately Complex	Low Complexity
	TK2	Technical Knowledge	Are the technologies reliable / proven ?	Unproven or Emerging	Proven, Int: (Limited), NZ (Not in use)	Proven, Int (Common), NZ (Limited)	Proven, Int (Common), NZ (Increasing)	Proven, Common Use
	TK3	Technical Knowledge	How resilient is each option to natural hazards and climate change ?	High	Moderate to High	Moderate	Low to Moderate	Low
Condition 23B b. and c	S1	Exceedances of standards, limits or targets	Is it expected that each option will minimise the frequency, magnitude and duration of exceedances of relevant standards, limits or targets?	Very High	High	Medorate	Low	Negligible
	S2	Exceedances of standards, limits or targets	Is the option directed at preventing or minimising any adverse effects of the discharge on the life supporting capacity of the Manawatū River?	Very High	High	Medorate	Low	Negligible
	S3	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects of growth of cyanobacteria and excessive periphyton?	Very High	High	Medorate	Low	Negligible
	S4	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects of changes to the structure and/or composition macroinvertebrate communities?	Significant cannot mitigate	Significant	Adverse	Minor	No more than minor
	S5	Exceedances of standards, limits or targets	In particular, is the option directed at preventing or minimising any adverse effects on the migration and habitat of trout and native fish?	Very High	High	Medorate	Low	Negligible
Condition 23B c.		RMA Part 2 and Section 104, 105 and 107 considerations	Broadly, how does each option align with the principles of Part 2 of the RMA (including enabling people and communities to provide for their social, economic, and cultural well-being and for their health and safety) and the considerations contained in sections 104, 105 and 107 of the RMA	Fails to align	Weak alignment	General alignment	Good alignment	Strong alignment

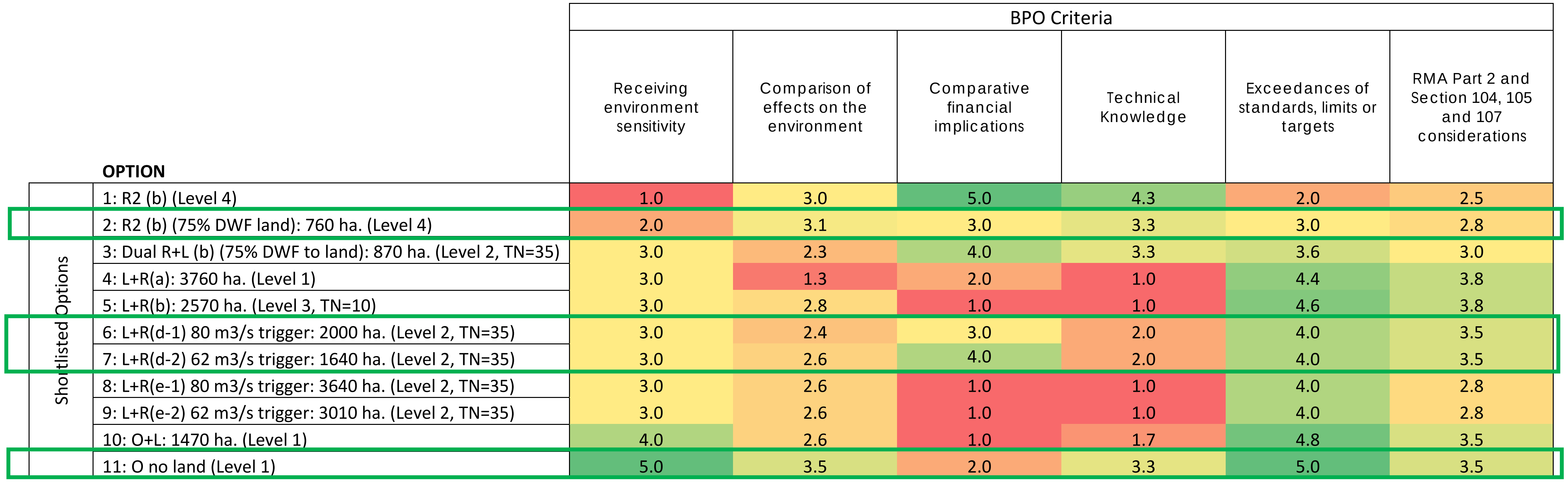
5.1 BPO Assessment

5.1.1 Explanation of BPO Criteria Scoring

Appendix I of this Report captures the breakdown of scores and reasoning behind the BPO Assessment (Table 12 below). These scores were derived through several interactive workshops attended by the technical experts, Council's Chief Engineering, PSG Chairperson and Project Manager. All options have been assessed through the BPO Criteria. This was done on the basis there is the potential for Council to consider an alternative weighting scenario at a Council Meeting on the 18th of August, which may change the initial removal of options at the weighting stage (refer Section 4.5 above).

Options for further consideration, that have not already been removed from the earlier assessment, are highlighted in green within Table 11 below. Table 11 below shows the overall score allocated to each of the BPO Criteria and an overall rank within the BPO criteria based on the total score. It should be noted that no weighting is being applied to individual BPO criteria. This is because the criteria are developed out of the specific resource consent Condition 23B and there is no indication in the current consent or previous consent decision that any one of the conditions/criteria should be weighted of higher or lesser importance.

Table 11 Options Assessment Scoring against BPO Criteria



		BPO Criteria					
	OPTION	Receiving environment sensitivity	Comparison of effects on the environment	Comparative financial implications	Technical Knowledge	Exceedances of standards, limits or targets	RMA Part 2 and Section 104, 105 and 107 considerations
	1: R2 (b) (Level 4)	1.0	3.0	5.0	4.3	2.0	2.5
	2: R2 (b) (75% DWF land): 760 ha. (Level 4)	2.0	3.1	3.0	3.3	3.0	2.8
Shortlisted Options	3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	3.0	2.3	4.0	3.3	3.6	3.0
	4: L+R(a): 3760 ha. (Level 1)	3.0	1.3	2.0	1.0	4.4	3.8
	5: L+R(b): 2570 ha. (Level 3, TN=10)	3.0	2.8	1.0	1.0	4.6	3.8
	6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	3.0	2.4	3.0	2.0	4.0	3.5
	7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	3.0	2.6	4.0	2.0	4.0	3.5
	8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	3.0	2.6	1.0	1.0	4.0	2.8
	9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	3.0	2.6	1.0	1.0	4.0	2.8
	10: O+L: 1470 ha. (Level 1)	4.0	2.6	1.0	1.7	4.8	3.5
	11: O no land (Level 1)	5.0	3.5	2.0	3.3	5.0	3.5

5.2 Recommended Options from BPO Assessment

All options have been considered through the BPO Criteria and this is the final phase of the assessment process, before wider considerations may be incorporated into the final BPO recommendation, by the Council and as recommended by Technical specialists. Options with a score of '1' within the BPO Criteria are considered to have high risks associated with non-compliance and/or adverse effects on the environment (refer Table 11). On this basis the options may be fatally flawed or at the least, have considerable risk of not being acceptable to Iwi and/or the consenting authority (Horizons Regional Council).

It is recommended that due to the high potential for not meeting one or more of the BPO Criteria, the following options are not considered for the final BPO solution:

- Option 1: R2 (b) (Level 4)
- Option 4: L+R(a): 3760 ha. (Level 1)
- Option 5: L+R(b): 2570 ha. (Level 3, TN=10)
- Option 8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)
- Option 9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)
- Option 10: O+L: 1470 ha. (Level 1)

6 Recommendation

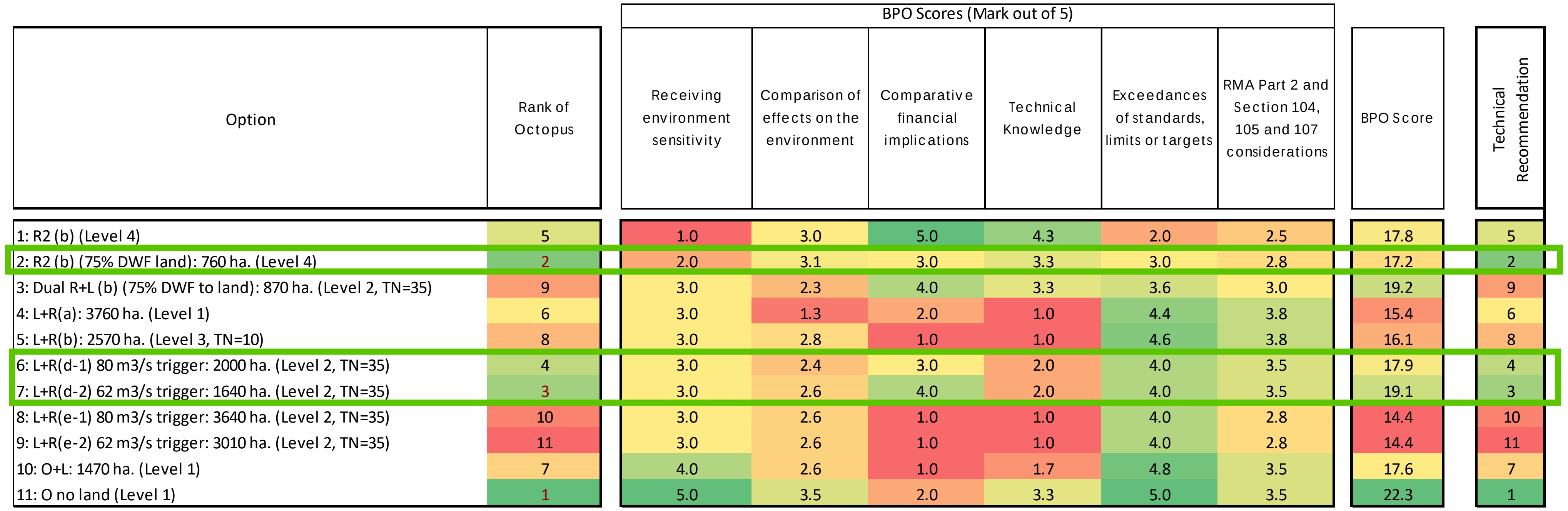
6.1 Outcomes Overall BPO Assessment

As outlined in Sections 4 and 5, the methodology applied to both the assessment scoring and BPO criteria, recommends that options considered with low levels of alignment to the assessments carried out prior to the BPO assessment should not be considered as potential BPO solutions (Section 4.5). This will result in several options already excluded through the weighting process and Option 11, which is fundamentally opposed by Iwi throughout the Region. Following this, all options have been assessed under the BPO criteria (Tables 11 and 12). It is the BPO assessment that is considered the most important and rigorous assessment to assist Council in identifying a potential BPO.

Options that have been identified as not having any reasonable alignment within an assessment and in consideration of the weighting scenarios applied to these assessments, are recommended to NOT be considered as a potential BPO. Under the BPO Assessment process, the same approach has been applied, in the options identifying with a ‘1’ are identified as having considerable risk to the option being consented, as it is considered to not meet one or more of the individual BPO criteria. Table 12 below shows the range of scores across the weighted assessment scores and the BPO Criteria. In summary, this indicates that the following options may be considered for the potential BPO solution:

- Option 2: R2 (b) (75% DWF land): 760 ha. (Level 4)
- Option 6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)
- Option 7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)

Table 12 Overview of BPO Criteria and Assessment Scores with Recommended potential BPO Solutions



Option	Rank of Octopus	BPO Scores (Mark out of 5)						BPO Score	Technical Recommendation
		Receiving environment sensitivity	Comparison of effects on the environment	Comparative financial implications	Technical Knowledge	Exceedances of standards, limits or targets	RMA Part 2 and Section 104, 105 and 107 considerations		
1: R2 (b) (Level 4)	5	1.0	3.0	5.0	4.3	2.0	2.5	17.8	5
2: R2 (b) (75% DWF land): 760 ha. (Level 4)	2	2.0	3.1	3.0	3.3	3.0	2.8	17.2	2
3: Dual R+L (b) (75% DWF to land): 870 ha. (Level 2, TN=35)	9	3.0	2.3	4.0	3.3	3.6	3.0	19.2	9
4: L+R(a): 3760 ha. (Level 1)	6	3.0	1.3	2.0	1.0	4.4	3.8	15.4	6
5: L+R(b): 2570 ha. (Level 3, TN=10)	8	3.0	2.8	1.0	1.0	4.6	3.8	16.1	8
6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Level 2, TN=35)	4	3.0	2.4	3.0	2.0	4.0	3.5	17.9	4
7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Level 2, TN=35)	3	3.0	2.6	4.0	2.0	4.0	3.5	19.1	3
8: L+R(e-1) 80 m3/s trigger: 3640 ha. (Level 2, TN=35)	10	3.0	2.6	1.0	1.0	4.0	2.8	14.4	10
9: L+R(e-2) 62 m3/s trigger: 3010 ha. (Level 2, TN=35)	11	3.0	2.6	1.0	1.0	4.0	2.8	14.4	11
10: O+L: 1470 ha. (Level 1)	7	4.0	2.6	1.0	1.7	4.8	3.5	17.6	7
11: O no land (Level 1)	1	5.0	3.5	2.0	3.3	5.0	3.5	22.3	1

6.2 Wider Considerations

6.2.1 Iwi

Council has recognized the partnership it has with Rangitāne through the establishment of the Project Steering Group (PSG) in 2017, with representation of Iwi on this governance group for the duration. A MoU is also in place between the Council and Rangitāne, signed midway through this Project. Throughout the project, Rangitāne has worked closely with the Project Team to provide review and input into many technical documents and undertaking of Cultural Values Assessments at both the longlist and shortlist assessment phases. As part of this final phase, a detailed CVA was prepared by Rangitāne and presented to the PSG in July 2021. The key messages of this CVA and presentation was:

- The highest treatment level should be adopted, no matter which receiving environment is being considered. This is the Treatment Level 4, as proposed in Options 1 and 2

- A direct discharge to a water body 100% of the time is not supported, which includes the ocean and Manawatū River. These are options 1 and 11, but this also relates to Options 2 and 10 due to the significant quantity of direct discharge to the waterbody being considered with these options.
- Discharging wastewater to land that is located outside of the Palmerston North area is not supported as this has the potential to impact on neighbouring Iwi, including Ngāti Raukawa.
- The uptake of significant land areas is not supported ie 97%, due to the inability to locate this in the district and the impact this has their Iwi. This is Options 4 and 5.
- The discharge of wastewater near Opiki (Option 3) is not supported due to the location and potential to impact on Iwi, including hapū and marae down stream of Palmerston North.

Rangitāne have confirmed a willingness continue work with Council in partnership, to further develop and refine the BPO option (Option 2 – Treatment Level 4) and discharging to land through an Adaptive Management approach, as proposed in Options 6 and 7. This is an option that can be seen as a refinement of Options 2, 6 and 7 that the Council can continue to work on in partnership with Rangitāne. In addition to this, Rangitāne ask that the land-based discharge should be considered as a 'resource', and any opportunity to utilise the treated wastewater as a resource to enhance currently deteriorated wetland systems throughout the Region should be explored. Sustainability measures, which seek to reduce wastewater at source, should also be progressed as a key priority for the BPO solution.

The hapū representing Ngāti Raukawa also presented their values assessment in August 2021 to the PSG. At this presentation, Ngāti Raukawa stated their support for the leadership provided by Rangitāne as mana whenua for the City. In support of Rangitāne 's Values Assessment, the following key recommendations were made by the representative hapū:

- An ocean discharge is completely unacceptable (Options 10 and 11)
- A discharge of wastewater to land that is outside of Palmerston North is not acceptable (Options 5, 8, 9, 10)
- The highest level of treatment (Treatment Level 4) should be adopted, no matter where the discharge ends up (Options 1 and 2)
- A direct discharge to the River all the time is not supported (Option 1).

All options were considered to have an adverse effect on both Iwi across a wide range of values, as identified in the CVA and MCA prepared by the Iwi. However, both Iwi are prepared to work with Council in a re-configured governance model where Iwi and the Council develop a solution in partnership. The starting point for this is the consideration of the highest treatment level combined with higher land areas to deliver a land-based discharge solution. This may be developed over time, through an adaptive management approach. Adaptive Management has been considered at a high level within the shortlist options and is considered a viable solution to enable Council to deliver on the highest ranked options for Iwi, which are Options 6 and 7.

6.2.2 Stakeholder and Community Feedback

The stakeholder engagement process identified the views of a range of community groups, individuals, targeted sectors, and stakeholders' groups. While there is opposing recommendations for where the discharge should go, between these stakeholder groups (as summarised in Appendix E), there are consistent messages that came from everyone that was involved in both Phase 1 and 2 engagement processes. These include:

- The highest treatment solution must be adopted
- The option must be affordable to ratepayers
- Council must take care of its own wastewater, within its own District
- Sustainability and resource recovery are key to managing the long-term effects of wastewater adverse effects on the receiving environment and the manage the impacts of growth in the long-term.

It is recommended that the above key messages are considered by Council in the determination of the final BPO solution.

6.3 Overall Recommendation

The BPO Project is a complex project with the potential to provide a long-term solution for Palmerston North and potentially the wider region. The methodology and approach adopted to get to this Final recommendation, has been developed by Council's Project Team, with the involvement of Council and peer reviewed by Councils legal counsel. The methodology is considered robust and takes into consideration a wide range of Council's vision and objectives for the Project, Iwi values across the Region, stakeholder input long term strategies and critical planning documents. The recommended BPO by the Project Team, is also considered to meet the requirements of the RMA.

The technical recommendation for Council to consider a potential BPO solution that incorporates the values and recommendation made by Rangitāne o Manawatū and supported by hapū of Ngāti Raukawa. Therefore, Option 10 and 11 is not recommended as a potential solution for the BPO. The final option also considers the consistent feedback provided by stakeholders. In summary, this is a solution that comprises a combination of the following:

- Option 2: R2 (b) (75% DWF land): 760 ha. (Treatment Level 4)
- Option 6: L+R(d-1) 80 m3/s trigger: 2000 ha. (Treatment Level 2, TN=35)
- Option 7: L+R(d-2) 62 m3/s trigger: 1640 ha. (Treatment Level 2, TN=35)

It is recommended that Council adopts the highest treatment level (Treatment Level 4) for discharges to the Manawatū River (Option 2), with a staged approach to increasing the portion of the discharge of treated wastewater applied to land over time, through an Adaptive Management approach.

Appendix A: BPO Shortlist Options

Appendix B: Comparative Cost Assessment

Appendix C: Multi-Criteria Assessment

Appendix D: Cultural Values Assessment & MCA

Appendix E: Stakeholder & Community Engagement Assessment

Appendix F: Project Objectives Assessment

Appendix G: Eco-City Strategy Assessment

Appendix H: RMA Planning Assessment

Appendix I: BPO Assessment Scoring

Simpson Grierson

To Melaina Voss and Paula Hunter, Palmerston North City Council **10 August 2021**

From Matt Conway and Oska Rego

Subject Three Waters and the Palmerston North Wastewater BPO Project

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Executive Summary

1. Palmerston North City Council (**Council**) was due to select the best practicable option (**BPO**) for its wastewater treatment and discharge in June 2021, with a consent application to follow in June 2022. This process has been delayed, and a BPO decision (**Decision**) is currently scheduled to be made on 1 September 2021.

2. The Council is due to lodge a complete consent application for all resource consents needed for the BPO (**Application**) with the Manawatu-Wanganui Regional Council (**Horizons**) by 1 June 2022.

3. On 30 June 2021, the Government announced that Cabinet had agreed to details of the Local Government Three Waters Reform Programme (**Three Waters**). There has been some suggestion that the Council should delay its Decision and/or Application, so that a new Three Waters entity can decide, or influence how, Palmerston North's wastewater should be treated and managed into the future.

4. There may be advantages to the Council in waiting to see what Three Waters reform looks like before making a Decision and/or lodging an Application. Three Waters reform could well lead to a new entity taking over the cost and responsibility for Palmerston North's wastewater, which may be advantageous to the Council as well as leading to Palmerston North's wastewater being dealt with on a more regional or multi-regional level.

5. However, in our view any potential advantages to delay are speculative, as there is no certainty on when Three Waters reform will be passed and what form it will take. The possible advantages of delay are, in our view, firmly outweighed by risks outlined below.

6. This memorandum addresses the implications of delaying the Decision or Application on the basis of the Three Waters proposals, including in terms of:
   (a) the ability to obtain a change in the conditions of the Council's existing wastewater discharge consent (**Consent**) to enable a delayed Decision, and the costs and challenges in doing so;
   (b) the risk of enforcement action should the existing consent not be complied with;
   (c) the impact on work already undertaken in order to determine the BPO.

7. Our overall view is that the Council should proceed based on the existing law and its obligations under its wastewater discharge consent. The Three Waters proposals are only proposals and do not override the Council’s current obligations.

8. There is no certainty about if or when the proposals will become law and the length of time it would take for a new water entity to take over the relevant functions from the Council.

9. Any delay would require an application to Horizons to change the timeframe in the conditions of the existing Consent. There is no guarantee that such an application would be successful and the Council would be open to enforcement action in the meantime.

Three Waters

10. Some key aspects of Three Waters that have been announced are:[1]

    (a) four new independent regional water services entities (with indicative boundaries), to be owned by local authorities;

    (b) some local authority and iwi/Māori influence over the objectives and priorities of these entities;

    (c) a funding package to ensure no local authority is "*worse off*" from the reform; and

    (d) future funding to ensure the reform leaves all communities "*better off*".

11. The Government has announced that local authorities have until the end of September 2021 to:[2]

    (a) consider the impact of the reforms (including the financial support package) on them and their communities;

    (b) seek clarification; and

    (c) provide feedback.

12. The Government will then consider next steps, including the process and revised timing for any consultation and decision-making.

Obligation to Comply with the Law as it Stands

13. Local authorities are obliged to comply with relevant legislation while it is in force. The Government is also subject to the laws passed by Parliament, and cannot lawfully compel local authorities to comply with legislation that is not yet in force, or to act in breach of legislation that is still in force.[3]

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[1] See information provided by the Department of Internal Affairs at https://www.dia.govt.nz/Three-Waters-Reform-Programme.
[2] Ibid.
[3] *Fitzgerald v Muldoon* [1976] 2 NZLR 615, at 622.

14. In relation to Three Waters, this means that the Council is required to comply with the Resource Management Act 1991 (**RMA**), and all current resource consents held by the Council under the RMA, and cannot avoid compliance in reliance on the Government's proposed reforms.

15. Likewise, Horizons is required, under section 84 of the RMA, to enforce observance of its One Plan, and should not suspend enforcement of the One Plan or consents issued under it on the basis of proposed reforms.

Obtaining a Change in Consent Conditions

16. Condition 23C of the Consent, which was introduced to reflect an agreement reached with Horizons during a 2015 review of the Consent, sets out BPO milestones that the Council must meet:

> The final decision on the Best Practical Option for the future wastewater scheme shall be made by the Permit Holder by no later than by June 2021
>
> …
>
> A complete consent application for all necessary resource consents for the future wastewater scheme shall be lodged with the Manawatu-Wanganui Regional Council by no later than 1 June 2022

17. The Council has not met the first of these requirements, but is working towards making a Decision on 1 September 2021. If the Council were to decide to stop working towards complying with this requirement by selecting a BPO, or to make a Decision but not make an Application by June 2022, we would advise that a change in Consent conditions is needed to avoid the risk of enforcement action.

18. Section 127 of the RMA provides that:

> (1) The holder of a resource consent may apply to a consent authority for a change or cancellation of a condition of the consent…
>
> (3) Sections 88 to 121 apply, with all necessary modifications, as if—
>
> (a) the application were an application for a resource consent for a discretionary activity; and
>
> (b) the references to a resource consent and to the activity were references only to the change or cancellation of a condition and the effects of the change or cancellation respectively.
>
> …
>
> (4) For the purposes of determining who is adversely affected by the change or cancellation, the consent authority must consider, in particular, every person who—
>
> (a) made a submission on the original application; and
>
> (b) may be affected by the change or cancellation.

19. To obtain a change of conditions from Horizons would, therefore, involve the equivalent of a resource consent application for a discretionary activity, as was done in 2015.

20. It is important to note that, when considering whether to limited or publicly notify such an application, and whether or not to grant the application, Horizons would be required consider matters such as:[4]

    (a) whether there are any affected protected customary rights or marine title groups;

    (b) whether the wastewater discharge is adjacent to, or may affect, any statutory acknowledgements;

    (c) the actual or likely environment effects of the wastewater discharge; and

    (d) any relevant provisions of planning instruments, including the Resource Management (National Environmental Standards for Freshwater) Regulations 2020, the National Policy Statement for Freshwater Management 2020 (**NPS-FM 20**), and the One Plan.

21. Horizons is primarily an environmental regulator. Accordingly, its primary concern when considering an application for a change in conditions will be environmental effects.

22. Furthermore, we consider that relevant planning instruments, and in particular the NPS-FM 20 (which was not in force at the time of the last change in conditions) and the One Plan would weigh against allowing the Council additional time.

23. Horizons would not be required to consider the possible effect of the Government's Three Waters proposals. If Horizons did factor in such a proposal when making a decision on consent conditions, we expect that this would make the decision vulnerable to legal challenge on the basis of it being an irrelevant, unlawful, and/or unreasonable consideration.

24. We also expect that such an application would garner significant opposition from iwi, as well as other interested parties. The current BPO process has involved a significant amount of consultation, including with Rangitāne o Manawatū and hapū that are representative of Ngāti Raukawa.

25. We note that getting a final decision such an application could take months, or even over a year, and would involve the preparation of evidence and legal arguments and could well be appealed. In addition to the time and expense, there is no guarantee about the final outcome.

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[4] Resource Management Act 1991 [**RMA**], sections 95A to 95G and 104.

Risk of Enforcement Action

26. As mentioned above, Horizons is an environmental regulator and is required to enforce the One Plan, and consents issued under it. The longer the Council goes without complying with its consent condition which requires it to select the BPO and then lodge an Application, the greater the risk of Horizons taking enforcement action.

27. Enforcement action could also be taken by iwi groups or others who are opposed to further delays, or such groups could encourage Horizons to take enforcement action.

28. In *New Zealand Motor Caravan Association Inc v Thames-Coromandel District Council*, the High Court that, while there is a discretion not to prosecute in individual cases, a general policy decision not to enforce a particular law would be unlawful.[5]

29. The High Court in *Royal Forest & Bird Protection Society of NZ v Canterbury Regional Council* held that this principle should not apply with any less rigour to the enforcement of rules in a plan, because:[6]

> those rules are made with considerable public input and with the knowledge that application of those rules will have significant consequences for how people undertake the regulated activities.

30. The same can be said for enforcement of rules that give effect to national policy statements, which are made with the input of public submissions,[7] to direct regulation to achieve objectives and policies that are considered to be of national significance.[8]

Work Already Undertaken

31. In addition to the considerable time, effort and cost that would be involved in seeking a change in conditions, or defending against enforcement action, we note that the Council has already undertaken a very significant amount of work in preparing to make a Decision, including developing and analysing options, consulting with its communities and with iwi, and engaging with Horizons, including by seeking to make discharge to land easier to consent by submitting on Plan Change 2 to the One Plan.

32. Undertaking this work has put the Council in a position where it can make an informed Decision, proceeding with preparing an Application, and thereby comply with its Consent conditions, so we would advise against now electing not to take these steps.

33. This work has included considering how the BPO will fit into a regional wastewater scheme, which should mean that any Decision will be well-placed to integrate into eventual Three Waters reform.

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[5] *New Zealand Motor Caravan Association Inc v Thames-Coromandel District Council* [2014] NZHC 2016, at [61].
[6] *Royal Forest & Bird Protection Society of New Zealand Inc v Canterbury Regional Council* [2019] NZHC 2223, at [51].
[7] RMA, sections 46A(3) and (4), and 48 to 51.
[8] RMA, section 45A(1).