Tonkin+Taylor

27 June 2023
Job No: 1017353.2301

HAWKES BAY REGIONAL COUNCIL
Private Bag 6006
159 Dalton Street
NAPIER 4142

Attention: [redacted] S7(2)(a)

Dear [redacted] S7(2)(a)

Letter of Engagement
HBRC Land Categorisation - Proposal for technical support for mitigation options assessment

Following our recent discussion of 19 June 2023, and as you requested in the project briefing sheet[1], we are pleased to confirm the basis on which we will provide engineering and environmental consultancy services for you as our client.

Tonkin & Taylor Ltd (T+T) have been supporting Hawkes Bay Regional Council (HBRC) since Cyclone Gabrielle with the rapid rebuild of the stopbank network on the Heretaunga Plains Flood Protection Scheme (HPFPS). This work is coming to a close and HBRC and other agencies have begun a process of land categorisation, to identify properties at risk of flooding in a 1% AEP event based on a review of observed performance, lidar information and other observations. Categories include:

- Category 1- Able to rebuild with no major flood protection scheme upgrades and minor damage repair
- Category 2A- Further information is required to establish whether flood protection is feasible.
- Category 2P- Property specific actions required to address flood hazard (i.e. raise floor level or provide individual property protection)
- Category 2C- Community lead actions required to address flood hazard (i.e. new or improved stopbank crest raise or drainage scheme)
- Category 3- Flood hazard is unlikely to be able to be managed for future events

HBRC have also proposed a Category 2C*, intended for sites which are protected by stopbank sites that are being repaired and subject to completion reporting and QA. We note that further hydraulic modelling (and further review of stopbank integrity) may be needed to confirm these sites are indeed provided protection by the current stopbank network for the chosen 1% AEP design event.

HBRC have requested T+T provide engineering support to identify short lists of options for the Category 2A, 2P and 2C sites and assess these in more detail to determine a preferred option or options. This work will include an assessment of planning constraints, review of geotechnical and civil/water engineering constraints, cost estimation, risk review and preparation of a Multi Criteria

[1] HBRC, Project Briefing Sheet, Land Categorisation Engineering Solutions- mid Zone

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Analysis (MCA) of options. The specifics of the MCA and the associated weighting factors/criteria will need to be workshopped with HBRC.

We understand the geographical extent to be delivered by the T+T team is:

1 Waiohiki;
2 Omahu (upstream of Omahu township)
3 Tangoio settlement
4 Dartmoor
5 Rissington
6 Pakowhai 2A area, between the Hawkes Bay Expressway and Pakowhai Road
7 Havelock North, Joll Rd

Scope of work

The scope of work is expected to be refined over the course of the project. We propose to commence two workstreams, run in parallel to develop a better understanding of the flood risk and associated mitigation options.

The first workstream proposes the creation of a hydraulic model of the Tutaekuri and Ngaruroro rivers, as well as the Tutaekuri-Waimate stream (between the two larger rivers and a tributary of the Ngaruroro). The modelling work is essential to develop a better understanding of the catchments, the current level of protection provided by stopbanks (post Cyclone Gabrielle) and test the proposed options to alter performance to achieve the required level of service. We note the need to complete hydraulic modelling review of the Tutaekuri-Waimate system is important in understanding how protection can be provided to Waiohiki, Omahu and Pakowhai areas specifically. It is unclear if the Rissington/Puketapu can be included in the overall catchment model and this will be reviewed as part of model development.

We understand that HBRC have very limited hydraulic modelling capacity due to heavy workload and the project team is required to develop these based on hydrology and topographical information inputs provided by HBRC, effectively from scratch. We note that the model will be useful for further future scheme review and design works. For the smaller catchments it is unclear the level of information currently available from HBRC or district councils, a model for these specific catchments may be required at a later date to sense check proposed options. We propose to review existing information as part of our initial scope. This will include checking T+T archives to review information avaliable (if that client is happy to make this avaliable), discussions with HDC and HBRC representatives to determine the level of information avaliable and preparing a scope for further works if required.

The second workstream will look at compiling background information on each site, reviewing planning constraints, developing concepts in a long list and preparing the MCA, developing short listed options and preparing high level overview drawings and a cost estimate.

The focus for the 1 % AEP level of service is to:

- Compile a list of options of specific enhancements that would enable properties in Category 2a 2c and 2p to be updated to a Category 1, or Category 3.
- Prepare concept designs and rough order construction cost estimates commensurate with the level of assessment.
- In the case of Category 3 provide a short list of engineering options and the fundamental issues with each which renders them non-viable given HBRC threshold criteria.

Project Management and Coordination

During initial phases of work we will prepare a more defined programme, reporting template and project management plan, prepare a project risk register, hold initial kick-off workshops with HBRC staff to identify information available, information gaps, any scope creep/overlap with others. We also suggest a workshop is held with relevant territorial authorities (i.e. Hastings District Council, to identify any previous information available on these sites). We will also discuss the relevant sites where stopbank rebuilds have been completed with the rapid rebuild team. It is not yet clear the level of stakeholder engagement, beyond public meetings and initial consultation. We understand that stakeholder engagement will be managed by HBRC directly.

We have also allowed for a 1-hour weekly meeting with the HBRC team and project manager, to be held via MS Teams. T+T PM to prepare weekly minutes and agenda. We have assumed about 18 weeks.

We have allowed for 2 hours a week for T+T administration time, for filing, invoicing, preparation of invoicing breakdowns, tracking reports and other such tasks. The T+T PM will prepare and manage project team H&S requirements for field visits.

Long List Concept Development and Meeting attendance

During this phase, the focus will be on data collection and the scope will include the following:

- Attending community briefing sessions in a "listen and observe" manner to record community inputs, experiences and observations during the cyclone. Review community briefing information and summarise options discussed.
- Review the land categorisation maps and extents in more detail. We have assumed HBRC will provide these to use in electronic format.
- Review post-cyclone lidar and high-resolution aerial imagery at each site.
- Review publicly held information provided to use, such as flood photos, social media information and make general observations about observed flood levels (where possible).
- Review background information provided to T+T that is held by HBRC or other organisations, relevant to the subject sites, such as reports, risk assessments, hazard maps and geotechnical observations and data from the rapid rebuild teams. Understand the level of existing hydraulic modelling information and results.
- Review flood protection scheme plans and current asset information on GIS maps. Map observations and damage from the cyclone where relevant. Identify key deficiencies and overtopping areas where possible.
- Prepare a long list of potential options, review these in plan form and prepare a series of A3 plans of options, identify key risks, uncertainties and opportunities. Prepare a summary Powerpoint file for review with HBRC in a milestone workshop.

Planning review

During the development of long list options, we propose to undertake a planning consents review of each location. The review will include:

1 Obtain background information to confirm the nature and scale of the activities proposed. We anticipate that there are a number of uncertainties with the final solutions proposed, so the scope of our review will generally be limited to drainage and earthworks solutions.

2 Review publicly available archaeology maps to identify known cultural sites of significance.

3 Review the HBRC Regional Resource Management Plan (RRMP) and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NESF) to identify potential resource consent requirements from HBRC;

4 Review the HDC and NCC District Plan and Resource Management (National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health)) Regulations 2011 (NES Soil) to identify potential resource consent requirements;

5 Prepare a brief memo, to later be incorporated into the concept report outlining the following:

- Potential resource consent requirements to undertake the works (based on a high level overview of the shortlisted options from the project team);
- Potential risks to obtaining the resource consents, such as 'avoid' type policies within the Regional and District Plans that may pose a risk to the resource consents being granted;
- The supporting specialist technical reporting that will be required to support the resource consent application(s); and
- Parties (i.e. Iwi) that may require consultation.
- Consideration of environmental constraints.

Hydraulic Modelling

We understand that updates are required for the hydraulic model for the Tutaekuri and Ngaruroro rivers. There are a number of changes required for the model since Cyclone Gabrielle due to changes in the catchments, limitations of the previous model and large scale geomorphic changes following the cyclone. We understand that the model has previously been used for capacity review of the flood schemes across these two rivers, therefore we have developed a scope to match this. The modelling work will be used to inform risks to the affected sites and assess the feasibility of the proposed long listed options.

The Ngaruroro River and Tutaekuri River have contributing catchment areas of approximately 2,000 km^2 and 830 km^2, respectively. The work will also include an investigation of the Tutaekuri-Waimate tributary.

Model updates

Our proposal is to build a new hydraulic model for the Tutaekuri and Ngaruroro rivers. We understand that there are existing models for these river reaches, however due to changes in ground surface over time and due to the recent cyclone Gabrielle flooding and bed deformation, the models need updating.

At the outset the model vertical datum requires consideration and agreement. We propose to use the same vertical datum as that for the most recent LiDAR survey, to ensure direct compatibility and to allow for easy updating should additional LiDAR be flown.

We propose to build a new model for each of these rivers, making use of the existing models for information where applicable ("applicability" will be discussed and agreed with HBRC). The model will be built to include the latest information from HBRC, and be able to be continuously updated for new information as that becomes available and to sense check concept options proposed (i.e. new stopbanks or encroachment within the channel).

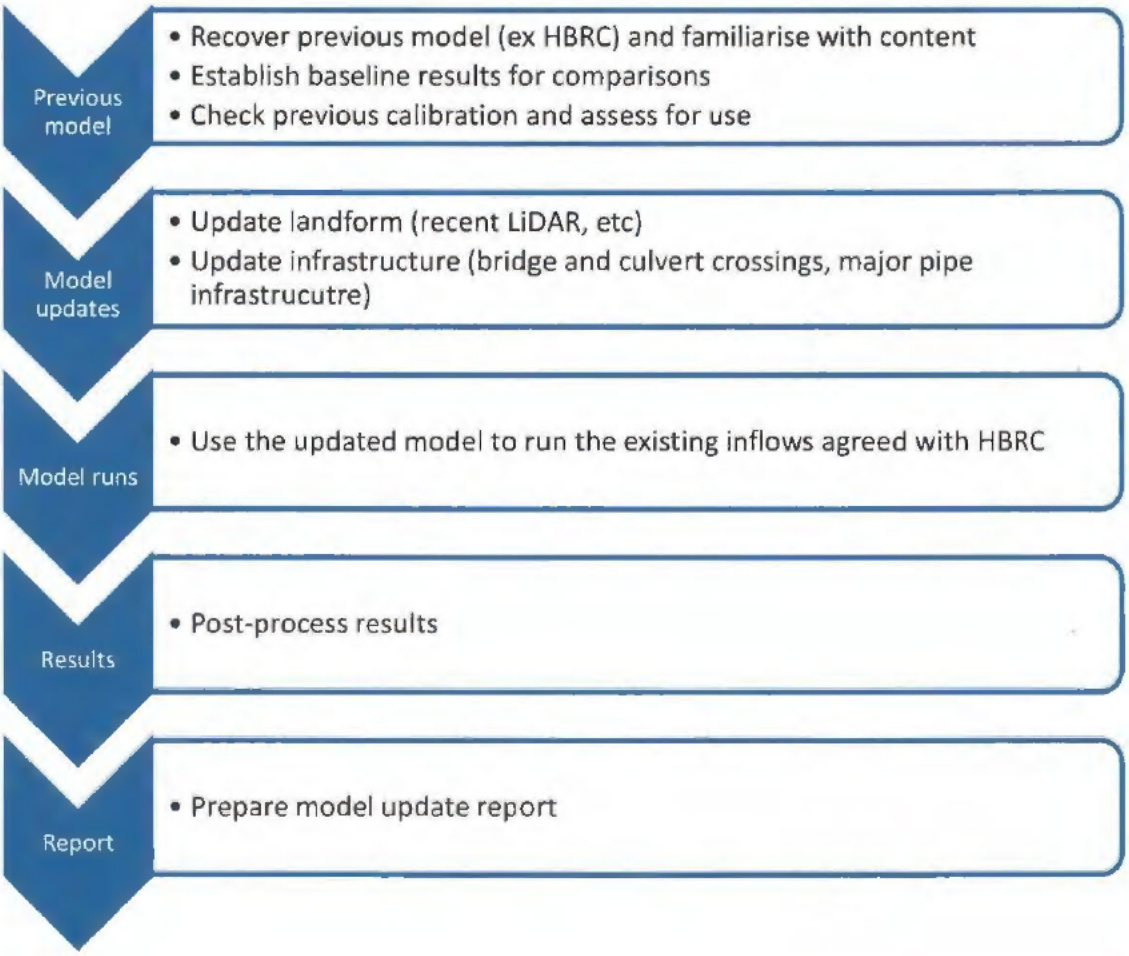
As part of this work we are proposing updates to the hydraulic model only, and keeping the same hydrological modelling approach. However, we recognise that the hydrology (e.g. flood frequency analysis) may also need updating, and we propose to agree these updates with HBRC during the

process. This also applies to model calibration, where we are unsure of the availability or quality of suitable calibration data. Our calibration/validation approach will be agreed with HBRC, and may extend to include detailed sensitivity analyses.

We propose to build the model in 2D, using TUFLOW QPC software. Using the most recent version of TUFLOW allows for full 2D representation of the channel at sufficiently fine grid resolution. Our preference for a 2D solution includes options relating to transfer of momentum over what would have been links in a 1D model, as well as resolution of hydraulic characteristics such as bend super-elevation. The recent Sub-Grid-Sampling (SGS) and Quadtree make this approach feasible.

As a provisional item, we have included the option of building the model using TUFLOW FV software. TUFLOW FV is a two-dimensional (2D) hydraulic and hydrodynamic modelling software which allows us to simulate and analyse sediment transport (i.e. is a 2D morphological model) in addition to the capabilities of a traditional fixed bed model. The advantage of this type of modelling is we are able to simulate changes in bed elevation over the course of a flood event, and predict bed deformation along the river reaches. This modelling gives a more realistic representation of river processes, but requires significant data input and calibration.

TUFLOW FV uses a flexible mesh as opposed to a 2D grid, therefore we need to build the mesh first to enable the model to be run in this software. We have priced a provisional item to build the model to the point where we can then upgrade the model to include sediment transport at a later stage.



Model boundaries

We have not initially proposed to update the model inflow boundaries and will just use the existing model boundaries previously used by HBRC. We are able to update this at a later date as an additional phase of work. For each river we propose to use an inflow boundary that comprises a gradually rising inflow (up to a maximum, which may be up to a 1%AEP discharge. This will allow for extraction of Q-h curves at each cross section location downstream. Using the Q-h relation, a user can "plug in" the discharge that corresponds to the sought frequency (adjusted by catchment area to the power of 0.8) to read off the level at that location that corresponds to the event frequency.

Using the above approach, the model will not be able to yield design water levels outside of the river corridor, but is suitably flexible to cope with changing frequency analysis (and/or potential consideration of climate change scenarios.

It will be possible to use an alternative approach whereby design inflows are applied with direct or lumped catchment inflows to obtain flood hazard maps of the lower catchment areas. It will also be possible to identify discrete breach locations and simulate breach flows, once this model is set up.

For the downstream boundary we propose to use a dynamic sea level boundary, applied sufficiently far from the river mouth as to be uninfluenced by river flow (i.e., in some cases the local sea level is elevated by river flows during a flood, and using a pure sea level at this location can induce artificial hydraulic grade at the mouth). At this stage we propose to use present-day (i.e., no sea level rise) dynamic tidal time series, with high tide adjusted to occur simultaneously with peak discharge. This may be conservative for peak water levels in the lower reaches, and further sensitivity testing may be required to fully determine the preferred approach.

For future time horizon simulations we may elect to apply higher sea levels, based on sea level rise predictions. We are aware that coastlines around New Zealand experience vertical land movement, which we have not assessed for this area yet. Our initial suggestion is to knowingly exclude this from this phase of the model build. It may emerge as desirable to simulate partial or total blockage at hydraulic structures that may occur due to debris load. While we do not intend including debris in our models, allowance for blockage can be made on discussion and agreement with HBRC.

Model extent

We are proposing to model the lower reaches of the Tutaekuri and Ngaruroro rivers as shown in dark blue in the figure below. River reaches are approximately 26 km and 17 km, respectively. We understand that new LiDAR has been flown after Cyclone Gabrielle, therefore the model will be limited to the reaches of the rivers captured by the new LiDAR, but will not be extended past the confluence into the light blue reaches.

Figure 1-Catchment overview of proposed model extent. Note the Tutaekuri-Waimate not shown. Lying between the two rivers.

Model runs

We will initially use previous estimates (i.e. pre cyclone Gabrielle) of design flows (supplied by HBRC), but expect to be able to update these from flood frequency work that occurs post-Gabrielle (also supplied by HBRC when available). If hydrological data is to be updated as part of this work, we will agree scenarios with HBRC as an additional phase of work.

Workshopping and Concept Short Listing

During the concept development and short listing we propose to:

- Workshop the list options and prepare a multi-criteria assessment (MCA), with inputs to be developed with HBRC staff.
- Assign weighting to the criteria in conjunction with HBRC.
- Test options, where possible, against the hydraulic model to confirm feasibility and review improvement options to the scheme for associated areas.
- Rank and list options, and identify level of uncertainty and key risks. Review and discount technically unfeasible solutions at a high level.
- Formalise the MCA and present a PowerPoint based workshop on MS Teams to confirm the preferred concept (s) to advance for high level pricing.

Development of preferred option cost estimate

Following workshopping and confirmation of short-listed option(s), we will:

- Prepare a summary report for each site, outlining the review undertaken, the associated constraints, risks, assumptions and exclusions, opportunities and an overview of options considered as part of the review for that site.

- Prepare a series of A3 markup plans of concept options. No formal CAD drawings will be provided.
- Develop a high-level schedule of key quantities based on A3 Plan markups. The quantities will be determined by reviewing and extrapolating typical cross section details. We have not allowed to create 12d model etc.
- Prepare a high-level and rough order construction cost estimate of the preferred option for consideration as part of business case development.
- Identify technical work required to advance the workstream to a consent level and detailed design (i.e. survey work needed, geotechnical investigations etc).

Interface with Scheme Review

T+T have been approached by HBRC to tender for the Heretaunga Plains Scheme Review as part of the HBRC engineering panel. We believe there may be significant benefits to T+T working on both packages, given the overlap in hydraulic modelling and concept solution development, as well as the familiarisation with a number of sites following the rapid rebuild held by our team. Nonetheless, coordination with the team undertaking the scheme review will be an important aspect of this project and potentially avoid duplication of work.

Deliverables

During the initial phases of work, such as the concept long-list development and review, we propose to issue a series of PowerPoint review documents for discussion at a series of workshops.

We will prepare weekly minutes and agenda for team meetings.

In the shortlisted options phase, we propose to compile a stand-alone report for each site, which will summarise the work completed, the planning review, MCA process and cost estimation work, with appended sketch/markup drawings.

The outcome will be:

- A list of options for Community and property specific enhancements that would enable properties in Category 2a 2c and 2p to be updated to a Category 1, or Category 3.
- In the case of Category 3 provide a short list of engineering options and the fundamental issues with each which renders them nonviable given HBRC threshold criteria.

Programme

We understand there is significant pressure to advance the works to assist local residents with insurance and rebuild processes as a result of the land categorisation process. The proposed HBRC programme does not appear achievable to deliver large-scale construction projects (i.e. 'shovel ready') by Nov/Dec 23, given the likelihood of consenting and design works yet to be programmed. However, we suggest that focus is given to identifying projects that can be delivered more quickly (or which are considered priority sites), breaking packages up into manageable workstreams, or where there is a more thorough understanding of the site, and greater certainty of outcome.

Our proposed programme is outlined below. We suggest regular programme reviews to identify key risks, track progress and update. We note that the final programme will be clearer once the level of background information is provided and a more detailed understanding of the sites is held by the project team.

The modelling work is expected to take about 12 weeks to complete and will need to be run in parallel with background review, initial concept and optioneering.

Scope item	July	August	September	October	November	December
Project Commencement and background review						
Hydraulic Modelling						
Concept Long List Option Development						
Planning Review						
Cost Estimation						
Review and Confirm Shortlisted options						
Develop options, advance preliminary designs and consent applications (beyond this scope)						

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[redacted]

S7(2)(b)(ii)

[redacted]

Exclusions

We have not allowed the following:

1 Model peer review, we have assumed this will be by HBRC staff.

2 Survey and drone footage capture, beyond that collected as part of the rapid rebuild.

3 Preparation of public engagement documentation.

4 Travel to Hawkes Bay other than attendance at public engagement sessions and site visits to the project sites.

5 Resource consent preparation.

6 CAD and digital drawings and models.

7 Detailed design and technical specifications.

8 Model creation for the small catchments (Havelock North, Tangoio) is currently excluded. Rissington may be able to be incorporated into the Tutauekuri model, which we will review during early development. We note that information may be publicly available or held by HBRC and we will determine the level of information avlaible as part of the scope. Further catchment modelling is outside of the scope of works. If necessary, we will agree a variation with you to compete this.

Client provided information.

We have assumed the HBRC team will provide the following:

1 Internal coordination of HBRC personnel.

2 Current models and hydrology inputs including flood frequency information/flow rates to assess and climate change scenarios (latter if any).

3 Digital files of scheme data, assets, Category extents, and river cross section surveys.

4 Post cyclone lidar, which is a key input to the hydraulic model. Resolution will need to be confirmed for modelling purposes.

5 Information from the rapid rebuild teams, i.e. as-builts, geotechnical investigation information, records and completion reports.

6 Any background reports held by HBRC relevant to the respective sites.

7 Access to sites for site walkovers. We have assumed HBRC will make necessary arrangements with the public.

8 Records of public engagement.

9 Ecology support (if required)

10 Existing scheme information, technical reports and design drawings.

Health and safety

T+T is committed to providing and maintaining a safe and healthy working environment at all of our places of work. In line with this commitment, and as required by health and safety legislation, we will consult, cooperate and co-ordinate our activities with you and others who will be working on the project. To assist us in this, please let us know if you have any specific health and safety planning and implementation requirements which are relevant to our services (including known risks) so that we can review these with you.

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Closing remarks

We trust that this satisfactorily meets your needs. We look forward to receiving your instruction to proceed and to working with you on this project. You can confirm your acceptance by returning the attached signatory form. Alternatively, we will take your instruction to proceed as confirmation that you accept this proposal.

[redacted] S7(2)(a)

Yours sincerely

[redacted] S7(2)(a)

[redacted]
Project Director

Attached:

1 Signatory page
2 ACENZ Short Form Agreement Feb 2019
3 Pricing Schedule