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Te Pane Matua Taiao

MEMO

TO Bruce Geden, Wairarapa Water Use Project

FROM Jamie Steer, Biodiversity department

DATE 30 March 2015

FILE NUMBER BDM/02/03/01-v11

Wairarapa Water Use Project: Multi-criteria Analysis for Environmental theme

The Biodiversity department has been asked to undertake a Multi-Criteria Analysis (MCA) to help refine the water storage site options for the Wairarapa Water Use Project (WWUP) as part of their prefeasibility investigations. This memo accompanies a spreadsheet that presents our MCA assessment[1]. It details the process we have followed, including the assumptions and limitations of the analysis, and discusses the results.

Our MCA contributes to the 'environmental theme' only (see below). Despite the incorporation of new information, our results are similar to those of an earlier MCA by Tonkin & Taylor Ltd (T&T). We conclude that, from an environmental point of view, Wakamoekau remains the most favourable water-storage site, with White Rock Road also scoring favourably.

Our MCA was limited to a desk top study that used easily accessible information. We recommend that future analyses incorporate additional finer scale information and field studies. These analyses would also benefit from stating the weightings given to each of the factors considered, as we have in this analysis.

Previous MCA work for WWUP

MCAs can be used to provide a structured approach to decision making and a systematic basis for ranking sites (or schemes) in order of favourability. Ranks are determined by considering multiple factors, each of which is weighted according to its importance, as perceived by the person undertaking the evaluation. The output of an MCA is a relative rank for each site from least favourable to most favourable.

MCA work for WWUP was previously undertaken by T&T in 2013[2,3]. Their Wairarapa Water Use Project: Options Refinement Report[4] (the Options Refinement) covered six themes - financial, social, cultural, environmental, risk and opportunities. The Options Refinement assessed nine water-storage sites in this way[5].

Multiple factors were considered for each theme but no weightings were given to the factors used. Instead, factors were grouped for each site and assessed in combination for each theme. Ranks were between 1 and 5, with 1 indicating sites that were least favourable for development as water-storage sites and 5 indicating sites that were the most favourable. As a consequence of the Options Refinement, potential WWUP sites have since been refined from nine to five[6].

MCA carried out by the Biodiversity department

Our prefeasibility assessment covered the current five sites under consideration: Tividale, White Rock Road, Te Mara, Black Creek and Mangatarere. It also covered Wakamoekau, a variation to the Black Creek site. It followed the general methodology used in the Options Refinement[7] but assessed the environmental theme only. The factors considered in the Options Refinement environmental theme MCA were re-used, where appropriate (see below). Like the Options Refinement, we assessed terrestrial and aquatic environmental sub-themes separately. However, we also combined these sub-themes (with equal weighting) to provide an overall environmental theme ranking for each site.

Some of the information sources used in the Options Refinement were not re-used as they were no longer applicable. For example, the factor 'RAP' (Recommended Area for Protection) was not used. This is because none of the remaining sites considered in this MCA included RAPs, meaning that the factor provided no value for ranking. Other factors were not re-used because they were incorporated, or updated by, new factors that were not considered or not available for consideration in the Options Refinement.

2 Tonkin & Taylor Ltd. (April, 2013). Wairarapa Water Use Project: Scheme options identification & analysis. Report prepared for Greater Wellington Regional Council

3 Tonkin & Taylor Ltd. (August, 2013). Wairarapa Water Use Project: Options refinement report. Report prepared for Greater Wellington Regional Council.

4 *Ibid.*

5 Wakamoekau, a variation to the Black Creek site, was also assessed.

6 *Ibid.*

7 Outlined in Sections 9.2.4 and 11.15 of Tonkin & Taylor Ltd (April, 2013). See Tonkin & Taylor Ltd. (April, 2013. Wairarapa Water Use Project: Scheme options identification & analysis. Report prepared for Greater Wellington Regional Council.

The Options Refinement considered landscape character as part of the environmental theme MCA[8]. We did not include this factor in our assessment. Although we had some information which might be used to interpret differences in value between the sites, we do not have the expertise to effectively rank this component within the Biodiversity department.

Appendix 1 presents the factors used in the 2013 Options Refinement MCA that were re-used in our prefeasibility analysis. It also explains why some factors were not re-used. Appendices 2 and 3 describe, in detail, each of the factors used to score our aquatic and terrestrial MCA sub-themes, including factors not considered in the Options Refinement.

Although some new factors were used in our analysis, factors were limited by their use in distinguishing between sites. Many possible new factors were therefore not used because they did not help to distinguish between sites. This was the case with many taxa-specific datasets because not all sites had been surveyed. Information from NIWA's freshwater dish database, for example, was not used because only some sites had been surveyed. We expect that this more detailed information will be used in later analyses that are able to compare sites on a finer scale.

Assumptions and limitations

Our assessment was guided by the assumptions and criteria developed during previous MCA work in relation to this project and others (see Appendix 4). It assessed the indicative water-storage footprint only and did not consider cumulative ecological effects or effects beyond the immediate area. The aquatic ecology assessment, for example, did not consider downstream effects. These other effects will need to be considered in the full feasibility phase of analysis.

Each factor considered in the MCA was weighted according to our opinion of its importance. However, this weighting was based on the information that we had at hand and would likely be influenced by the incorporation of further useful factors. Weightings should therefore be read as appropriate for our MCA, and the specific factors considered in it, only.

A consideration for trout was part of the Options Refinement and remained a part of the environmental theme in our analysis. In our MCA, we included two factors to rank the value of each site for trout in the aquatic sub-theme. Nevertheless, we suggest that future analyses should consider the possibility that trout might more appropriately fit under the 'social' or 'cultural' themes as trout are only one of many fish species contributing to the ecology of each area.

As this is prefeasibility work, only a high-level desktop analysis was undertaken. It should therefore not be read as an assessment of effects. Further analysis, including field surveys by suitably qualified ecologists, would be required to confirm findings.

8 Nevertheless, it did not affect their rankings (see Appendix 1).

Results

We calculated MCA scores for the terrestrial and aquatic sub-themes for each of the five water-storage options (plus one variation: Wakamoekau). We also calculated combined (terrestrial + aquatic) MCA scores for each. In addition, results from our analysis were compared with those of the Options Refinement.

Our full prefeasibility MCA results are presented in the accompanying spreadsheet[9]. Key results are presented in Figures 1-2 and summarised below.

- **Terrestrial:** The most favourable site for the terrestrial sub-theme was Wakamoekau (5), followed by Mangatarere (4), Te Mara (3.5) and White Rock Road (2). The least favourable sites were Black Creek (1) and Tividale (1).

- **Aquatic:** The most favourable site for the aquatic sub-theme was White Rock Road (5), followed by Wakamoekau (3.5) and Tividale (3.5). Black Creek (1.5), Te Mara (1) and Mangatarere (1) were the least favourable sites.

- **Combined:** Wakamoekau (5) was the most favourable site overall, followed by White Rock Road (4), Te Mara (2.5), Mangatarere (3) and Tividale (2). Black Creek (1) was the least favourable site overall.

Figure 1: Prefeasibility MCA scores for each water-storage site (1 = least favourable, 5 = most favourable).

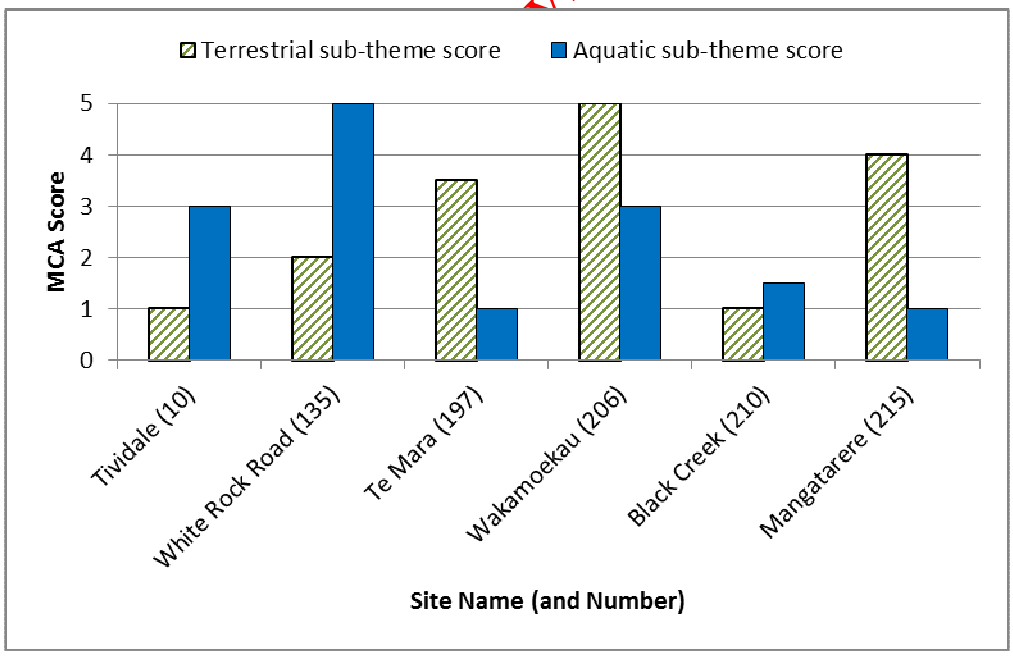
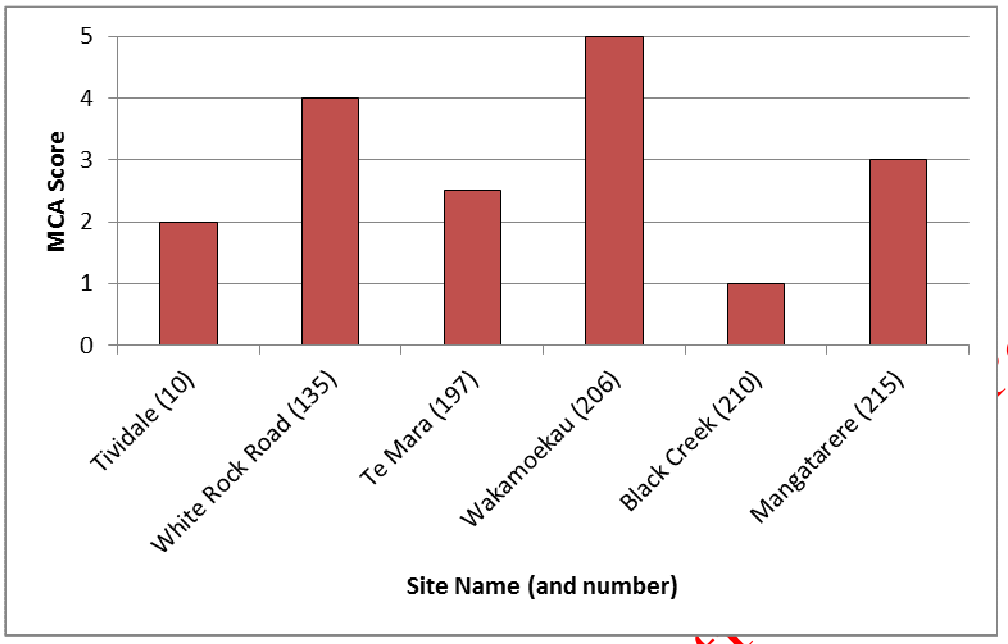


Figure 2: Combined MCA scores for each water-storage site (1 = least favourable, 5 = most favourable).



Discussion

We believe that these results are a refinement of the 2013 Options Refinement MCA as they incorporate new and important factors (eg, the LENZ Threatened Environments Classification) and remove factors that are no longer relevant to ranking sites (eg, RAPs).

Despite the incorporation of new information, Wakamoekau remained the most favourable site and White Rock Road and Te Mara also continued to rate relatively favourably (see Appendix 5). This result should give WWUP some confidence that the sites ranking highly (ie, most favourably) in both the Options Refinement and our analysis are, given the assumptions inherent to this analysis, the most suitable water-storage sites for the environmental theme.

There is a range of further information available that could be used to prioritise these sites at the next stage of feasibility analyses. These could include the incorporation of new field surveys and finer-grained analyses using existing information. The Ornithological Society of New Zealand, for example, has bird distribution data corresponding with these sites that could be accessed with permission. Such information could be used as a complement to field surveys. WWUP could consider using the Environmental Science department for these further feasibility analyses.

The weightings given to each of our factors were made explicit in our analysis. It is suggested that future MCA work for this project should consider being similarly transparent with their weightings. This would make it easier for future MCA assessments to build on such work.

We appreciate the opportunity to contribute to the WWUP through this analysis. If you would like to discuss these results further please do not hesitate to contact me.

Regards,

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Appendix 1: Factors considered in Options Refinement that were re-used in the prefeasibility MCA.

The left column of this table lists the factors considered in the 2013 Options Refinement MCA (using their wording). The right column indicates which of their factors were used in the prefeasibility analysis. Factors that were not used were either not useful for ranking or covered by new factors listed in Appendices 3 and 4.

Factors considered in Options Refinement	Used in prefeasibility MCA?
Terrestrial theme	
Recommended areas for protection	No. There are no recommended areas for protection within potential sites.
QEII covenanted area	Yes.
High value terrestrial biodiversity	No. Data provided by new factors.
Landscape character area	No. There are no landscape character areas within potential sites.
Geopreservation inventory	Yes.
Combined district plan annotations	No. Data provided by new factors.
Aquatic theme	
On river?	No. All potential sites include rivers.
Distribution	No. Information did not assist with prioritisation.
Trout fishery	No. Data provided by new factors.
Aquatic migratory spp	No. Data provided by new factors.
Aquatic threatened spp	No. Data provided by new factors.
Wetlands	Yes.
Combined district plan annotations	No. Data provided by new factors.

Appendix 2: Description of factors used in terrestrial MCA assessment[10].

The left column of this table lists the factors considered in the prefeasibility MCA assessment. Those marked with an asterisk were not considered in the 2013 Options Refinement. The right column describes the factor and indicates how it was used to rank sites.

Factor	Description
Hectares*	The total number of hectares covered by the water storage footprint, including a 20 metre buffer. Larger sites ranked lower than smaller ones.
LENZ Threatened Environments Classification*	The Land Environments of New Zealand (LENZ) Threatened Environment Classification is a combination of three national databases: LENZ, classes of the second land cover database (LCDB2), and the protected areas network (PAN-NZ). Using this data, the Threatened Environment Classification divides all of New Zealand's land into six threat categories on the basis of past loss of indigenous vegetation and current legal protection. The most threatened environments are Category 1 (Acutely Threatened) and the least threatened are Category 6 (Less Reduced and Better Protected)[11]. Sites with more threatened environments ranked lower than sites with less threatened environments.
Ecosystem Types	Existing ecosystem types identified using LCDB2. Sites with more indigenous ecosystems ranked higher than sites with less.
Department of Conservation Land*	Department of Conservation administered estate, reserves and covenants. Sites that included Department of Conservation land rated lower than those without.
QEII National Trust Covenant	Land covenanted by the Queen Elizabeth II National Trust. Sites that included QEII National Trust covenants rated lower than those that partially included, or did not include, covenants.
NZ Geopreservation Inventory	The New Zealand Geopreservation Inventory highlights the best examples of the wide diversity of natural physical features and processes that together characterise each part of New Zealand and document its long complex geological history, the formation of its landforms and the evolution of its unique biota[12]. Sites that included land recognised by the NZ Geopreservation Inventory rated lower than sites that did not.

10 Data was obtained directly from Greater Wellington Regional Council's GIS library and accessed using either Landinfo 3 or ArcMap 10.1.

11 For more information see Walker, S.; Cieraad, E.; Grove, P.; Lloyd, K.; Myers, S.; Park, T.; Porteous, T. (2007). Guide to the Threatened Environment Classification, Ver 1.1, Landcare Research, New Zealand.

12 For more information see Appendix 6 in Boffa Miskell Ltd. (August, 2010). Wairarapa Landscape Study 2010: Landscape character description. Report prepared for Greater Wellington Regional Council.

Appendix 3: Description of factors used in aquatic MCA assessment[13].

The left column of this table lists the factors considered in the prefeasibility MCA assessment. Those marked with an asterisk were not considered in the 2013 Options Refinement. The right column describes the factor and indicates how it was used to rank sites.

Factor		Description
Watercourses*		Main watercourses (eg, rivers, streams) and total length of watercourses affected. Sites with longer watercourses within the footprint rated lower than sites with shorter ones.
Wetlands		Wetland presence. Sites with wetlands rated lower than sites without them.
Draft NRP Rivers and Lakes with Significant Indigenous Ecosystems*	High Macroinvertebrate Community Health	Rivers and lakes with Significant Indigenous Ecosystems containing high macroinvertebrate community health as defined by the draft Natural Resources Plan (NRP) for the Wellington Region 2014[14]. Sites meeting this description rated lower than sites that did not.
	Habitat for Indigenous Fish Species of Conservation Interest	Rivers and lakes with Significant Indigenous Ecosystems containing habitat for indigenous fish species of conservation interest as defined by the draft NRP for the Wellington Region 2014[15]. Sites meeting this description rated lower than sites that did not.
	Habitat for Six or More Migratory Indigenous Fish Species	Rivers and lakes with Significant Indigenous Ecosystems containing habitat for six or more migratory indigenous fish species as defined by the draft NRP for the Wellington Region 2014[16]. Sites meeting this description rated lower than sites that did not.

13 Apart from the 'Key Landscape Characteristics' factor, data was obtained directly from Greater Wellington Regional Council's GIS library and accessed using either Landinfo 3 or ArcMap 10.1.

14 Greater Wellington Regional Council (2014). Draft natural resources plan for the Wellington region.

15 *Ibid.*

16 *Ibid.*

Factor	Description
Cawthron Highest Value Reaches for Fish	Highest value reaches for freshwater fish according to Strickland & Quarterman, 2001[17]. Sites meeting this description rated lower than sites that did not.
Cawthron Sports Fish Spawning and Recruitment	Spawning and recruitment habitat for sports fish (eg, trout) according to Strickland & Quarterman, 2001[18]. Sites meeting this description rated lower than sites that did not.
Draft NRP Trout Habitat*	Trout habitat as defined by the draft NRP for the Wellington Region 2014[19]. Sites meeting this description rated lower than sites that did not.

17 Strickland, R; Quarterman, A. (2001). Review of freshwater fish in the Wellington region. Report prepared for Wellington Regional Council. Cawthron Report No. 669.
18 *Ibid.*

19 Greater Wellington Regional Council (2014). Draft natural resources plan for the Wellington region.

Appendix 4: Assumptions and criteria used to guide the MCA assessment.

Below are the assumptions and criteria provided by the WWUP to use as guidelines for the MCA process.

(a) For consistency, previous theme elements (Options Refinement) should be continued; in many cases we now have more (rather than just better) information to break a category down to another level

(b) Where expenditure of capital can be applied to avoid, remedy, or mitigate an 'effect', it will be included in the Financial category – also helps avoid double counting e.g. a passage for fish to help mitigate environmental issues is a cost to the project

(c) Care is needed to ensure that 'double counting' is eliminated

(d) Scoring will range between 1-5 inclusive to provide a relative (not absolute) ranking between sites for the various attributes

(e) For each scoring category, at least one site would score a '1', and at least one would score a '5' to provide a range. No other 'rules' apply to scoring e.g. 4 × '5's & 1 × '1' is possible

(f) A score of 1 means it's the least favourable (not necessarily 'unacceptable') of all the schemes for that component, and a score of 5 means it's the most favourable (not necessarily 'ideal')

(g) To ensure consistency of approach, sensitivity testing will determine at what point the altered weightings significantly affect the outcomes once the scores have been agreed

(h) Categories, weightings and scores must be finally decided by the nominated professional experts – SAG etc. can provide comment i.e. challenge the scores, but the experts ultimately have to 'own' these judgements

(i) For clarity, Governance, Stakeholder, Leadership & Working Group members are not professionally qualified experts other than Lisa for example in communications

(j) The process and outcomes should be entirely replicable by another panel of experts

Appendix 5: Comparison of combined MCA scores for Prefeasibility Analysis and Options Refinement

Figure 3 (below) compares combined prefeasibilty MCA scores from this assessment with those of the 2013 Options Refinement. It shows that both the Options Refinement and our prefeasibility combined environmental theme MCA results produce the same rankings for Tividale, White Rock Road, and Wakamoekau. Both MCA assessments considered Wakamoekau to be the most favourable site.

Black Creek dropped significantly in its ranking – from somewhat favourable (3.5) to least favourable (1). Te Mara also dropped from 4 to 2.5. In contrast, Mangatarere rose in its ranking – from 1 to 3. Although we know that some of the factors used in the Options Refinement differed from ours, we do not know the weighting given to each of their factors so cannot determine exactly why our results differed for this site. However, an important difference may have been our incorporation of the LENZ Threatened Environments Classification and a consideration for the number of hectares affected in the terrestrial sub-theme analysis.

Figure 3: Comparison of combined MCA scores for Prefeasibility Analysis and Options Refinement (1 = least favourable, 5 = most favourable).