Kāpiti Water Supply Project
Response to issues raised in GWRC wetland ecological review

This memo is in response to GWRC’s further information request around wetland effects and specifically answers Questions 33 and 36 and adds to other related questions (for example Questions 24-29 and 35) already answered in our response submitted on 26 February 2013.

The memo responds to the issues raised by Ms Shona Myers and provides further detail around the monitoring and adaptive management approach proposed for wetlands. The intention is that this memo helps to inform GWRC’s technical review reports and helps to provide further clarification for those submitters interested in wetland monitoring and management. We expect that the wetland monitoring plan will be further refined through the hearing process and that the final outcome of this memo will be a clear consent condition for the preparation of a detailed wetland monitoring plan.

Wetland Report Questions

Question 24: Please provide more information on the criteria and methodology used to rank the significance of each wetland.

Response: Wetlands are ranked based on the GWRC Wetland Delineation Project. No change in discussion with Ms Myers and Mr Park – but change wording to reflect that criteria and methodology adopted was consistent with M2PP project as discussed with GWRC through Board of Inquiry conferencing. Ms Myers and Mr Park agree that due to the loss of wetlands in the context of the Kāpiti Coast, understanding the potential effects on all wetlands identified as being potentially affected (regardless of significance ranking) an adequate monitoring regime is important in this case.

Question 25: You mention (in one of the ecology reports) that there may be other wetlands not identified in the report which may be affected by the proposal. It is noted that the assessment has been based on existing information and reports. What has been the method to decide which are potentially affected and which are not? Will other survey work be undertaken to identify other potentially affected wetlands?

Response: This lack of information remains an issue. However, Ms Myers and Mr Park agreed that being based on GWRC, KCDC and DOC information on wetlands from a full range of sources (including multiple GIS formats – LCDC2, LIDAR etc.), the GWRC Wetland Delineation Project that formed the basis for this report continues to be the best source of information. Given this background information, Ms Myers and Mr Park agreed that a further review of high resolution aerials in areas like Waikanae (with forest) is likely to have limited benefits. Further field survey would be time-consuming and expensive.

The methodology for potentially affected wetlands is entirely based on advice from BECA modelling with a GIS layer of known wetlands overlain. However, Mr Park was involved in discussions with BECA team in development of modelling and overlay of wetland data and information (which also took into account more detailed M2PP wetland information).

Question 26: What are the likely effects on fen wetlands and other wetlands where information is unknown?

Response: No change – in the absence of more hydro-geological data (which would be highly difficult to gather and determine- as evidenced in local reports cited in wetland report), it will be difficult to establish this information. Ms Myers and Mr Park agreed that the focus should be on monitoring, adaptive management and precautionary approach, including
potential effects on fen wetlands (rather than detailed understanding of individual wetland type).

**Question 27:** How will the potential effects of the M2PP project be separated from the effects of this proposal? Many of the same wetlands will be affected, and some of the wetlands affected by the expressway (e.g. El Rancho) have been identified as control sites for your proposal. We note that further discussion with our technical expert, Shona Myers, may be required to address this question

**Response:** The overlap of potential effects of both projects on wetlands remains an issue. Ms Myers and Mr Park agree that the M2PP project will be beneficial in terms of modelled effects on wetland largely being contained within 200m of Expressway. However, Ms Myers and Mr Park agree that additional wetland monitoring outside of the M2PP zone of influence (i.e. 200m) is required as part of the KCDC water supply project and this will improve understanding regional or more localised wetland hydrology and – most importantly - provide a greater ability to determine whether changes in wetlands, if any, are attributable to the Water Supply Project. As M2PP wetland piezometer information becomes available, this will assist with wetland understanding, particularly in relation to localised changes (particularly given dry summer conditions in 2013 summer).

**Question 28:** How will the potential cumulative effects of multiple stresses be addressed? (e.g. drought, surrounding land use change, climate change, drainage).

**Response:** Ms Myers and Mr Park agree that this remains a significant issue in terms of existing and future stresses on wetlands of the Kāpiti Coast. However, Ms Myers and Mr Park also agree that good monitoring and good understanding of wetlands and wetland hydrology can only be beneficial in understanding these complex systems. The solution has to recognise that we are ultimately dealing with remnant landscapes that are dynamic and systems that have been significantly modified over the years.

As outlined above, Ms Myers and Mr Park agree that a good monitoring and adaptive management framework, as well as restoration work to mitigate potential effects, is the realistic way of addressing this issue.

**Question 29:** What are the potential effects on wetland fauna?

**Response:** Ms Myers and Mr Park agree that these areas do provide habitat for wetland fauna. However, given the limited background information on avifauna and freshwater species present in all the potentially affected wetlands – and the high costs and timing to fully understand and quantify wetland fauna, Ms Myers and Mr Park agreed that the best solution would be to ensure that the adaptive management framework took into account addressing wetland fauna as part of response management to trigger levels (i.e. breach of a trigger or extended low groundwater levels may trigger freshwater fish sampling/fish passage surveys). Ms Myers recommends that mitigation for effects should also address restoration and protection of wetland habitat within the wider area.

Ms Myers and Mr Park are still to agree whether wetland fauna are required to be specifically monitored, but agreed that costs would be significant and would be unlikely to assist with monitoring or trigger alert framework.

**Monitoring, mitigation and adaptive management questions**

**Question 30:** Very little detail is provided in the proposed adaptive management approach. How will alert or action levels be set? What is the process for determining an adverse effect? How will wetland condition and groundwater monitoring be linked? How will a management response be implemented and the success monitored?
**Response:** Agree, a proposed adaptive management response is outlined in the following table, with action and alert levels to be determined following baseline monitoring information.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Location</th>
<th>Frequency</th>
<th>Method</th>
<th>Trigger for Response/ Adaptive Management</th>
<th>Response/ Adaptive Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water levels in wetlands.</td>
<td>In the wetlands outlined in the draft wetland monitoring plan as being of ecological significance and subject to a RRwGW drawdown of greater than 100mm (with additional locations to be confirmed in conjunction with GWRC). Control sites north and south of the operational borefield.</td>
<td>As determined by hydro-geologists (potentially tele-metered). Baseline monitoring is required to establish what natural water levels in wetlands would be in a severe drought. Baseline monitoring is required to establish the existing condition of wetlands to monitoring any future trends.</td>
<td>Piezometer r. 200mm variation outside the naturally occurring range for the piezometers for wetlands with established monitoring locations; or 50% trigger levels based on the lowest historical level minus 50% of the historic variation in the other wetlands with less monitoring information.</td>
<td>Monitoring frequency will be increased and investigations will be undertaken to confirm whether the effect is due to borefield pumping and to confirm the extent of the effect. Specific monitoring will include:  1. Definitive change in wetland extent (as determined by the expert ecologist and hydro-geologist from baseline mapping). Method will be High-resolution aerial photography, vegetation community mapping.  2. Visible changes in wetland species composition. Wetland Condition Monitoring information and permanent plots and photo-points. Vegetation die-back, increased weed species dominance, reduction in area of open water. If adverse environmental effects are considered likely by the expert hydrologist and ecologist, the following measures will be assessed for implementation by the Adaptive Management Committee in order of preference:  1. Reconfigure bore use (reduce take from bores near affected wetland)  2. Management of affected wetland system (controlling water levels though placement of weirs, redirecting drains, direct wetting of wetlands, restricting bore use in the area of wetlands during significant drought periods)  3. Aquifer injection  4. Restoration and/or replanting of similar wetland communities  5. Decommission bores, create new bores across the borefield (spread the effects appropriately across the borefield to minimise effect on wetlands)</td>
<td></td>
</tr>
</tbody>
</table>

Wetland condition monitoring will be a response to groundwater monitoring outcomes. The piezometer information is undertaken to establish baseline levels of wetland hydrology and set an alert / action level by which ecological monitoring of wetland health and functioning is to be undertaken using baseline information from Wetland Condition Monitoring, aerial photographs, vegetation community mapping fixed photo-points as outlined in the proposed monitoring programme appended to this response.

**Question 33:** Please provide a draft monitoring plan for the wetlands identified as potentially being affected by the proposal. This should include the recommendations contained in the Wetland Report by Boffa Miskell, address points raised by the various technical memos (enclosed) and also include a larger number of the wetlands potentially affected than recommended in that report.

**Response:** Ms Myers and Mr Park have discussed this briefly. In summary, we agree that further wetland monitoring sites are required to characterise all wetland types within and outside the M2PP zone of potential influence (i.e 200m). The attached proposed outline
monitoring methodology has been updated with the addition of the following additional wetlands (to those already outlined in the wetland report) to have piezometers installed to assist with wetland hydrological information as part of monitoring and adaptive management framework:

- Te Hapua Swamp Complex A
- Poplar Ave Peatlands
- PekaPeka Road Swamp

**Question 35:** How will the wetland condition and groundwater monitoring be linked?
The monitoring and adaptive management approach needs to specifically address assessing the hydrological connection between wetland and groundwater.

**Response:** Ms Myers and Mr Park agree that an improved understanding of the hydrology of key wetlands potentially at-risk of the RRwGW project and of the extent to which wetlands are supported or influenced by different groundwater sources – surface and subsurface – would provide improved information to base the adaptive management approach on (as hydrology is the primary determinant of wetland class and vegetation type). Please refer to the outline monitoring programme appended to this response.

Ms Myers and Mr Park are largely in agreement that wetland condition monitoring (as agreed in M2PP conferencing and recommended in KCDC water supply project wetland report) may be of limited benefit in terms of being able to address and quantify short-term project-induced wetland changes. Ms Myers and Mr Park are to discuss further with a view to refining baseline physical wetland monitoring in relevant wetlands.

Initial agreement between Ms Myers and Mr Park is that that wetland condition monitoring and piezometer monitoring may not be able to be sufficiently linked as part of the adaptive management process (and trigger setting). There is uncertainty regarding the hydrological characteristics of the wetlands affected and whether piezometer monitoring will pick up changes in wetlands. The wetland condition monitoring may also be too coarse to pick up short term changes in wetland species composition and habitat extent. Rapid changes in species composition have been observed within these systems and changes due to the extent of and influence of seasonal fluctuations.

**Question 36:** Wetland condition monitoring should include monitoring of the potential adverse effects on swamp and fen wetlands on pages 18 and 20 of the wetlands investigations report. E.g. increase in dry periods, changes in areas of open water, peat composition, change in species composition, impacts of exotic species. Please comment.

**Response:** As above, in response to question 35 and potential shortcomings in Wetland Condition Monitoring. Both swamp and fen wetlands are proposed as part of the appended wetland monitoring programme and the parameters raised by the GWRC review are intended to form part of the baseline monitoring and adaptive management programme following a trigger of action or alert levels from piezometers in wetlands.
Question 37: Wetland restoration in areas not affected by the project should be addressed as a potential mitigation method.

Response: We anticipate any effects on wetlands are going to be less than minor. However, should any effects on wetlands be attributed to the RRwGW project, wetland restoration in areas not affected by the project could provide a mitigation response as part of adaptive management approach.

Question: Given the uncertainty of effects, the recommended groundwater and wetland condition monitoring should include a larger number and range of the wetlands potentially affected by the project than recommended in the report.

Response: Agree. A greater number of wetlands (both fen and swamp) will be included in the monitoring programme, including an increased number of wetlands outside of the zone of influence of the MacKay’s to PekaPeka Expressway (‘the Expressway’). Please refer to appended outline of the proposed monitoring plan.

Question: There will be very limited time for baseline monitoring to determine natural fluctuations in water levels of wetlands. This will severely limit the understanding of the wetlands and the effects.

Response: The intention of the proposed monitoring plan appended to this response is to ensure there is detailed baseline information on wetlands prior to the RRwGW project.
Kāpiti Water Supply Project
Outline of a Proposed Wetland Monitoring Programme

(Draft for discussion purposes)

Background
Following questions from GWRC and an increased understanding of the dynamic nature of the vegetation and hydrology in these wetland systems, a number of amendments have been suggested to the proposed monitoring programme for the CH2M Beca RRwGW Scenario 4 Modelled Drawdowns in the Holocene Sand Aquifer with GWRC Wetlands (the ‘RRwGW’ project) to address these issues. This report outlines our recommendations as to what components the wetland monitoring programme should include.

As outlined in the original wetland report, a combination of piezometer information and Wetland Condition Monitoring\(^1\) in a number of representative wetlands was recommended to monitor RRwGW effects as part of a suggested adaptive management approach. Based on the background information reviewed for the original ecological assessment, we do not consider there is sufficient information on the wetlands of the Kāpiti Coast to sufficiently determine wetland triggers arising from drawdown levels from piezometer information. However, we consider that piezometer information remains the best indication of immediate changes in groundwater to act as a trigger for review of wetland health and to increase monitoring frequency in order to establish whether there are any adverse effects on wetlands.

Objective
The proposed monitoring programme should undertake detailed monitoring of two fundamental types of wetland indicator:

1. Wetland hydrology (piezometers) to provide ‘early warning’ action and alert triggers and direct an adaptive management response; and
2. Plants/plant communities (Wetland Condition Monitoring, aerial photos and permanent plots and photo-points) to show cumulative responses.

This baseline information is to be used to set action and alert trigger levels (piezometers) and assist with determining potential adverse effects and any adaptive management response (plant and plant community information).

Methodology
The following table outlines the recommended wetland monitoring locations for the RRwGW project. These wetlands have been selected on the basis of:

- Typically the more ecologically significant wetlands.
- Being more established and relatively stable ecosystems, and not subject to the influences of more rapid succesional vegetation changes.
- Subject to typically greater than 100mm drawdown under the RRwGW modeling scenario.

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- Having a good distribution within the RRwGW effects envelope, and sufficient consideration of the M2PP project effects area.
- Wetlands with baseline monitoring information from existing piezometers or Wetland Condition Monitoring surveys.

Table 1. Recommended RRwGW Wetland Monitoring Locations

<table>
<thead>
<tr>
<th>Wetland location</th>
<th>Wetland class</th>
<th>RRwGW Scenario 4 Drawdown (mm)</th>
<th>Existing shallow groundwater monitoring well</th>
<th>Wetland Condition Monitoring undertaken?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muaupoko Swamp Forest</td>
<td>Fen</td>
<td>110</td>
<td>Locations to be confirmed</td>
<td>No</td>
</tr>
<tr>
<td>Nga Manu Wetland</td>
<td>Fen</td>
<td>140</td>
<td>GWRC Nga Manu, Well Site K5 Nga Manu</td>
<td>No</td>
</tr>
<tr>
<td>Te Hapua Swamp Complex A</td>
<td>Swamp</td>
<td>90</td>
<td>WRC Monitoring Bores – locations to be confirmed – refer Allen Thesis.</td>
<td>No</td>
</tr>
<tr>
<td>Te Hapua Swamp Complex D²</td>
<td>Fen</td>
<td>100</td>
<td>As above</td>
<td>No</td>
</tr>
<tr>
<td>Te Harakeke Wetland</td>
<td>Swamp</td>
<td>170</td>
<td>Te Harakeke 03, M2PP 2011/BH209, M2PP 2012/BH18</td>
<td>No</td>
</tr>
</tbody>
</table>

Representative wetlands for each wetland class identified by GWRC as locally significant or insufficient information to determine significance

<table>
<thead>
<tr>
<th>Wetland location</th>
<th>Wetland class</th>
<th>RRwGW Scenario 4 Drawdown (mm)</th>
<th>Existing shallow groundwater monitoring well</th>
<th>Wetland Condition Monitoring undertaken?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PekaPeka Road Swamp</td>
<td>Swamp</td>
<td>160</td>
<td>Unknown?</td>
<td>No</td>
</tr>
<tr>
<td>Tini Bush</td>
<td>Fen</td>
<td>210</td>
<td>Location to be confirmed</td>
<td>No</td>
</tr>
<tr>
<td>Ngarara Bush</td>
<td>Fen</td>
<td>190</td>
<td>KCDC/K12, M2PP 2012/BH20</td>
<td>No</td>
</tr>
<tr>
<td>Ngarara Road Wetland D</td>
<td>Fen?</td>
<td>150</td>
<td>Well Site K4 – Cooper #1, M2PP 2011/BH210</td>
<td>No</td>
</tr>
<tr>
<td>Crown Hill Manuka Bush</td>
<td>Fen</td>
<td>110</td>
<td>M2PP 2012/BH09</td>
<td>No</td>
</tr>
<tr>
<td>Poplar Ave Wetland</td>
<td>Fen</td>
<td>10</td>
<td>To be confirmed</td>
<td>Yes – Site of GWRC Wetland Monitoring Programme.</td>
</tr>
</tbody>
</table>

2 The Te Hapua and Otaihanga Wetland monitoring locations outlined above should provide a general reference for monitoring of the hydrology of the wider Te Hapua Wetlands (approximately 21).
1. **Piezometer Monitoring**

The installation of piezometers, including potentially tele-metered piezometers in those wetlands most at-risk of RRwGW effects (as outlined in Table 1 above), should be used in a number of representative wetlands as recommended in the wetland report (including the addition on a number of additional representative wetlands to ensure Expressway effects can be separated out).

Baseline information from these wetland piezometers should be used to set alert or action levels for each of the wetlands being monitored, based on fluctuations from historical monitoring as outlined in the wetland report and re-evaluated following improved baseline monitoring information. These piezometer trigger levels should be used as the basis for initiating ecological involvement and a series of actions for determining adverse effects as part of the adaptive management approach.

2. **Wetland Condition Monitoring**

We continue to recommend baseline wetland condition monitoring on the wetlands outlined in Table 1 above. The proposed methodology for collecting baseline monitoring information on the representative monitoring wetlands should be quantitative and based on national guidelines, including: *Monitoring Changes in Wetland Extent* (Ward et al. 1999), the *Handbook for Monitoring Wetland Condition* (Clarkson et al. 2004) as well as specific attributes for measuring the effects of the RRwGW project.

Wetland pressures should be recorded as part of the wetland condition monitoring by describing the vegetation and land uses surrounding each wetland, noting wetland weed threats and describing each wetland’s location within the landscape. Animal access and damage should also be assessed in the monitored wetlands by recording whether wetlands are fenced, the condition of fences, and sign of stock damage.

Other specific attributes beyond those defined in the *Handbook for Monitoring Wetland Condition* that need to be measured to establish the baseline for effects monitoring of RRwGW shall also be identified in the monitoring programme, along with their specific measures and thresholds.

We have revised our recommendation to survey wetlands using Wetland Condition Monitoring during winter conditions during periods of inundation and high water tables - and late summer conditions during dryer conditions. Based on our field experiences, these are highly variable and may not be consistent across the RRwGW zone of influence. There is also a risk that such an approach may not be the best measure for ensuring seasonal variations in water levels and corresponding changes in vegetation communities are established.

3. **High-resolution aerial photography and mapping**

The extent of representative monitoring wetlands and their vegetation types (Level 4 of the New Zealand Wetland Classification framework) should also be mapped from high-resolution aerial photographs (specifically flown for this purpose) and their condition assessed based on the *Handbook for Monitoring Wetland Condition* to provide an overall assessment of condition and any changes to the overall condition of wetlands over time.

The high resolution aerial photography should be used as the basis for detailed mapping of the vegetation communities within the monitored wetlands, using the
Atkinson\(^3\) system of vegetation description with dominant species listed in each layer listed. Field verification of mapping should be used and to assist with more detailed species lists in conjunction with wetland condition monitoring surveys.

Mapping and recording each vegetation type in these monitoring wetlands should provide a sufficient baseline measure by which any changes in the dominance of native species and dry-land plant invasion can be assessed. A combination of detailed mapping and GIS information can be used to quantify the extent of valued wetland vegetation potentially at-risk and can be used as a baseline measure of any wetland lost of significantly modified by the RRWGW project.

**Monitoring and adaptive management**

In conjunction with the wetland piezometer information, the baseline information on wetland condition and the aerial photographs, mapping and permanent photo-points should assist with determining vegetation changes from the base condition to determine whether there is an adverse effect.

The monitoring programme should set out an adaptive management response to be developed by an ecologist and hydro-geologist. This should set out a process for the determination of a plausible cause-effect association with the Project (in consultation and agreement with GWRC and KCDC), followed by any remedial or mitigation requirements and, if required, success monitoring. For example, one option could be assessing the effects of any changes in water table regime from the RRwGW project on vegetation composition through applying the Prevalence Index (PI) method (US Army Corps of Engineers 2010)\(^4\) to the plot vegetation data used for the wetland condition monitoring surveys.

We understand that rating categories of obligate (OBL), facultative wetland (FACW), facultative (FAC), facultative upland (FACU) and upland (UPL) are in the process of being developed for NZ wetland plant species (BR Clarkson, Landcare). If water tables are significantly lowered as a result of the RRwGW, the plant species composition in the wetland condition monitoring plots in the most affected and higher valued wetlands may become less hydrophytic and the PI will increase. One option could be to use these parameters to determine RRwGW effects.

Overall, we consider that the combination of piezometer information, wetland condition monitoring and high-resolution aerial photography recommended in the most affected and higher valued wetlands should provide a good baseline for the wetlands of the Kapiti Coast potentially at risk of the RRWGW Project. As outlined by the US Army Engineers\(^5\), the presence of hydric soils and wetland hydrology indicators in addition to vegetation indicators will provide a logical, easily defensible, and technical basis for measuring effects on wetlands.

Matiu Park

Associate Principal: Senior Ecologist, Boffa Miskell

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\(^4\) The PI provides a quantitative measure of how hydrophytic (‘wet’) the vegetation is, based on species abundance and wetland ratings.