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Coastal Science and Engineering Services - **Takutai Kāpiti: Our community-led coastal adaptation project**

RFP Reference No.: 2020/C340

Prepared for: Kāpiti Coast District Council

15 July 2020

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Appendix A: CVs

Response Form

In response to Request for Proposals (standard version)

by: Kāpiti Coast District Council

for: Coastal Science and Engineering Services - Takutai Kāpiti: Our community-led coastal adaptation project

Ref: 2020/C340

Date of this Proposal: 15.07.20

Checklist for Respondents	✓
1. Complete all sections of the Response Form.	✓
2. Delete all 'supplier tip' boxes, guidance notes in red font, and yellow highlighting.	✓
3. Make sure that you have complied with all the instructions contained in the RFP.	✓
4. Arrange for the declaration to be signed.	✓
5. Arrange for the Proposal to be submitted electronically before the Deadline for Proposals.	✓

1. About the Respondent

Our Profile

Item	Detail
Trading name:	Jacobs New Zealand Limited
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Type of entity (legal status):	Limited Liability Company
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Country of residence:	New Zealand
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Our Point of Contact

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2. Response to the Requirements

1. Proposed solution	Weighting 30%

Solution Overview

A. Project Understanding

Kāpiti Coast District Council (KCDC) have initiated the procurement of a Coastal Hazard and Risk Assessment for the District coastal environment and technical advisory services on coastal adaptation pathways. The Project will identify areas exposed to current and future coastal inundation and erosion hazards over a 100-year time frame with climate change and have consideration of how these will interact with other hazards such groundwater, pluvial, and fluvial flooding which may also be exacerbated by climate change. The outputs from the project will include mapped hazard overlays setting the coastal hazard context of the Kāpiti Coast District Coastline from Otaki in the north to Paekakariki in the south, identification of the high-hazard areas along the 42 kms of district coastline, and vulnerability and risk assessments in these high-hazard areas.

It is our understanding that the primary purpose of the coastal hazard and risk assessment is as input into the proposed coastal plan change to the Kāpiti Coast District Plan and in the development of preferred coastal adaptation pathways for the Kāpiti coastal communities under the Takutai Kāpiti project. In additional to these purposes, it is understood that that the outputs will also have a range of other uses including in asset management and resilience planning for council assets identified as being in high-hazard risk areas. As such, it is understood that all information created from the hazard and risk assessments must be easily understood by the community and council asset managers.

We are aware that there have been several previous coastal hazard assessments undertaken for the Kāpiti District coastline, and that assessments undertaken under this project require a review and update of these previous assessments, with consideration of review panel comments from the 2014 Coastal Erosion Hazard Assessment (Carley et al., 2014) on the methodologies undertaken in some of those assessments. It is understood that the methodologies used in the updated assessments need to be scientifically robust and defendable, and consistent with the relevant requirements of NZCPS (Doc 2010) Policy 24, the MfE (2017) Coastal Hazard Guidance and any other best practice guidelines, and results are fit for purpose to assist KCDC and their coastal communities with future decision marking for their coastal environments. These methodologies and results are to be presented in a comprehensive report that will be externally peer reviewed to ensure that they meet the above requirements.

It is our understanding that following the presentation of the Coastal Hazards and Risk Report, that the we will be required to act as a Technical Adviser to the Takutai Kāpiti Community Assessment Panel(s) to provide best practice technical advice on the development of preferred Dynamic Adaptative Planning Pathways for each community to manage their future coastal hazard risk.

B. Our Solution

Our team brings together a strong mix of international and local experience in coastal processes interpretation, coastal hazard identification, assessing the coastal and multi-hazard impacts of climate change and sea level rise, coastal management and development of Dynamic Adaptation Planning Pathways, coastal protection engineering and community engagement. This experience includes the use of innovative techniques to model and map future hazards under climate change scenarios. To provide a strong local knowledge to the New Zealand and International team, the project team will include and be managed by experienced members of our Wellington based office, who have experience in successfully delivering stormwater projects for KCDC.

To ensure that we have correctly scoped the project and understand the requirements of KCDC and the local site characteristics, the initial stage of our solution includes an inception meeting and site visit of key personnel from Jacobs with KCDC to confirm the approach to sea level rise required for both the District Plan provisions and the development of Adaptative Planning Pathways, methodologies, data availability and timeline for delivery. The initial phase of the project will also involve the review of previous assessments to confirm the scale of additional investigations required to bring the past assessments up to date with acceptable methodologies and modelling. This review will focus on the following previous assessments:

- 2012 coastal erosion assessment (CSL, 2012),
- 2012 and 2019 storm surge assessments (NIWA, 210 and 2019),
- 2012 KCDC fluvial and pluvial flood modelling for coastal reaches of the Ōtaki, Waikanae, Wharemauku, Paekākāriki and Mazengarb catchments
- 2012 assessment of climate change impacts on groundwater levels (SKM, 2012).

At the end of this review, we will produce a technical memo outlining the gaps and limitations in the previous assessments, and confirmation of the investigations methodologies and data requirements required for updated assessments. The purpose of this gap and limitation assessment is to ensure that all past information is used if possible and that KCDC finances are not wasted duplicating work that is technically suitable.

Following the above initial phase and gap analysis, we would proceed to update the hazard and risk assessments, covering the following areas:

- **Coastal Erosion:** Probabilistic assessment of the future shoreline erosion for both open coast and inlet shorelines over agreed time frames up to 100 years to include extrapolation of historical trends, short-term storm erosion effects, and the impacts of a range of sea level rise scenarios. We recognise that different methodologies will be required to assess the different processes and shoreline morphologies operating along the open and inlet coasts of the Kāpiti Coast District (e.g. sediment supply). Details of the proposed methodology for the coastal erosion assessment are provided in Section 1.3 of this response.
- **Coastal Inundation:** Update of the NIWA (2019) modelling to incorporate additional agreed sea level rise scenarios, how these interact with agreed pluvial and fluvial flood scenarios with future sea level rise from existing KCDC flood modelling, and how they interact with elevated

groundwater levels because of sea level rise. Details of the proposed methodology for the coastal inundation assessment are provided in Section 1.3 of this response.

- **Vulnerability and Risk Assessment:** The hazard mapping will be used to develop vulnerability risk assessments for coastal erosion and inundation. This study will follow on from the work completed by GWRC (2019) which carried out a high-level vulnerability study based on infrastructural, ecological and cultural assets. This assessment would be more detailed, on a property by property basis, which could be used for input into the District Plan. Details of the proposed methodology for the risk assessment are provided in Section 1.3 of this response.

In preparing the technical reporting and GIS map outputs from the above assessments, we will focus on presenting results within a coastal unit approach based on the eight coastal cells presented in GWRC (2019) vulnerability study. To ensure that the assessment methodologies, reporting and mapping outputs are acceptable to the KCDC external peer reviewer and avoid potential issues at the end of the project, we would like to work with the reviewer carrying out a rolling review throughout all stages of the project.

Due to the use of the information created from the hazard and risk assessments being used community engagement for both the District Plan Review and for the development of community led Adaptative Pathways, easier to follow and understand summaries of the technical report and maps will be produced for these engagement sessions. Although interactive web-based hazard and risk map outputs are not within the scope of this project, we could produce as a follow-on project to assist the Community Assessment Panel(s) with their discussions and decision making.

Following the preparation of the Coastal Hazard and Risk Assessment report, to assist with developing adaptive coastal pathways plans for each coastal community we will provide best practice advice in the role of Technical Adviser to the KCDC Coastal team and Community Assessment Panel(s). It is anticipated that this role will include assisting with the development of initial long-list of adaptation options that might be suitable for each coastal unit, then providing best practice advice in assessing these options to develop a short-list of possible adaptive planning pathways over a 100-year timeframe for each coastal unit. In providing this advice, we could use several analysis tools such as criteria for a Multi-Criteria Analysis (MCA), Cost Benefit Analysis, sustainability and value by design tools, and an interactive adaptative management exercise tool developed by Jacobs. It is anticipated that this technical advisory role will involve the presentation of best practice advice to the KCDC Coastal Team and the Community Assessment Panel(s) via technical memorandums and the presentation of technical information at Community Assessment Panel workshops.

Key Deliverables

- **Deliverable 1 –** An updated Coastal Hazard and Risk Assessment of both Coastal Erosion and Coastal Inundation Hazards. This will be delivered as a technical report. The report will show maps of the hazards under each SLR scenario and timeframe, and these will also be provided with the report as GIS layers.
- **Deliverable 2 –** Technical advice to the Takutai Kāpiti Community Assessment Panel throughout the development of coastal adaptation pathways. This will be delivered during workshops/meetings and can be delivered by memorandums when written confirmation of decisions is required.

Methodology

A. Stage 1: Coastal Hazard and Risk Assessment

A.1 Sea Level Rise Approach

It is recognised that a vital component of the hazard and risk assessment for both the District Plan Provisions and the development of Adaptive Planning Pathways is the consideration of magnitude and timing of future coastal inundation and erosion hazards with projected sea level rise. Therefore, it is important to establish up front the approach to projections of sea level rise to be used in the assessment. The MfE (2017) coastal hazard Guidance recommends the use of a range of sea level rise scenarios with clear identification of the uncertainties in the resulting erosion and inundation hazard extents from the different scenarios.

While the District Plan instruments (e.g. Objectives, Policies, Rules) are more likely to be based on hazard extent over a specified time (e.g. 50 and/or 100 years), the development of Adaptative Planning Pathways requires triggers of action when the vulnerability to hazards reaches unacceptable levels. Therefore, requires an incremental approach to sea level rise largely independent of time. To satisfy both these requirements, as well as the requirements of the MfE (2017) Guidance and the NZCPS (2010) Policy 24 (identification of hazard areas over a 100-year time frame), it is proposed that the coastal inundation and erosion hazards be assessed under the following range of incremental sea level rise scenarios presented in Table 1:

Table 1: SLR projections in meter to be used on the Kāpiti Coast coastal erosion assessment compared to projections in MfE (2017) for the wider New Zealand region.

Year	Proposed KCDC hazards assessment	NZ RCP2.6 M (median)	NZ RCP4.5 M (median)	NZ RCP8.5 M (median)	NZ RCP8.5 H+ (RCP 8.5 83rd percentile)
2030 (e.g. 30 yrs.)	0.2	0.13	0.13	0.15	0.18
2070 (e.g. 50 yrs.)	0.4, 0.6	0.32	0.36	0.45	0.61
2120 (e.g. 100 yrs.)	0.6, 0.8, 1.0, 1.35	0.55	0.67	1.06	1.36

The confirmation of these sea level scenarios and how they relate to the past hazard assessments undertaken for the Kāpiti Coast will be an item for discussion at the inception meeting. Note the time component is not relevant for the coastal inundation assessment (unless considering the effect of geomorphic shoreline responses associated with erosion in the inundation assessment), so there are proposed to be six sea level rise scenarios for coastal inundation and seven for coastal erosion.

A.2 Project Start-Up

The project start-up includes the following four tasks:

1	**Review of previous assessments of the coastal hazards** of the Kāpiti Coast to confirm that the methods proposed in this assessment are appropriate and to confirm the data needs to undertake the assessment
2	An **Inception Meeting** to confirm key components of the methodology and data requirements with key KCDC staff
3	A **Site Visit** for the key members of the Jacobs project team to gain a visual appreciation of the KCDC coastal area and processes particularly at areas with already identified hazard issues.
4	**Collation of required data**

A.2.1 Previous Hazard Assessment Review

Based on our understanding of the criticism of some of the methodologies used in previous coastal hazard assessments for the Kāpiti District coast (e.g. CSL, 2012), it is considered important that we gain an in-depth understanding of the methodologies and their limitations employed in these past assessments, and to confirm the assessment areas required to be updated and our methodologies prior to meeting with KCDC for the inception meeting. This comprehensive review will focus on the following relevant reports from Takutai Kāpiti's online coastal bibliography and any other considered important by KCDC staff:

- NIWA (2019) Storm Surge Inundation Maps for the Kāpiti Coast. Consultancy Report for GWRC.
- Carley, J et al., (2014) Coastal Erosion Hazard Assessment for the Kāpiti Coast: Review of the Science and Assessments Undertaken for the Proposed Kāpiti Coast District Plan 2012. Panel Review.
- De Lange, W (2013) Kāpiti Coast Coastal Hazard Assessment. Submission to the Review Panel
- CSL (2013) Erosion Hazard Assessment: Northern Shoreline of Waimeha Inlet
- CSL (2012) Kāpiti Coast Erosion Hazard Assessment – 2012 Update. Report for KCDC
- NIWA (2012) Joint Probability of storm tide and waves on the open coast of Wellington. Report for GWRC.
- SKM (2012) High Level Assessment of Climate Change Impacts on Kāpiti's Groundwater. Report for KCDC.

- NIWA (2012) Assessing the storm inundation hazard for coastal margins around the Wellington region. Report for GWRC and KCDC.
- Kāpiti Coast District Council flood modelling for the for coastal reaches of the Ōtaki, Waikanae, Wharemauku, Paekākāriki and Mazengarb catchments
- CSL (2008) Kāpiti Coast Erosion Hazard Assessment (Parts 1, 2, & 3). Report for KCDC.
- Lumsden (2003) Strategies for Managing Coastal Erosion Hazards on the Kāpiti Coast. Report for KCDC.

Following this comprehensive review, we will prepare a technical memo to be tabled at the inception meeting outlining the gaps and limitations in the previous assessments, and confirmation of the investigations methodologies and data requirements required for updated assessments. The purpose of this gap and limitation assessment is to ensure that all past information is used if possible and that KCDC finances are not wasted duplicating work that is technically suitable.

As outlined above, one of the key aspects to be considered in this review is the magnitudes and timeframes of sea level rise considered in the previous assessments, and how they relate to the increments of sea level rise proposed to be used in this assessment.

A.2.2 Inception Meeting

Following the review of the previous assessments, key Jacobs technical staff will travel to KCDC to have an inception meeting with the key project partners which will allow us to confirm the approach to be adopted in the hazard assessment. Key points of discussion at the inception meeting include:

- Tabling of the review of pervious assessments with focus on limitations, ability to use the past assessments, and the updates required in the current the assessment;
- Confirmation of the methodologies of be used in the inundation, erosion and risk assessments (details of proposed methodologies given below);
- Confirmation of proposed sea level rise projections from section A above;
- Confirmation of probabilistic outputs (e.g. P50, P95, P33, P66 etc);
- Confirmation of assumptions on continuation of existing coastal processes, particularly sediment supply to the coastal sediment budget and transport;
- Confirmation of transfer of available information and data (see section A.4 Data Collation below);
- Confirmation of timeline for outputs;
- Confirmation of the use of the assessment outputs so that the technical reporting and mapping can be pitched to the correct audience;
- Confirmation of whether the optional post assessment results workshop with key KCDC staff and elected members is required or not; and
- Confirmation of requirement to attend Community Assessment Panel meetings and other community engagement during the preparation of the Hazards and Risk Assessment phase.

It is recommended that the KCDC external peer reviewer be engaged right from the inception meeting to ensure that they are party to all discussions on methodologies.

A.2.3 Site Visit

We consider that understanding the local coastal process environment is important for the correct interpretation of coastal hazards. Therefore, coupled with the inception meeting we will undertake a site visit to various locations along the Kāpiti District coastline to gain a visual appreciation of coastal processes operating along both the open coast and within the coastal inlets, particularly at areas with already identified hazard issues such as the northern QEII coast, and seawall sections at Paekakariki and Raumati. This site visit will also allow us to determine the changes in morphology and processes occurring at the boundaries of the eight coastal cells identified in the GWRC Vulnerability Study (2019) and shown in Figure 1, which could drive differences in the methods used within each cell to assess the erosion impacts of accelerated future sea level rise. KCDC staff will be invited to attend the site visit so that discussions from the inception meeting can continue site.

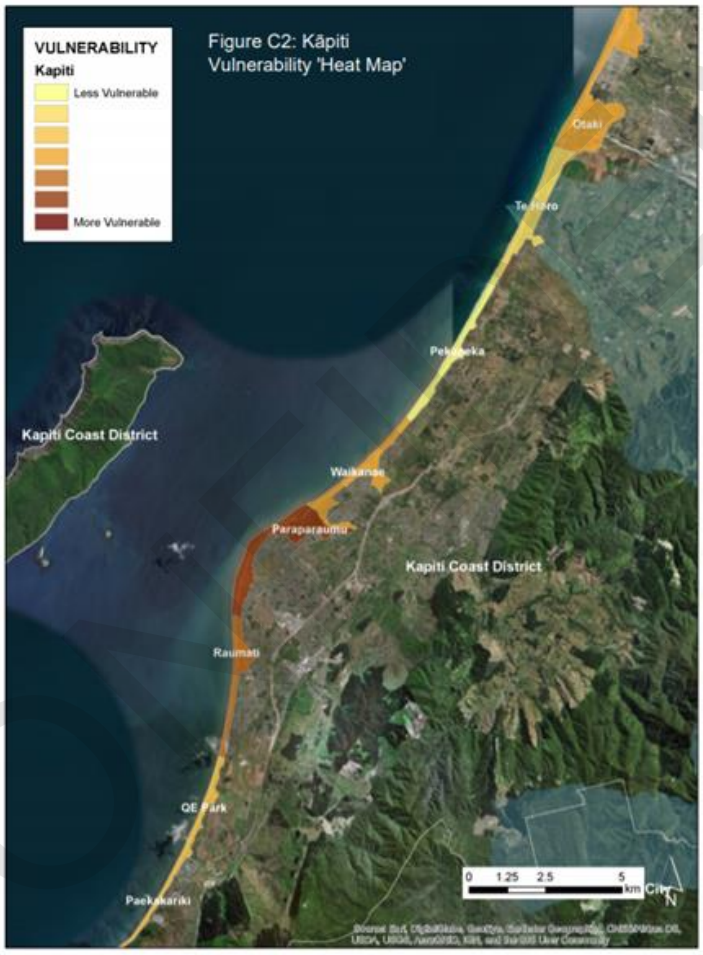


Figure 1: Coastal Cells from the GWRC Vulnerability Study (2019).

A.2.4 Data Collation

Geographic Information Systems (GIS) will be used to collect, store, integrate and visualise datasets from various sources required for the updated assessment. It is anticipated that the

following data may need to be collated in the initial stage of the project for use in the assessment either as inputs in the modelling or for validation of the models:

- The most recent LiDAR and RPAs (drone) surveys for ground elevation inputs in the inundation modelling;
- Flood models results and water levels for the coastal reaches of the Ōtaki, Waikanae, Wharemauku, Paekākāriki and Mazengarb catchments;
- Bathymetry mapping or data;
- Digital data on past shoreline positions mapped from aerial imagery in previous coastal erosion assessments;
- Recent aerial imagery since the CSL coastal erosion assessments in 2008 and 2012;
- Beach profile surveying/ monitoring data;
- Any wave data relevant for the Kāpiti Coast
- InfraRed imagery to get overland roughness for inundation modelling;
- Council Asset Data (storm water, floor levels, roading levels, building footprints)
- Any additional digital information on coastal seawall position and elevations and drain inverts;
- Any records or database of coastal storm event to provide storm wave inputs into short-term storm erosion models.

It is understood that some of this data will need to be requested from GWRC and NIWA.

The link, http://www.iapad.org/wp-content/uploads/2015/07/p3dm_arcbc.pdf is to a methodology and principles used in the engagement of various components of the community to understand indigenous and local knowledge using Participatory GIS. Although a few years old, the principles remain the same but with the technology updated to a more reliable and efficient technology to engage and understand people's and community's knowledge of their environment

A.3 Coastal Inundation Hazard Assessment

The NIWA coastal inundation modelling (2012, 2019) has already considered case of purely storm tide driven flooding from the joint probability of tides, storm surge and waves (but not coincident with pluvial/fluvial) over the whole district, so it is considered that there is no need to replicate this modelling.

However, there is a need to better define the interaction between coastal storm tide inundation and fluvial and pluvial flooding and how this may change under sea level rise and associated possible elevation of groundwater levels. For this assessment, we will make use of the seven existing KCDC stormwater models which were used to define the current flood hazard maps. We are familiar with these coupled MIKE11-MIKE21 models MIKE URBAN coupled models of the stormwater pipe network for some catchments, having developed them and use them day to day to support KCDC in assessing development proposals and updating the flood hazard maps and district plan maps. We note that new models are being developed under a separate project, but for efficiency and programming purposes we consider that it makes sense to use existing available models. The Current flood hazard maps are for a 1 in 100 AEP pluvial/fluvial event combined with

a 1 in 20 AEP storm tide event including climate change allowances for rainfall intensity (16% increase) and mean sea level rise of 0.8 m.

Our proposed methodology is to model simulations for each catchment to assess effects of smaller AEP storm tide and higher AEP pluvial/fluvial (e.g. 1 in 100 AEP storm tide and 1 in 10 AEP or 1 in 20 AEP pluvial/fluvial). The actual combinations to be modelled are proposed to be confirmed with KCDC at the inception meeting. It is proposed that the storm tide to include the increments of mean sea level rise as set out in Table 1 above, or any variations as agreed with KCDC at the inception meeting. For costing purposes, we allowed for 6 separate scenarios of storm tide + SLR + pluvial/fluvial AEP for each of the existing models (e.g. 42 simulations in total).

The models are to include initial water levels representing estimated groundwater ponding for each scenario (assuming these are available, costs include allowance for processing data to required input data for model but not for generating GW levels themselves).

For efficiency (e.g. time/cost), the existing models will be used "as is" with only minor modifications if/where needed to successfully simulate these scenarios. Model results will provide indications of extent and degree of impact of coastal hazards on pluvial/fluvial hazards rather than detailed flood risk assessment.

We have not allowed for future changes in coastline position to erosion (or accretion) to be represented in model, however, this can be included as extra scenarios at extra cost if required.

A.4 Coastal Erosion Hazard Assessment

A.4.1 Erosion Hazard Zone Calculation

Our methodology will involve a probabilistic approach to produce mapped future shoreline positions over pre-determined planning timeframes from the combination of:

- continuation of long-term retreat/accretion;
- the effects of future accelerated sea level rise; and
- the occurrence of short-term storm erosion at the end of the planning timeframe.

These components are combined in the following formula to produce a Coastal Erosion Hazard Zone, termed here as a Projected Future Shoreline Position (PFSP)

$$PFSP = (LT \times T) + SL + ST$$

Where:

LT = Extrapolation of the long-term erosion rate (zero if accreting coast);

SL = Erosion due to future accelerated sea level rise erosion for agreed sea level rise increments or scenarios

T = Time frame of 30, 50 and 100-year selected to correspond to Adaptative planning pathway, asset management, Building Consent and Resource Management Act land-use planning timeframes.

ST = Short term storm erosion.

This approach is consistent with the requirements of Policy 24 of the NZCPS: *Identification of coastal hazards*, and with the best practice recommendations in MfE (2017) *Coastal Hazard and climate Change Guidance to Local Government* and Ramsay et al (2012) *Defining coastal hazard zones for setback lines: A guide to good practice.*

The proposed methodology to determine each of the above erosion components are described in the following sections. Each of these methods are recommended based on our knowledge of the Kāpiti Coast, considering the following factors specific to the local coast that will shape the future erosion response:

- Shoreline and coastal inlet morphology, including sand beaches exposed to wave overtopping;
- Coastal processes: wave climate, water levels, sediment supply and transport; and
- Anthropogenic influences e.g. Shoreline protection structures.

A.4.2 Probabilistic Approach

In line with the approach taken by Jacobs (2020) for the Timaru District, and NIWA (2019) for the Waitaki District coast, a 'probabilistic' approach will be used to manage the uncertainty in the three erosion components (LT, SL, ST). This approach assumes a normal or triangular distribution of erosion rate for each component (depending on the amount of data available on each component) and using MATLAB to run Monte Carlo simulations where 10,000 random realisations of the erosion distance for each component are made and then combined to provide a distribution of 10,000 random projections of the total CEHZ width from the current shoreline position for each SLR scenario. Probability statistics are applied to this distribution to obtain the "most likely" (e.g. 50th or 33rd-66th percentile) and "very unlikely" (e.g. 95th percentile – so only 5% chance that they will be exceeded) shoreline position for each SLR scenario.

A.4.3 Long-Term Erosion Determination

Long term (historical) erosion rates will be determined from digitised shoreline positions from past aerial photo imagery. If possible, this will use the previous digitised past shoreline positions up to 2007 from CSL (2012, 2008), and updated to include the shoreline from the 2017 aerial images. For costing it is assumed that the CSL shoreline mapping is accurate and available in digital format. If not, then shorelines from the six to ten photo series available over the last 80 years will need to be digitised, with the early images also needing to be geo-referenced and orthorectified to provide a measure of relative accuracy of shoreline position.

The DSAS (Digital Shoreline Analysis System) tool from ArcGIS will be used to calculate the change in shoreline position at 50m alongshore intervals and develop linear regression trends of rate of shoreline movement over the complete time series of images at each transect. The regression co-efficient (r^2) will be used to test trends in rates of shoreline movements, and further analysis of coastal processes and any anthropogenic effects (e.g. seawalls, river mouth training structures) will be considered for locations that do not fit a linear trend.

If the resulting historical rates of movement from the DSAS are erosional or indicate a long-term trend towards erosion, the extrapolated future retreat distances over timeframes of 30 years

(2050), 50 years (2070) and 100 years (2120) will be calculated for input into the coastal erosion hazard zones. For sites where the rates of retreat have been artificially held by seawalls, an assessment of potential future likely erosion without the structure will be also be made based on coastal processes and local site conditions.

It is recognised that due to the nature of erosion processes, the erosion rates from the DSAS could have a high degree of variability across adjacent transects, which will create difficulty for the mapping of erosion hazard zones. To overcome this problem, a moving average filter across 10 transects will be used to smooth the erosion rates for hazard mapping. The LCI95 calculated in the DSAS will be used to determine the max and minimum from the distribution that enters the Monte Carlo simulation.

A.4.4 Accelerated Sea Level Rise Erosion Impacts

It is proposed that the erosion impacts of accelerated sea level rise will be assessed for all the increments of rise and timeframes presented in Table 1, which cover the range of scenarios recommended by MfE (2017) and meet the requirements of NZCPS (2010) for up to a 100-year timeframe. These increments will be confirmed in the inception meeting.

To avoid double accounting of sea level rise impacts on erosion hazard zones, as identified in the 2014 review of the previous CSL (12) assessment, the future rates of rise will be discounted for the contemporary rates of rise over the last 50 years (taken as average of 2mm/yr.), as this rate of rise is already included in the extrapolation of historical coastal erosion. Therefore, the erosion impacts from this component of hazard zone calculation are for the future acceleration of sea level rise.

The main beach type found along the Kāpiti Coast is sand beaches. For this beach type, the most widely used geometric two-dimensional beach response model applied to determine the effect of sea level rise on shoreline position is a Bruun Model approach (Bruun 1962, 1988). The best practice guidelines for defining coastal setbacks (Ramsay et al, 2012) state that the Bruun Model is applicable for use on open sandy beaches and it has been accepted for use by the Environment Court as an appropriate approach for determining sea level rise impacts on coastal erosion. The model involves the assumptions of conservation of an equilibrium profile shape with the volume eroded seaward from the beach being that required to raise the nearshore profile out to the closure depth for cross-shore sediment transport by the same vertical magnitude as the magnitude of sea level rise. Therefore, the resulting horizontal shoreline retreat is dependent on the beach-nearshore slope from dune crest to the closure depth and is expressed by the following equation

$$Retreat = S\,\frac{L}{(h+d)}$$

Where: S is SLR; h is dune crest height; d is closure depth; and L is distance from dune crest to closure depth.

Data inputs for the Bruun Rule calculations include beach topography from the monitored profiles and LiDAR surveys, bathymetry data and wave data to calculate “closure depth” for the offshore

limit of beach sediment exchanges. Maximum and minimums for the probability distribution are determined from adjusting the nearshore slope. The impact of longshore plan shape considerations and cross shore changes in the coastal topography on the SLR erosion outputs will be considered at each of the assessed timeframes.

However, it is noted that CSL (2008, 2012) applied an alternative model from Komar et al (1999) which is based on the concept of conservation of the form of the inter-tidal beach as sea level changes. This model is expressed by the following equation

$$\text{Retreat} = S/\tan \beta$$

Where S is SLR; and tan β is the slope of the inter-tidal beach.

It is our methodology to undertake sensitivity testing on the results of both geometric beach response models to determine the range of possible shoreline responses for each increment of sea level rise to define the probability distribution for input into the Monte Carlo simulation.

A.4.5 Short-Term Storm Erosion

The assumption for inclusion of this component when calculating erosion hazard zones is that the storm resulting in this erosion will occur at or near the end of the planning timeframe under consideration, and therefore the beach will not have the opportunity to recover within the designated timeframe.

We understand that the 2014 review of the CSL (2012) erosion assessment conducted for the Kāpiti Coast found that the method used (i.e. a statistical approach attributing change from outside of the long-term linear trend to short term change) was not sufficiently robust and recommended that the methods used in the Lumsden et al (2003) hazard assessment (i.e. methods from Ruggiero et al., 2001) should be used and updated with the most recent profile and wave data. We have adopted this recommendation in our proposed methodology.

In this model, the erosion of the foredune is dependent on the water-level elevation compared with the elevation of the toe of the foredune, with the components of the calculation being

shown in Figure 2.

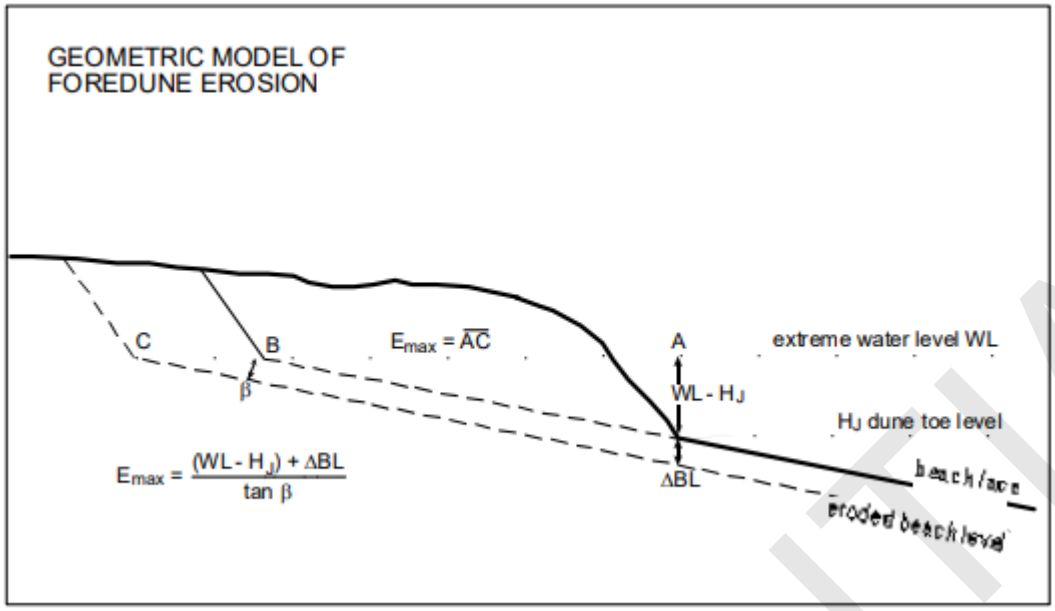


Figure 2: Geometric model of foredune erosion from Ruggiero et al (2001), as taken from Lumsden et al (2003).

The total water level (WL) is the combined resultant tidal elevation and storm wave run-up. At any specific location, the beach face is dominated by wave swash and has a typical uniform slope angle (β). The model assumes that this slope is maintained as the dunes are eroded back so the analysis focuses on the right triangle depicted in Figure 2 where erosion due to high water alone cuts back the foredune to point B. Additional erosion could result from the lowering of the beach due to the presence of a rip current or general beach erosion during the storm. This vertical shift in the profile is represented by the beach-level change ΔBL, which results in a further retreat of the dunes to point C in Figure 2. The total retreat of the foredune is now given by the line segment AC, which is taken as equivalent to E_{max} (the theoretical maximum dune erosion during extreme storms).

For this assessment of short-term erosion, data from beach profiles extrapolated out to the start of the bathymetry data will be used to attain a 'typical' profile at each site.

A.5 Erosion Zone Mapping

Following the combination of the individual erosion components as per the Projected Future Shoreline Position (PFSP) formula given earlier, manual interpretation and smoothing of the resulting shoreline position will be applied to obtain lines appropriate for planning purposes.

ArcGIS will be used to map the resulting erosion zones for each of sea level increments at the 30 year, 50 year and 100 year timeframes (or alternatives agreed on at the inception meting) along with the agreed range of likelihoods to express the uncertainty in the results (e.g. from 50% or 66% probability as 'most likely' maximum erosion distances, and 5% probability of occurrence as an 'very unlikely' maximum erosion distance). All GIS shape files will be made available to KCDC

along with the presentation of the results and erosion zones maps for each coastal cell in the final Hazard and Risk assessment report

A.6 Vulnerability and Risk Assessment

It is our understanding that the risk assessment will be following on from the high-level vulnerability study carried out by GWRC in 2019. This assessment looked at 24 different criteria (e.g. Roads, 3 Waters, Lifelines Infrastructure) and their intersection with a 1 in 100-year storm event with 1 m of SLR, to determine what coastal cells are most vulnerable. While this assessment was useful in identifying vulnerable coastal cells at a high level, a more detailed assessment is required to inform adaptive pathway planning, to get an indicative idea of what magnitudes, potential timeframes and frequencies of when sea level rise begins to have a significant impact on the coastal communities. To do this, both erosion and inundation hazards will be assessed against their intersection with dwellings, properties and infrastructure to get an indication on a more detailed level of how communities and their assets will be impacted.

Risk, in line with the MfE (2017) guidance, is defined as:

Risk = Consequence x Likelihood

For this risk assessment, we propose to use the results of the hazard assessment (outlined in 1.3.2 and 1.3.3) to inform the risk assessment. In each coastal cell, we will use property boundary data and building footprint data from LINZ data service to determine the intersection of the hazard footprints with the data. Building footprint data will be filtered for one building per property as the assumed 'dwelling' to remove any garages and sheds. The inundation risk will be assessed on both dwellings and properties, whereas erosion risk will be determined from the intersection of the projected future shoreline position with properties.

The intersection of the hazard footprint will also be assessed against key infrastructure, including:

- Roads
- Three waters infrastructure
- Sites of cultural significance
- Parks
- Schools
- Hospitals/ medical centres
- Civil Defence Sites

This list of infrastructure and assets will be confirmed at the inception meeting with council.

The results of the risk assessment will be presented in tabular form showing the number or meterage (e.g. 500m of road affected) of assets/dwellings/properties affected, and this will form part of the hazard and risk assessment report. The results of this assessment will help council identify in more detail which coastal cells are likely to be impacted, and when this is likely to occur. Knowing this timeline of when private and public assets are likely to be impacted can aid council in planning adaptive pathways and develop trigger points for when an action is required.

Where possible the RiskScape tool (NIWA/GNS) will be used to assist with the risk assessment, however it is understood that that there is limited support for the current version of the model while a significant new version is being developed.

A.7 Final Reporting

The key deliverable for stage one of this project will be a report detailing the results of the review and updated erosion and inundation hazard assessment, as well as the results of the risk assessment. The methodology and results of the above tasks will be reported alongside the maps and outputted GIS layers.

It is important that people's knowledge is captured, structured and can be viewed spatially. GIS tools such as web apps will be used to interactively input local knowledge and vision. This will also be used to provide expert knowledge from the team. With GIS we will be able to see where the overlaps lie in these 2 sources of knowledge. This can be the starting point of collaboration and understanding with the aim of empowering and enabling resiliency in the communities.

The structure of the report will be confirmed at the inception meeting but could follow the main task headings outlined above. We have allowed for issue of draft and final reports, following review by KCDC, as well as a peer review. Derek Todd will be the primary author of the report, drawing on his extensive experience of technical writing for a range of audiences, including to support public consultation.

A.8 Optional workshopping of results

As an optional extra, following submission of the final report, we would be available to workshop the key findings of the hazard and risk assessment to the relevant KCDC staff and council members. It is our experience that the opportunity to explain and discuss the findings of the project to key members of the client's team has been a very valuable addition to projects of this nature.

A.9 Risks and Limitations

The most significant risk to the study is around the supply and quality of the data required to input into the erosion and coastal inundation modelling, and the uncertainties about future changes in ground and flood bank levels. These include:

- That the previous digitised past shoreline positions up to 2007 from CSL (2012, 2008) are technically accurate and digitally available, and if not, that errors associated with aerial photographs georeferencing and shoreline digitising can be minimised to a satisfactory level to allow meaningful extrapolation of results into the future.
- That trends in erosion rates over time are appropriate to extrapolate into the future.
- Assumption that the future sediment supply from the Otaki River and the Waikanae River and transport alongshore will be at similar volumes and directions as at present.
- Assumption that present day shoreline protection structures will be the same as at present, or if removed/destroyed/overwhelmed, they are not replaced.

- That the information on wave climate, water levels and bathymetry is enough to define the closure depth (for SLR erosion assessment) and 1% storm (for short-term erosion effects).
- That the 1% AEP storm wave characteristics will still represent a similar storm frequency at the end of the planning period being considered.

These risks and limitations will be managed by consideration of the methods to be employed and reporting of the additional levels of uncertainty of results.

Stage 2: Technical Advice to the Takutai Kāpiti Community Assessment Panel

Following the successful delivery of the Coastal Hazard and Risk Assessment, we will provide ongoing technical advice and support as required to the Takutai Kāpiti Community Assessment Panel to assist in the development of coastal adaptation pathways and working towards a district plan change.

In this role, we will offer technical advice drawing on our experience to identify potential adaptation options that might be suitable for each coastal unit to manage coastal hazards over the next 100 years. We can then support the panel to assess the merits and applicability of each of the options in a structured multi-criteria assessment to refine down to a short-list of adaptive pathways for each of the eight coastal units. Jacobs has extensive experience in the development of robust coastal adaptation strategies assisting our clients in planning and managing their risks into the future with phased actions and confident triggers for implementation. Our team provides KCDC with access to expertise in a broad range of mitigation options ranging from hard coastal engineering solutions such as seawalls, rock revetments, groynes etc. to softer nature-based solutions such as beach re-nourishment, dune planting, vegetation etc.

We see our role in stage two as a technical advisory role, in which we can provide high level advice on an as required basis.

Derek Todd will be our nominated Technical Team Leader, who will be available to be present at the six-weekly Community Assessment Panel meetings. Derek is NZ based and has completed numerous coastal hazard and risk assessments across New Zealand in the context of adaptive planning and inputs into district planning, will be on hand to provide local expertise and advice on a regular basis. Derek will draw on his experience in working with other NZ councils to define and manage coastal hazards and in providing quality control in presenting information to communities.

KCDC and the Community Assessment Panel can also draw upon advice from our international expertise, Adam Hosking who has led the development of the UK Defra 2006 Shoreline Management Plan Guidance, and Samuel Watkin, our APAC coastal engineering technical director who has led the delivery of a range of coastal management strategies globally including the development of both hard engineering and nature-based coastal protection solutions. Jacobs also has extensive in-house coastal modelling capability which can be drawn upon by KCDC as required to test the effectiveness of the selected short-list adaptive pathways. This would enable the Community Assessment Panel to quantify and compare the performance of the adaptive pathways to assist in the selection of preferred options. From our extensive experience in

conducting risk assessment projects, our team knows that it is important that the focus is on the level of risk reduction achieved by an adaptive pathway, not the straight cost benefit analysis which can lead to selection of an option that provides little in terms of risk reduction. For example; the use of posters to warn people against the carriage of dangerous goods in the mail stream against the installation and use of x ray machines to scan all mail items.

Following the preparation of the Coastal Hazard and Risk Assessment report, to assist with developing adaptive coastal pathways plans for each coastal community we will provide best practice advice in the role of Technical Adviser to the KCDC Coastal team and Community Assessment Panel(s). It is anticipated that this role will include assisting with the development of initial long-list of adaptation options that might be suitable for each coastal unit, then providing best practice advice in assessing these options to develop a short-list of possible adaptive planning pathways over a 100-year timeframe for each coastal unit. In providing adaptative pathways advice, we would use several analysis tools such as criteria for a Multi-Criteria Analysis (MCA), Cost Benefit Analysis, sustainability and value by design tools, and an interactive adaptative management exercise tool developed by Jacobs. Jacobs developed an Adaptive pathways tool for Christchurch multi hazard study to assist decision makers in identifying the best adaptive pathway options to be considered going forward. This tool can be adapted for use for KCDC and the Community Assessment Panel.

It is anticipated that this technical advisory role will involve the presentation of best practice advice to the KCDC Coastal Team and the Community Assessment Panel(s) via technical memorandums and the presentation of technical information at Community Assessment Panel workshops.

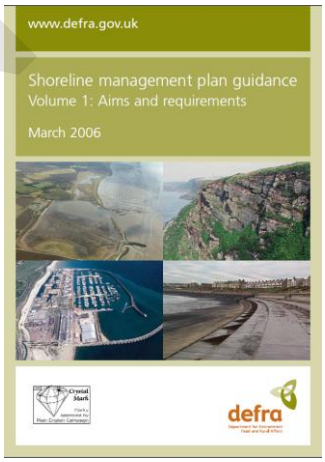
2. Capability to Deliver	Weighting 40%

Capability Overview

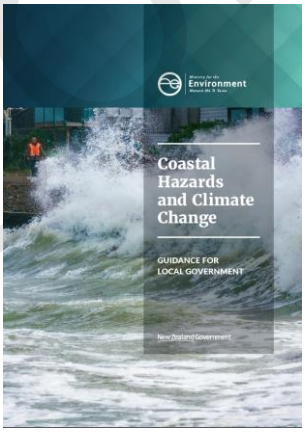
At Jacobs, we're challenging today to reinvent tomorrow by solving the world's most critical problems for thriving cities, resilient environments, mission-critical outcomes, operational advancement, scientific discovery and cutting-edge manufacturing. We turn abstract ideas into realities that transform the world for good.

With USD13 billion in revenue and a talent force of approximately 52,000, Jacobs provides a full spectrum of professional services including consulting, technical, scientific and project delivery for the government and private sector.

A key advantage of Jacobs relates to the breadth of our offices throughout Australia & New Zealand and the depth of our global resources. We are committed to bringing Global Solutions and Technology Leaders to work with our local team, to actively contribute to projects. For this project, we have compiled a team of local and international experts in the fields of Coastal Science, Coastal Hazards, Coastal Engineering, Coastal Modelling and Environmental. The team has the ability, experience and local knowledge to assist KCDC in t comprehensive assessment of coastal hazards and the development of sustainable adaptation pathways to form a robust strategy. **Adam Hosking** – one of our Technical Advisors, based in the UK - is Jacobs' Global Solutions Director for Resilience and has led the development of the **UK Defra 2006 Shoreline Management Plan Guidance;** which outlines the framework by which the governing body (Environment Agency) assess and manage coastal hazards in the UK.



Complementing our global reach is our local experience of delivering coastal hazards projects and other related studies for local councils in New Zealand. Jacobs Technical Team Lead, **Derek Todd**, is our principal coastal scientist based in New Zealand. Derek has extensive experience over the last 35 years in monitoring and investigating coastal processes and hazards, assessing potential future changes in coastline and river mouth stability, in defining coastal erosion and inundation hazard zones, and appearing in Environment Court as an expert witness. Derek has delivered numerous coastal hazard assessments throughout his career which includes setting up the regional coastal profile database for the South Canterbury Coast, mapping initial coastal hazard zones for Ecan, and numerous hazard assessments of Timaru district Council and PrimePort Timaru.



The Jacobs multidisciplinary coastal and spatial team has delivered, and is currently delivering, numerous coastal projects in New Zealand over the last few years, including sea level rise hazard assessments for the Waimakariri District Council and the Hurunui District Council, multi-hazard and shoreline condition projects for Christchurch City Council.

All the work our coastal team delivers involves a component of coastal process assessments, whether it be from a coastal hazards or coastal science perspective. Often these assessments will also involve a geological component, given the diverse nature of the New Zealand coastline. A recent project we delivered for the Hurunui District Council involved an assessment of the earthquake effects of an alluvial cliff in a coastal setting. We have a specialist geotechnical engineering team situated in our local team who can be drawn upon to assist with geological assessments.

Due to a large amount of Jacobs work being in the local government arena, we have extensive experience in presenting and disseminating technical information in a range of formats to a range of audiences. In our recent Estuary Edge Condition Inventory project for Christchurch City Council we were involved with engagement and presentations with council planning and technical staff throughout the project, as well as with Councillors, Community Boards, and community meetings. A key part of this engagement was the production of clear and easy to understand maps by our in-house spatial team.

Derek Todd also has an extensive amount of experience in presenting technical information at both RMA and Environment Court hearings. Complimenting the experience of Adam & Derek, we also have **David Cobby** from Jacobs as a Technical Advisor in this project. David has stayed in New Zealand for many years to deliver complex land drainage, economic and strategic multi-hazard projects required because of the Christchurch earthquakes, and to drive adaptation to future climate change and, particularly, sea level rise. Presently located in UK, he continues to lead key projects in New Zealand while presenting work at international conferences. He has been a Technical Director in Jacobs' Climate Resilience and Adaptation Group, with a key role in growing and delivering Jacobs business with Lead Local Flood Authorities. He also led development of a range of Flood Risk Management and Water Resource Management tools based in GIS and other industry standard packages

The project manager from Jacobs will be **Anthony Kubale** who has worked as an Environmental Consultant with 10 years' experience specialising in Environmental Sciences and Management services across a range of marine and terrestrial industries. Anthony has worked with KCDC on previous projects including the Kenakena Stormwater Upgrade project and as part of the Jacobs team that undertook regular stormwater sampling programme. Anthony is experienced in coordinating and managing large multidisciplinary teams and delivering complex projects that meet client expectations whilst ensuring any potential environmental issues are identified and mitigated.

Samuel Watkin is our Coastal Engineering Specialist and a Chartered Civil Engineer (CEng) with extensive experience in the field of coastal engineering. Sam has led the delivery of strategic coastal hazard management strategies and the design of coastal erosion and inundation mitigations to support the sustainable management and development of coastlines around the world.

Sam has significant experience in the design of both coastal protection and management solutions including rock and armour unit breakwaters, rock revetments, wave return and vertical walls, beach re-nourishment, scour protection, groynes and natural vegetation solutions.

In addition to this, the support team includes Joris Jorissen & Damien Debski who have a wealth of applied coastal-hazard and coastal modelling experience to support the team.

2.1 Health & Safety

Jacobs are deeply committed to ensuring the health and safety of our staff and clients and have developed mandatory health and safety management systems that are regularly audited and reviewed to ensure compliance with legislation and industry practice. The Jacobs ANZ HSE system is certified to **AS/NZS 4801:2001** (Safety Management Systems), **OHSAS 18001:2007** (Occupational Health & Safety Management Systems) and **AS/NZS 14001:2015** (Environmental Management Systems). These certifications are valid until November 2022.

All Jacobs site offices have a health and safety management plan which ensures the health and safety for Jacobs employees in our site office and clients who visit.

Additional health and safety requirements for projects are addressed through our Project HSE Work Procedures documents, in which the project manager will develop a Health and Safety Field Work Pack. The health and safety fieldwork package include a risk assessment and job safety evaluation. 'Step back' forms are completed in the field by site workers when on site to identify any additional risks which were not addressed in the field work pack and allows the site worker to evaluate the safety of the job and decide if it is safe to carry out the fieldwork on the day.

We anticipate that the fieldwork for this project will involve a site visit to various spots along the Kāpiti Coast coastline to help determine any boundaries of morphological cells along the shoreline that will require different approaches to future erosion modelling, and to get a more detailed appreciation for coastal processes operating within the cells. KCDC staff will be invited to attend the site visit for which we will develop a Health and Safety Plan for staff attending using our internal systems. This health and safety plan will be reviewed and approved internally at Jacobs and can be supplied to the Council if requested.

With the dynamic and changing environment surrounding the recent COVID-19 outbreak, Jacobs also has the capability for staff to work remotely. This is to ensure the health and safety of staff and clients as they remain our top priority. We understand that this is an evolving situation, however KCDC can be assured that works can still be carried out should the staff require self-isolation. Should this occur, we also have an ability to host online meetings between Jacobs and KCDC to allow for staff to connect in remotely to minimise exposure to the virus.

2.2 Quality Assurance & Control

Jacobs is committed to providing you with quality services, delivered in a reliable and responsible fashion.

Jacobs's quality system has been certified by DNV certifier around the globe as meeting the requirements of ISO 9001:2008 "Quality Management Systems - Requirements". The system applies

to all facets of Jacobs operations and includes a quality manual, mandatory quality procedures, and a set of guideline manuals procedures, flowcharts and forms, for a range of activities.

Quality Assurance is defined as "all those planned and systematic actions necessary to provide adequate confidence that agreed requirements will be met" Confidence that services with appropriate quality will be delivered for every project comes from adequate preparation and planning. Our Management Systems have been constructed in a manner which makes them compliant with international standards.

We have developed and operate total quality management procedures under which we ensure all design documentation, together with programme objectives are independently checked and closely monitored throughout the commission.

In addition, we carry out regular 'peer' reviews of all our projects to ensure that the deliverables are most appropriate for the client brief and that the best practices are being offered. More specifically than the mentioned accreditations, we would note that our quality assurance procedures are designed primarily to provide a quality service that delivers effective solutions and provides exceptional value to our Clients as their consultant of choice. The achievement of this goal is supported by the Group's management systems that embrace both quality assurance and continual improvement of our service.

- Quality Assurance provides confidence to our Clients' our own management and our shareholders that our service will meet their expectations on quality. Our Quality Assurance System which complies with ISO 9001:2008 emphasises the importance of adequate planning and review in the delivery of a quality service and aims to meet our Client's requirements on each consulting commission undertaken.
- Continuous improvement addresses another of our key goals, which is to develop our reputation, people, and technologies and finances so that we have a sustainable practice. It includes improved Client interaction, more effective learning from our project experience and more support for our Project Managers so that they can apply the right technology and enhanced risk management to projects. Our service targets exceptional value and is reinforced by our culture of openness, teamwork and sharing of experience.
- Personal attitudes, co-operation, teamwork and a keen sensitivity to the continual improvement of our services are strongly encouraged.
- On each project, a Project Quality Plan is developed and maintained. This includes a plan for formal design reviews of the project, which are carried out at key stages in the project by a dedicated review team. Records of these meetings are retained within the Quality file, noting the actions required and taken. This system aims to bring the best concepts and ideas to each project, and to achieve design documentation of the highest standard.
- Audits of quality on each project are regularly carried out by our Regional Quality Manager and in addition to this; each one of our global offices is fully, rigorously and internally audited by our global Group Quality Manager. Although they are not related to accreditation purposes, we take these internal audits very seriously as a measure of how we are delivering our intended quality to clients.

In addition, several our offices have recently received accreditation to ISO 14001 as part of the firm's policy to hold international recognition for its Quality, Environment and Health & Safety Management Systems and their application on our business.

We also recently received an accreditation to BS 10500:2011 Anti-Bribery and Anti-Corruption (ABC) as part as our approach to ensure to meet our corporate legal and moral obligations. The approach mitigates risk of non-compliance with the UK Bribery Act 2010, Foreign Corrupt Practices Act (United States), and legislation in any other jurisdiction pertaining to anti-bribery and corruption. The UK Bribery Act sets the highest bar in terms of obligations and compliance. By complying with this Act, Jacobs ensures that we meet or exceed the obligations required in other jurisdictions in which we operate. Jacobs's processes have been reviewed and meet the British Standard for Anti-Bribery Management Systems. Jacobs encourages all employees to report any instances or attempts of bribery and corruption.

2.3 Specialist Software

In addition to the standard reporting & analysis software and spatial tools based in ESRI ArcGIS and/or Feature Manipulation Engine environments, we can provide the following specialist software relevant to this project, the first two of which are unique to Jacobs.

- **CLIMSystems Software and Services for Climate Change Assessments:** Jacobs part own CLIMSystems, which is based in Hamilton and provides state-of-the-art climate change risk and adaptation assessment tools and services. CLIMSystems designs and develops advanced software systems for assessing impacts and adaptations to climate variability. CLIMSystems has assembled an excellent team of climate change adaptation and risk assessment experts with a combined experience of over 200 years with projects in over 50 countries. Jacobs, through its acquisition of CH2M in 2017, acquired a part share in CLIMSystems and our combined experience includes iconic projects in Africa, the Middle East and the United States. Six members of the extended team were part of the large team named as part of the UNFCCC Nobel Peace Prize award in 2007 and, as such, represent the strong scientific underpinning of the CLIMSystems suite of data products, software and services. In New Zealand, CLIMSystems is a member of the recently convened Science & Research Services Panel under the Ministry of the Environment. Through Jacobs part ownership, and our relationship with the company and its managing director Dr Peter Urich based in Hamilton, we offer Council unique access to this world-class resource.
- **FloodFX Flood Management Cost Benefit Software:** Jacobs has developed a GIS-based tool and methodology (termed FloodFX) for Christchurch City Council, to appraise the economic benefits and costs of stormwater infrastructure schemes across the city. Delivery required joint working between expert Jacobs resources in Christchurch, UK and Australia to deliver a cutting-edge GIS-based calculation and viewing tool, based on international best practice in flood economics. The study facilitated closer working between Council, NIWA and other parties in the relevant area of the economics of flood management and adapting to climate change. Using the same theory and spatial framework, we could develop a similar tool for Council.

- **Coastal Process and Engineering Packages:** We hold licenses and are proficient users of many coastal processes and engineering packages, including:
  - DHIs **MIKE coastal modelling software packages**. MIKE is the leading software package for 2D/3D modelling of hydrodynamics, waves, sediment dynamics, water quality and ecology. It includes simulation engines for tidal flows, storm surge, wave propagation, sand and mud transport, water quality, harbour and structure impacts, advection-dispersion, and oil spills. The team also runs the LITPack suite of models which simulates sediment transport to project potential beach erosion and shoreline change over time.
  - The Delft University of Technology's **SWAN** spectral wave modelling software is a third-generation spectral wave model that computes random, short-crested wind-generated waves. The model considers propagation in time and space with shoaling and refraction due to depth included. Waves can be generated applying wind throughout the model or by specifying boundary conditions, or a combination of both.
  - Veritech **CEDAS** (Coastal Engineering Design & Analysis System), an interactive windows-based software package for engineers and scientist working in coastal environment including modules for wave prediction, transformation, set-up and run-up, sediment transport, shoreline erosion, inlet processes, structural and harbour design.
  - Interactive version of US Army Corp of Engineers **CEM** (Coastal Engineering Manual) containing formulas and interactive graphs for coastal hydrodynamics, sediment processes and geology.

2.4 Data

We have access and experience of using a range of coastal data for analysis, optioneering and presentation for coastal planning. For example, we have access and experience of the NZ Coastal Sensitivity Index Data which is only available from NIWA, and similarly for the NZ coastal hydro system database. More specifically, through our team's delivery of work for both Kāpiti Coast District and Greater Wellington Regional Councils, we have a good understanding of the data available and insights into past decisions, as well as community feedback and views.

Relevant experience and track-record

Jacobs has a long history of delivering projects collaboratively with KCDC. One of the longest ongoing Projects with KCDC that Jacobs had was the **Global Stormwater Discharge Consent Monitoring and Reporting Program**. Jacobs (then SKM) prepared the original resource consent application for global network stormwater discharge consents in 2006, and during the ten-year duration of that consent we undertook a range of environmental monitoring (stormwater, freshwater, coastal, and sediment quality) and submitted annual consent monitoring reports on behalf of KCDC to Greater Wellington Regional Council, fully compliant with the consent requirements. Jacobs also designed and consented several stormwater treatment wetlands to mitigate the impacts of stormwater quality on the receiving aquatic environments from several higher risk catchments. In 2016 KCDC engaged Jacobs to prepare a new global stormwater consent application under the proposed Natural Resource Plan for the Wellington Region (pNRP). Jacobs prepared the application and consent conditions, and liaised with GWRC consents team with KCDC, and KCDC received their new 5-year global stormwater discharge consent in 2018. Jacobs are now successfully helping KCDC to manage this new consent through the first year, in consultation with the three iwis in the District. Jacobs have a strong and trusted relationship with KCDC through this and our work with the solid waste management team.

Jacobs has extensive national coastal hazards experience across New Zealand recently working with the Hurunui District Council, Christchurch City Council and Otago Reginal Council, Environment Canterbury, Timaru District Council and Waimakariri District Council to support them in the assessment and management of their coastal hazards. We have also advised the New Zealand Ministry of Foreign Affairs and Trade (MFAT) with coastal hazards and resilience issues to support their foreign aid programs across the Pacific Islands.

Since 2013, Jacobs have managed KCDC's three landfill consents for Otaihanga Landfill (nearing closure), and Otaki and Waikanae closed landfills. Jacobs have successfully conducted compliance monitoring since 2014 and gained full compliance on KCDC's behalf each year. Jacobs successfully sought and designed the resource consents and consulted with iwi to design and build several landfill leachate treatment wetlands, and we are supervising the construction about to begin.

Jacobs (and previously SKM) built Kāpiti's flood models and developed flood hazard maps for the entire District that were incorporated into the District Plan. KCDC continue to engage Jacobs for ongoing flood queries for new developments seeking to build in sometimes flood prone areas. Jacobs query the models and advise KCDC on these new developments and their potential to exacerbate existing flood levels and risks to properties.

Jacobs has been at the forefront of developing coastal hazard assessment procedures internationally and in the UK have been instrumental in the development of Shoreline Management Plans (SMP) for large areas of the UK coastline which include the assessment of coastal hazards and risk assessment. This included the development of eleven first round SMPs in the UK between 1994 and 1999 and leading the production of the 2006 central government

Procedural Guidance. In developing this guidance, we undertook three 'pilot' SMPs in the UK (Kelling to Lowestoft, South Foreland to Beachy Head, and Beachy Head to Selsey Bill), and subsequently went on to complete a third of all Plans produced. Further to this UK experience, we have evolved and tailored the UK SMP approach for application to the specific needs of several international locations, including Belize and Louisiana.

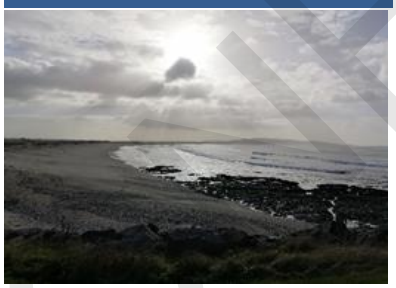
We have chosen the following projects to demonstrate relevant experience and track record for the Kāpiti Coast community-led coastal adaptation project. These project examples highlight our national and internationally-recognised capability in the assessment of coastal hazards and the development of targeted adaptation pathways. The project examples also include projects where we have worked collaboratively with Kāpiti Coast District Council over the last 20 years, to provide the sustainable solutions for the local communities.

Project Name	**Hurunui District Coastal Hazard and Risk Assessment**
Client Name	**Hurunui District Council**
Project Dates	**August 2019 – May 2020**
Team Members	**Derek Todd (Technical Team leader), Kate MacDonald**

Project Scope: Jacobs have been commissioned by Hurunui District council to undertake a coastal and groundwater hazard assessment at six different coastal settlements situated within the Hurunui District coastline to determine the impact in which sea level rise will have on their coastal residents. This project is using historical literature, aerial imagery, ECan beach profile data and LiDAR surveys to assess coastal erosion and coastal inundation hazards under RCP8.5 and RCP8.5+ scenarios for 30, 50- and 100-year projections. The vulnerability and risk of these coastal settlements was assessed using populations, building footprints and property boundaries to assess how the populations and assets will be affected. We will now be involved in community engagement as the start of adaptive planning pathways in the Hurunui District.

Relevance: The erosion hazard assessment methodology and risk assessment methodology are very similar to what we are proposing in this project. We found on delivery that by providing a risk assessment on a dwellings/properties basis that the council could use this information to inform decisions around when communities are likely to become impacted in the future with SLR, and how significantly they may be impacted.

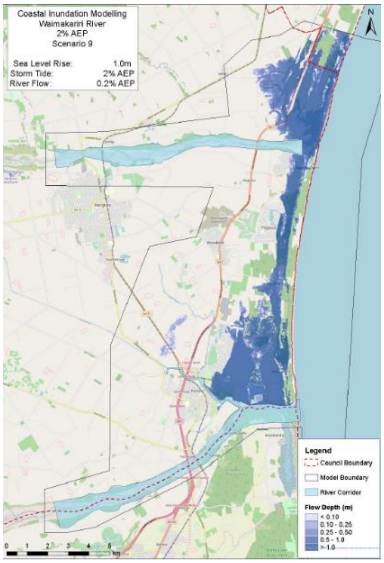
Project Name	**Molyneux Bay – Clutha Delta Climate Change and Geomorphology Investigation**
Client Name	**Otago Regional Council**
Project Dates	**June 2020 – Present**
Team Members	**Derek Todd (Technical Team leader), Kate MacDonald, Damian Debski, Sam Watkin**



Project Scope: Jacobs is currently undertaking work with Otago Regional Council conducting a climate change and morphological investigation into the expected shoreline change with future sea level rise along Molyneux Bay, at the two mouths of the Clutha River. The assessment is looking at shoreline change over the next 50 years with consideration of the future presence of river mouth training wall structures, which have had a severe impact on sediment transport and subsequent erosion along this section of shoreline since the 1980's. This assessment is also taking a two-stage inundation approach in the lower Clutha using a 'bathtub' approach with a 1% AEP storm event and SLR, which will proceed to stage 2 (hydrodynamic modelling) if it is flood banks are seen to be overtopped in the stage 1 assessment.

Relevance: This project uses a similar methodology for determining the erosion hazard along a coastline and has consideration of coastal protection and river mouth training structures. This assessment is looking at coastal hazards in terms of asset management for a council, in which the information will help ORC determine how much maintenance they will need to do on their structures over the next 50 years, and what the effects of maintaining these structures might have.

Project Name	**Waimakariri District Coastal Hazards Assessment**
Client Name	**Waimakariri District Council**
Project Dates	**2018**
Team Members	**Derek Todd (Technical Team Leader), Damian Debski, Joris Jorissen (Reviewer)**



Project Scope: Jacobs was commissioned by the Waimakariri District Council to provide information on the extent of future coastal erosion and sea water inundation hazards including the impacts of sea level rise and other climate change effects on coastal processes, to help districts approach to managing natural hazards over a 50- and 100-year planning time frame. Stage 1 of the project involved bathtub modelling of coastal inundation using LiDAR surveys, as well as coastal erosion zone mapping using historical aerial imagery and GIS software to determine historical shoreline change rates. With stage 1 having identified areas at risk of coastal inundation as per the bathtub modelling, stage 2 undertook hydrodynamic modelling to further define the interaction of sea water inundation with fluvial flooding and elevated groundwater levels under coupled fluvial flood and sea level rise scenarios.

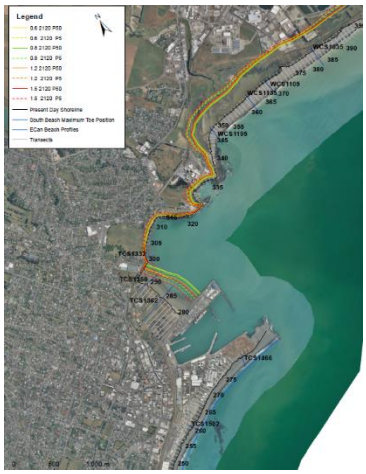
Relevance: This project used a similar methodology as is proposed for the KCDC coastline, where similar methods including DSAS tools to define the historic coastal erosion rate, and a staggered approach was used to determine the level of inundation required. This project shows that this methodology has been successfully tried and tested in a local government setting in the context of a plan review before. This assessment also looked at the interaction of fluvial flooding and elevated ground water levels rise sea-level rise, which would be also explored in the KCDC district.

Project Name	**Southshore Erosion Management**
Client Name	**Christchurch City Council**
Project Dates	**2020 - Ongoing**
Team Members	**Derek Todd (Technical Team Leader), Sam Watkin, Kate MacDonald**

Project Scope: Jacobs have been commissioned by Christchurch City Council to undertake an assessment of possible engineering options to implement along the Southshore estuary edge to mitigate the erosion hazard. When developing options, consideration was had to the ability for the structures to be able to be adapted in the future as sea levels rise. Through this process, Jacobs have liaised with the community nominated technical expert to help develop some possible solutions and have continued to engage with the community through public drop-ins, community board meetings and Residents Association Annual General Meetings. Jacobs have led a transparent process with the council to ensure the community continue to be informed about the future of their shoreline.

Relevance: This project demonstrates Jacobs experience in working with communities and council to develop adaptable strategies to tackle erosion issues in coastal communities.

Project Name	**Timaru Coastal Erosion Hazard Assessment**
Client Name	**Environment Canterbury and Timaru District Council**
Project Dates	**October 2019 to July 2020**
Team Members	**Derek Todd (Technical Team Leader), Damian Debski, Joris Jorissen (Reviewer)**



Project Scope: Jacobs were commissioned by Environment Canterbury to undertake a coastal erosion assessment along the entire Timaru District coastline for input into their next District Plan. This assessment used a probabilistic approach to calculate projected future shorelines with varying degrees of sea level rise across many complex morphologies along the coastline, including gravel barriers, mixed sand and gravel beaches, loess cliffs, alluvial cliffs, basaltic headlands and sand beaches. The assessment looked at coastal erosion over a 50 and 100-year timeframe under various sea level rise scenarios. A parallel assessment of coastal inundation hazards was undertaken by NIWA acting a s a sun consultant to Jacobs.

Relevance: This project used a similar methodology in assessing the erosion hazard as is proposed for the KCDC coastline. This methodology aligned with the MfE (2017) guidance and is being used in the district planning process. This methodology underwent an independent review and shows that this approach is appropriate for use in the public domain, and to help inform future planning in the district.

Project Name	**Temaiku Land and Urban Development Project**
Client Name	**New Zealand Ministry for Foreign Affairs and Tourism**
Project Dates	**2017 – 2019**
Team Members	**Sam Watkin (Technical Team Leader), Joris Jorissen (Coastal Modeller), Anthony Kubale (Marine Science) and Bruce Clarke (ESIA Lead)**

Project Scope: The New Zealand Ministry for Foreign Affairs and Tourism (MFAT) is supporting the Government of Kiribati (GoK) in the consideration of undertaking a land reclamation and urban development project in the Temaiku Bight, South Tarawa, Kiribati. The Project will assist Kiribati in adapting to climate change through raising the height of the land by 2 m within 290 hectares of land, which is estimated to provide protection against sea level rise over the next 200 years. Other benefits of the Project would include reclamation of low-lying land for development, which will to some extent help to address overcrowding on South Tarawa in the short-term. The project included assessment of coastal hazards to assess the resilience of the existing land and the proposed development. Coastal management practices were ingrained into the design to mitigate future risk of erosion and inundation including adaptive designs to address long term future rick such as coastal management buffer zones and future modifications to seawalls to address future sea levels.

Relevance: Undertaking stakeholder engagement in a culturally appropriate manner to develop adaptive climate change mitigation options and demonstrated experience and skills in conducting coastal modelling to predict the impacts of sea level rise.

Project Name	**Reducing Coastal Hazards Risks in Tokelau**
Client Name	**New Zealand Ministry for Foreign Affairs and Tourism | Tokelau**
Project Dates	**2018 - Ongoing**
Team Members	**Joris Jorissen (Coastal Hazard Specialist), Derek Todd (Coastal Hazard Specialist), Sam Watkin (Coastal Engineering) and Anthony Kubale (Marine Science)**

Project Scope: Tokelau comprises three remote coral atolls with fragile environments. As a nation consisting of three low lying coral atolls, coastal hazards have impacted built and natural assets across Tokelau in the past. Climate change effects and sea level rise are expected to significantly exacerbate the existing levels of coastal hazards.

Jacobs has an on-going commission with MFAT and the Government of Tokelau to define impacts of coastal change and climate change to develop a focused resilience strategy and adaptive pathways for coastal hazards and a business case for investing in a management plan. Extensive community consultation on a national level with atoll councils, Fatupaepae (women's committees) and Aumaga (able bodied men) on each of the atolls was undertaken to inform the programme design.

Relevance: Undertaking stakeholder engagement in a culturally appropriate manner to develop adaptive climate change mitigation options and demonstrated experience and skills in the Coastal hazard and risk assessment of sea level rise on marginal low-lying land.

Project Name	**Resilience Planning for Economic Development in Belize**
Client Name	**Inter-American Development Bank**
Project Dates	**October 2016 – April 2018**

Project Scope: Jacobs (Adam Hosking) developed a strategy for long-term coastal resilience for the Corozal Bay region of northern Belize (85km of coast) against vulnerabilities to natural disasters and climate change. Key project elements included:

- Definition of coastal hazards, including climate change.
- Development of a long-term SMP for the Corozal Bay, based on an evolution of the UK SMP approach
- Planning and design of four demonstration nature-based shoreline stabilization projects
- Engagement of local community groups and stakeholders to inform development of outputs.
- Training to ensure stakeholders can apply lessons from demonstration projects and SMP.
- Socio-environmental and economic feasibility studies for sustainability of recommendations.

Recommendations were made for coastal resilience priority areas, targeting support for tourism and economic growth. Preliminary shoreline stabilization designs were developed, integrating nature-based approaches and complementary non-structural measures. These will act as demonstrations for delivering sustainable resilience elsewhere in Belize and the wider region. The outputs were also used to underpin a comprehensive SMP for Corozal Bay, which sets out the long-term coastal resilience strategy.

Relevance: Experience in developing long-term coastal resilience using adaptative pathways and community engagement.

Project Name	KCDC Stormwater Monitoring and Resource Consenting
Client Name	Kāpiti Coast District Council
Project Dates	2004-2020

Project Scope: Jacobs (SKM) has been undertaking stormwater quality monitoring for KCDC in 2004. In 2005 we prepared the application for the first stormwater discharge consent, which expired in 2015. We have provided stormwater monitoring, reporting and consenting services since 2004. Earlier work included routine monitoring of water quality and specific technical studies, however in this section we have focused on more recent (past five years) activities. Key activities have included:

- Developing a technical report on the actual and potential effects of stormwater discharges on water quality in the district to support the application for temporary stormwater discharge resource consent as required by the Regional Plan.
- Creating an AEE to support the application for resource consent.
- Drafting an Adaptive Monitoring Plan (AMP) outlining the proposed monitoring to support the consent application.
- Applying for the resource consent and then responding to s92 requests which resulted in resource consent being granted.
- Working with KCDC and GWRC on an application to change the conditions of the consent which has involved close liaison with the Regional Council to discuss and seek agreement on potential changes.

Relevance: Familiar with the KCDC personnel and the Kāpiti area.

Project Name	KCDC Closed Landfill Monitoring and Consenting
Client Name	Kāpiti Coast District Council
Project Dates	Contract commenced 2013-Present

Project Scope: Jacobs has been providing the Solid Waste Services team at KCDC with professional consulting services since 2011. Our engagement with KCDC started as a review of the original resource consents at Otaihanga Landfill, which we re-wrote and then successfully obtained a s127 (change of conditions) for. In 2013, we took over the routine monitoring of the three KCDC closed landfills at Otaihanga, Waikanae and Ōtaki. This work includes quarterly monitoring of storm water quality, groundwater and landfill gas.

Over the duration of our engagement with KCDC, we have also completed a review of the Ōtaki and Waikanae resource consent conditions, design and construction supervision of three treatment wetlands on the Otaihanga landfill site and many other smaller pieces of work.

Relevance: Familiar with the KCDC personnel and the Kāpiti area and acting as KCDC 's trusted adviser over a number of years.

Project Name	High Level Assessment of Climate Change Impacts on Kāpiti's Groundwater
Client Name	Kāpiti Coast District Council
Project Dates	2012

Project Scope: Jacobs to undertake a preliminary, high level assessment of future climate change impacts on Kāpiti's coastal groundwater system. Groundwater levels are strongly influenced by the amount of rainfall recharge entering an aquifer system and by changes to system boundary conditions, such as sea level. The project provided understanding of how climate change (i.e. a wetter climate and sea level rise) will affect groundwater levels and saltwater intrusion, and hence the implications for both residential and commercial properties on the Kāpiti Coast. This preliminary study has been designed to investigate the sensitivity of the Kāpiti coastal aquifer system to a wetter climate and sea level rise.

Relevance: Familiar with the Kāpiti groundwater regime and its reactions to sea level rise.

Table 3: Summary of projects we have worked upon in New Zealand & Globally which highlights our experience specifically in Coastal Hazards.

	Project	Project summary	Multi Hazard Analysis	Coastal Erosion Assessment	Coastal Inundation Assessment	Vulnerability and Risk Assessment	Community Engagement	Technical Advisory/ review Role	Use in District Planning Process	Adaptive Management Planning
New Zealand Coastal Hazards Work	**Hurunui District Coastal Hazard Assessment** (Hurunui District Council) 2019- 2020	Coastal and groundwater hazard assessment at six different coastal settlements situated within the Hurunui District coastline to determine the impact in which sea level rise will have on their coastal resident over 30, 50- and 100-year timeframes.	✓	✓	✓	✓				
	Christchurch Multi-Hazards Investigation (Christchurch City Council) 2018-Ongoing	Multi-hazards investigation for coastal catchments for Christchurch City. Hazards considered included fluvial & pluvial flooding; sea level rise effects on coastal erosion, inundation, & groundwater levels; tsunami; earthquake, liquefaction, and mass movement.	✓	✓						
	Porirua Coastal Hazards Assessment Review (Porirua City Council) 2020	Independent peer reviewer for recent Porirua City Council commissioned report for coastal hazard assessment.						✓		

	Project	Project summary	Multi Hazard Analysis	Coastal Erosion Assessment	Coastal Inundation Assessment	Vulnerability and Risk Assessment	Community Engagement	Technical Advisory/ review Role	Use in District Planning Process	Adaptive Management Planning
	Waimakariri District Coastal hazards Assessment (Waimakariri District Council) 2018	Provide information on the extent of future coastal erosion and sea water inundation hazards including the impacts of sea level rise and other climate change effects on coastal processes, to help districts approach to managing natural hazards over a 50- and 100-year planning time frame.	✓	✓	✓				✓	
	Timaru Coastal Erosion Assessment (Environment Canterbury and Timaru District Council) 2019-2020	Coastal erosion assessment along the entire Timaru District coastline for input into their next District Plan.		✓					✓	
	Molyneux Bay – Clutha Delta Climate Change and Geomorphology Investigation (Otago Regional Council) 2020 - Ongoing	Climate change and morphological investigation into the predicted shoreline change with future sea level rise at Molyneux Bay, looking at shoreline change over the next 50 years with consideration of the future presence of river mouth training wall structures.		✓	✓	✓				✓

	Project	Project summary	Multi Hazard Analysis	Coastal Erosion Assessment	Coastal Inundation Assessment	Vulnerability and Risk Assessment	Community Engagement	Technical Advisory/ review Role	Use in District Planning Process	Adaptive Management Planning
	Southshore Erosion Management Strategy (Christchurch City Council) 2020 - Ongoing	This assessment is looking at conceptual design of appropriate shoreline protection strategies including both naturalized edges and hard engineering structures to provide erosion protection for the next 20 years, with the potential for adaptivity into the future with sea level rise.				✓	✓			✓
	Estuary Edge Condition Inventory (Christchurch City Council) 2019	This project was an assessment of the coastal structures in the Avon Heathcote Estuary, where a detailed map of each structure and surrounding land condition was mapped along the 7km stretch of shoreline to determine the change pre-post-earthquake.		✓		✓				
	New Brighton Hot Pools Coastal Hazards Assessment (Development Christchurch) 2019	Assessment of coastal hazards and sea level rise effects likely to affect a hot pools development on the beach at New Brighton. Included recommendations on coastal protection options for the development and adjacent sand dunes and preparation of Coastal Protection Management Plan for ongoing occupation of the beach front site.		✓	✓	✓				✓
	Auckland Sandspit Waste Enclosure Hazards Assessment	Coastal hazard assessment looking at the inundation hazard at a new waste enclosure site and determining options to mitigate risks.			✓	✓				✓

	Project	Project summary	Multi Hazard Analysis	Coastal Erosion Assessment	Coastal Inundation Assessment	Vulnerability and Risk Assessment	Community Engagement	Technical Advisory/ review Role	Use in District Planning Process	Adaptive Management Planning
	(Auckland City Council) 2019									
	Evans Bay Cycleway Detailed Design and Hazards Assessment (Wellington City Council) 2018	Coastal hazards assessment for the Evans Bay cycleway. This included an overtopping assessing current overtopping volumes along the extent of the existing seawall, and likely changes due to sea level rise over the next 50 (2070) and 100 (2120) years. For sections of the cycleway where seawalls are not present the potential for shoreline erosion due to sea level rise was also investigated		✓	✓	✓		✓		✓
International Jacobs Projects	**Resilience Planning for Economic Development in Belize** (Inter-American Development Bank) 2016-2018	Development of a strategy for long-term coastal resilience for the Corozal Bay region of northern Belize (85km of coast) against vulnerabilities to natural disasters and climate change.		✓	✓	✓	✓	✓		✓
	Temaiku Land and Urban Development Project (NZ Ministry of Foreign Affairs and	Multi-disciplinary feasibility study comprising coastal processes and geotechnical engineers (Joris Jorrissen, Sam Watkin), marine and terrestrial environmental scientists, social impact and stakeholder engagement specialists to determine the feasibility of raising 290		✓	✓	✓	✓	✓		✓

	Project	Project summary	Multi Hazard Analysis	Coastal Erosion Assessment	Coastal Inundation Assessment	Vulnerability and Risk Assessment	Community Engagement	Technical Advisory/ review Role	Use in District Planning Process	Adaptive Management Planning
	Trade) 2017-2019	hectares of land by 2m to provide protection against SLR for the next 200 years.								
	Tokelau Coastal Hazard Risk Mitigation Plan (NZ Ministry of Foreign Affairs and Trade) 2018	Strategic project to reduce the coastal hazard risks of three low lying coral atolls in the Pacific Ocean. The project scope included tropical cyclone modelling, assessment of the coastal inundation risks, including wave overtopping modelling and development of the risk mitigation options		✓	✓	✓	✓	✓		✓

Relevant skills and qualifications

We have put together an experienced and established multi-disciplinary team from Jacobs which has all the required local knowledge and international experience to deliver this project and meet the requirements. Our team will communicate with you through our experienced project manager Anthony Kubale and will be technically led by Derek Todd. The relevant qualifications and experience of our team are outlined below. For more details, please find attached their CVs as **Appendix A.**

Derek Todd	Technical Team Leader

Derek Todd is our Technical Team Leader due to his long experience in coastal hazard assessment and management. Derek is a Coastal Geomorphologist with over 35 years' experience in managing coastal resources, monitoring and investigating coastal processes and hazards, and assessing the potential future changes in coastline and river mouth stability. This experience includes time working in consultancy, local and central government, and universities in both New Zealand and Australia. Within this experience is 12 years of running his own specialised Coastal Management consultancy, DTec Consulting Ltd (DTec), in which Derek was involved in over 100 coastal projects throughout New Zealand, including over 30 coastal hazard assessments for a range of clients. Derek has developed a large degree of experience and skills at providing science advice on coastal hazards to inform planning decisions. His areas of expertise include Coastal Hazards, Coastal Planning & Management, Costal Processes & River Mouth Processes. His experience is further supplemented by working on projects like Environment Canterbury on the Timaru District Coastline, working with Christchurch City Council, Hurunui District Council, Waimakariri District Council & Tokelau Sea Level Rise Coastal Erosion Assessment for the Ministry of Foreign Affairs amongst many others.

Anthony Kubale	Project Manager

Anthony is an Environmental Consultant with 10 years' experience specialising in Environmental Sciences and Management Services for both private and public sector clients across a range of marine and terrestrial industries. Anthony has worked with KCDC on previous projects including the Kenakena Stormwater Upgrade project and as part of the Jacobs team that undertook regular stormwater sampling programme. Anthony has also been a core member of project teams delivering coastal resilience and adaptation in the Pacific for Kiribati and Tokelau and is excited to bring this experience to this project. He is experienced in coordinating and managing large multidisciplinary teams and delivering complex projects that meet client expectations whilst ensuring any potential environmental issues are identified and mitigated.

Bruce Clarke	Project Director

Bruce has worked on a number of projects where the impacts of climate change coastal infrastructure need to be assessed and mitigated, including Temaiku Urban Development and Cirebon Flood Risk Assessment development in Indonesia. As Project Director, Bruce will be responsible for the technical quality of the deliverables and will support the Project Manager in day to day management of the Project. He will liaise regularly with the KCDC Coastal team and other Project team members and provide strategic advice on impact assessment and issues as they arise. Bruce is highly experienced in this role, regularly working for a range of municipal, industrial and state sector clients in Indonesia, South East Asia, New Zealand, Australia, the Pacific Islands and the United Kingdom. Bruce was also a resident of the Kāpiti Coast for 10 years and has family which continues to reside there and as a result is very familiar with the area.

Adam Hosking	Technical Advisor

Adam Hosking has responsibility within Jacobs for Water Resources and Ecosystem Management, including stormwater, flood and coastal risk management, and climate change adaptation. With a background in coastal geomorphology, he is a Fellow of the Chartered Institute of Water and Environmental Management with more than 23 years' experience in projects and programs addressing coastal resilience. He has led shoreline management projects globally, including New York wastewater infrastructure resilience strategy following Hurricane Sandy, and in the UK, USA and the Caribbean.

David Cobby	Technical Advisor

David is a Chartered Scientist and Water and Environmental Manager with 16 years' experience in consultancy and academic research environments particularly on the sustainable management of flood risk (stormwater and groundwater) and interactions with other natural hazards. Up to 2015, he was a Technical Director in Jacobs' Climate Resilience & Adaptation Group, with a key role in growing and delivering Jacobs business with Lead Local Flood Authorities. He also led development of a range of Flood Risk Management and Water Resource Management tools based in GIS and other industry standard packages. David relocated to New Zealand between 2015 and 2019 to deliver complex land drainage, economic and strategic multi-hazard projects required as a result of the Christchurch earthquakes, and to drive adaptation to future climate change and, particularly, sea level rise.

David relocated back to Jacobs UK in June 2019 but continues to lead key projects in New Zealand. He presents work at international conferences and has authored numerous journal papers.

Sam Watkin	Coastal Engineering Technical Advisor

Sam Watkin has extensive experience in Coastal Engineering, having led the delivery of strategic coastal hazard management strategies and the design of coastal erosion and inundation mitigation designs to support the sustainable management and development of coastlines around the World. Sam has significant experience in the design of both coastal protection and management solutions including rock and armour unit breakwaters, rock revetments, wave return and vertical walls, beach renourishment, scour protection, groynes and natural vegetation solutions. Sam has worked on projects in Kiribati, Micronesia, Papua New Guinea, Naru, Indonesia, Phillipines, Morocco, Mexico and Malaysia.

Joris Jorissen	Coastal Modelling Technical Advisor

Joris has worked across many parts of the world as an engineer and numerical modeller on port development, mining, oil and gas and (water) infrastructure projects. His experience spans a wide range of specialist fields including natural hazards investigations, coastal processes assessments, coastal management studies, engineering design of coastal structures and dredging programs, and receiving water modelling. He has extensive experience in the assessment and numerical modelling of coastal and estuarine processes, particularly in relation to waves, (flood) hydrodynamics, sediment transport and water quality issues and has provided technical leadership to numerous challenging engineering projects during all phas**es of** project development, from pre-feasibility, feasibility, design and construction.

Damian Debski	Flood Risk Technical Advisor

Damian is a civil engineer with 25 years' experience, specialising in hydraulic modelling, analysis and assessment for a variety of applications from river and coastal flood risk studies and protection works to the detailed design of water and wastewater treatment works and major water conveyance systems. This experience includes two years working with physical models in the hydraulic research laboratory at Bristol University in the UK and over twenty years' experience in international engineering consultancy, working for Halcrow Group Ltd, CH2M HILL and, most recently, Jacobs.

Based in the UK for most of this period, Damian has worked on consulting projects elsewhere in Europe and in Asia. He relocated with Jacobs to New Zealand in 2018 where he has worked on projects to assess fluvial and coastal flood risk and flood protection measures in the Wellington, Manawatu-Whanganui and Canterbury regions. Clients include city, district and regional councils, national government agencies, water and power utility companies and commercial property developers.

Damian has also contributed to the development of the Flood Modeller Pro flood modelling software system, marketed and supported by Jacobs, and has provided training courses in flood modelling and using the software to a range of public and private sector clients. His areas of

expertise include River flood modelling and flood risk assessment, Coastal flood modelling and tidal flood risk assessment & Open channel and pipe system hydraulics.

Jasmin Callosa-Tarr	Spatial Specialist

Jasmin has over 25 years of GIS experience working in different disciplines and projects in New Zealand. She had been involved in a few hazard and resilience related projects. She was the main GIS resource in the NZTA National Resilience Project completed in 2018. The project reviewed and analysed the national road network based on its resiliency to tsunami, earthquake, flood and storm, and volcanic hazards using GIS. She was also involved in the Wellington Region Road Network Resiliency Project looking at tsunami and earthquake vulnerabilities over a few years (2008, 2012, 2017). Jasmin is also experienced in participatory GIS where communities are the main stakeholders were engaged to provide input in various community collaborative research and environmental and conservation activities.

Kristin Stokes	Flood Risk Specialist

Kristin is a senior hydrologist and hydraulic modeller who is experienced in modelling of rivers, stormwater networks, flood investigations, hydrological and hydraulic modelling and the analysis of hydrological data. Kristin's hydrological modelling experience includes rainfall-runoff modelling using the MIKE suite, HEC-HMS and RORB, baseflow modelling and low flow estimation. Kristin has had wide involvement in leading one- and two-dimensional modelling projects using hydraulic modelling software MIKE FLOOD, Innovyze ICM and HEC-RAS for flood hazard assessments, dam breaks, bridge replacement and road design. She is proficient in using GIS software for preparation of topographic inputs to models, analysis of input information and results and the presentation of output.

Tim Baker	Hydrogeologist / Ground Water Specialist

Tim is an experienced Senior Water Resource Scientist and Hydrogeologist with over 25 Years' experience. Tim's technical expertise is groundwater quality and assessing the impacts of land use on groundwater, however he is proficient in a range of water resource science including hydrology and water quality studies. Tim is based in our Wellington office and has delivered numerous projects to Kāpiti Coast District Council. He understands KCDC drivers well in respect to coastal inundation and the impacts of seas level rise on the local groundwater regimes

Nick Cooper	RMA Planner

Nick has 20 years' experience in environmental planning. This has primarily been in the provision of resource consent applications and the management of RMA processes. As a local government RMA Planner, Nick has been involved mainly with the case management of resource consents including completeness checks, notification assessments, preparation of public notices, conducting prehearing meetings, drafting of officer's reports, presenting evidence to Hearings Panels, drafting of conditions, and the provision of evidence to the Environment Court

Kate MacDonald	Coastal Scientist

Kate has been involved in several coastal hazard assessment projects including Coastal Hazard Assessments both the Hurunui District Coastline and the Timaru District Coastline, where Kate played a vital role in helping develop robust methodologies for determining the effect of sea level rise on different coastal environments, in order for the work to be used in the District Planning process. Kate has also been involved in collecting data in a coastal setting for the Estuary Edge Condition Inventory project for Christchurch City Council and has developed skills in reviewing and collating data for other coastal projects including a hazard review for Paramount Group Ltd. in Barrytown, and for Christchurch City Council around the Akaroa Wharf. Kate is proficient is GIS and uses these skills to clearly present findings of coastal hazard assessments to be used in the public domain.

3. Capacity to deliver	Weighting 10%

Capacity overview

Jacobs has put together a team and the right resources to meet the project deliverables' timeline. The Deliverable 1 - A Coastal Hazard and Risk Assessment Report by **December 2020** & the Deliverable 2 - Provision of best practice technical advice to the Takutai Kāpiti Community Assessment Panel(s) by **January 2021.**

Jacobs project management systems and resource trackers allow us to track workloads for individuals over time to decide the capability for future workload. Our Project Manager is Wellington based and will be responsible for ensuring that our team is well resourced, delivering on time and to the budget. Anthony Kubale will manage the team to ensure that the project is on track to deliver on time, within budget, and in line with Jacobs Health and Safety policy. Derek (nominated Technical Lead) and Kate will have the availability to ensure that the inputs for the Coastal hazard & risk assessment report are provided on time. For the Deliverable 2, Jacobs will use its extensive experience in community engagement for other climate change adaptation projects in the Pacific & NZ to assist the council in an effective and culturally appropriate consultation process with the affected communities. We will ensure that the Technical Lead Derek Todd is available to attend Community Assessment Plant (s) meetings on a six weekly cycle either in person or by video conferencing or if he is not available, an alternate from the Jacobs' team will be supplied as required.

In case required, we shall recruit additional local resources which will have the skills required to undertake some work if necessary.

With the dynamic and changing circumstances surrounding the recent COVID-19 outbreak, Jacobs has the capability for staff to work remotely should any members of our team be required to self-isolate. We understand that this is an evolving situation, however we do not anticipate that this would affect the timeline of this investigation at this stage. Jacobs utilises Microsoft Teams and Zoom video conferencing services on a regular basis for personnel and clients working remotely from our offices. We also have HDVC conferencing facilities in our offices.

4. Supporting local residents, local businesses and the local economy	Weighting 10%

4.1 Jacobs Relationship with the Kāpiti Coast

Jacobs has over a **30-year history** of providing consultancy services to the Kāpiti Coast and particularly to the Kāpiti Coast District Council in the areas of water resources, flood risk, transport and traffic studies, stormwater management, monitoring services, landfill rehabilitation and resource consenting. These services have enabled KCDC to meet its statutory obligations under the Local Government Act and Resource Management Act and to deliver valued engineering and science advise for policy development and for servicing ratepayers needs. Jacobs has a strong commitment to the Kāpiti Coast and to its development in a sustainable manner. We have been involved in sustainable housing developments on the Kāpiti Coast namely **Waikanae North and Ngarara** which are looked up to as models for the future developments in the area. Jacobs has also been involved in assisting businesses on the Kāpiti Coast including extensions to the **Kāpiti Cheese factory, Master planning of the Coastlands redevelopment.**

In addition, Jacobs has several staff members who reside on the Kāpiti Coast and are actively involved in the community.

4.2 Future Plans for association with Kāpiti Coast

If we are successful in securing this project, we would actively aim to continue to broaden our service offering to the Kāpiti area to assist in the sustainable economic growth of the area including local communities and businesses. Sea level rise and the resulting coastal erosion effects along the Kāpiti Coast are key concerns for the Council and local communities which have historically had some strong rigorous debate given several properties along coast have suffered loss of land due to storm events. Jacobs intention is that through this project a large degree of certainty can be provided to businesses and the community going forward as to the level of risk posed by climate change including changes to areas of coastal erosion, flood inundation levels, impacts on groundwater regime and on Council underground services , the mitigation measures that can be implemented in cost effective and sustainable manner so that ongoing development on the Kāpiti Coast can be planned for and managed accordingly.

The aim is to provide solutions that are effective in managing the level of risk posed but will not entail excessive costs and place undue financial burden of Council ratepayers and businesses.

KCDC, like many councils that we work with, aim to achieve the best project outcome for the best cost to maximise the return from rate payer investment. This is also an important objective for us, and we are committed to bringing value for money to KCDC from our services. To measure this value, we conduct assessments and performance appraisals on the value for money as part of a balanced scorecard. This way we stay accountable by tracking our delivery with our commitments and taking responsibility for our own performance. Ultimately, delivery on time, cost and programme is the underlying measure, but how we do that the value for money assessment is critical.

Jacobs Value Plus is method of measuring the capital value savings from our engineering (design) work. To date, globally, we have saved 70% of our fees through Value Plus, which is unprecedented

in the consulting market. In NZ, our Value Plus is supported by Sustainability Plus, which measures environmental, community and programme (time) savings that do not necessarily have an easily quantifiable dollar value. Jacobs and our panel partners are committed to KPI measures to demonstrate evidence of our Value for Money to KCDC.

4.3 Sustainability Framework

The Jacobs framework for sustainability, **PlanBeyond**, sets out how we integrate sustainability into our business and is outlined in the graphic below. We are committed to establishing sustainable practices in our own offices and contributing to the communities in which we live and work. The outcomes of the work we do with our clients reaches far beyond individual projects.

4.4 Diverse Networks

Globally, Jacobs is focused on inclusion and diversity. Our willingness to embrace diversity of thought, background and experience helps us create imaginative and responsive solutions for our clients and the community. In February 2020, **Jacobs in New Zealand joined the Diversity Agenda and become an Accord signatory**. It is a joint initiative from Engineering New Zealand, the New Zealand Institute of Architects and the Association of Consulting Engineers New Zealand. Launched in early 2017 with an initial goal to see 20% more women engineers and architects, the campaign has since expanded beyond gender to encapsulate the full range of diversity and inclusion.

4.5 Priority Social Group: Maori, Pacifica and other ethnic minorities

We also honour the unique position of Māori as tāngata whenua within Aotearoa/New Zealand and seek to foster an environment that is inclusive, supportive and respectful of Māori tikanga / culture and te reo / language. As an equal opportunity company, we encourage understanding of cultural beliefs and protocols and foster an understanding of a broad world viewpoint. Our strategy also recognises the close geographical and cultural relationship that exists with neighbouring Pacific nations and their people. Our key aims are:

- To identify and create opportunities for Māori and Pasifika within our industry
- To improve cultural awareness and representation through education, mentoring and engagement interventions

Ranked in the top quartile of **Forbes' Best Employers for Diversity**, Jacobs continue to advance inclusion and diversity to create an environment where all employees can thrive. We know that if we are inclusive, we're more connected, and if we are diverse, we're more creative. We promote diversity because it makes us a stronger company, where brilliant people of all backgrounds feel at home.

Assumptions

Please state any assumptions you have made in relation to the Requirements. Where you have made assumptions in relation to the costs and pricing information please state these in the next section.

Below are some of our assumptions that we have made in relation to the requirements:

- That all meetings for Deliverable 1 apart from an initial site visit will be conducted via video conferencing.
- We have allowed for one round of consolidated review comments from KCDC on Deliverable 1.
- That the mapping of historical shorelines by CSL (2012) was technically accurate and digitally available.
- We can extrapolate the GW impacts for the different SLR scenarios from the SKM (2012) report.
- We do not need to update NIWA storm surge inundation reports (2012 & 2019).
- We have access to GIS layers of the inundation outputs from both NIWA storm surge reports (2012 & 2019) to undertake the risk assessment.
- We have access to KCDC stormwater flood models.
- That Covid-19 related issues (such as travel restrictions) does not occur preventing the ability to hold any face-to-face meetings or site visits.

3. Price

Price as a weighted criterion

5. Price	Weighting 10%

Pricing schedule

Item		
Deliverable 1. Please provide an all-inclusive fixed price, excluding GST. Please include a breakdown to show how the fixed price was calculated.		$ 146,768
Project Mobilisation and Kick-Off		$8,151
Data Collation & Review		$23,147
Coastal Inundation Assessment		$42,125
Coastal Processes and Erosion Assessment		$28,467
Risk Assessment and Mapping		$18,347
Draft and Final Reporting		$26,531
Total Fixed Price		**$146,768**
Option 1: Attendance at Community Assessment Panel Meeting (per meeting)		$1,920
Option 2: Workshop with KCDC and CAP of Final Results		$4,420
Deliverable 2. Please provide daily and/or hourly rates, excluding GST, for each type of resource involved with the delivery of Deliverable 2.	Junior Specialist – Kate MacDonald, GIS Specialist	$120 X per hour
	Technical Specialist – Anthony Kubale, Kristin Stokes, Nick Cooper (RMA planner)	$170 X per hour
	Senior Technical Specialist – Damien Debski, Derek Todd, Tim Baker, David Cobby	$200 X per hour
	Technical Lead – Sam Watkin, Adam Hosking, Bruce Clarke, Joris Jorissen	$230 X per hour
Disbursements. Please detail any travel-related disbursements, excluding GST, not included in the fixed price or hourly/daily rates.		$ 400 for return Christchurch to Wellington Flight and car hire relating to Deliverable 2. All other

	disbursements are included in Deliverable 1 Fixed Price

Assumptions

Please state any assumptions you have made in relation to the cost and pricing information.

Below are some of our assumptions that we have made in relation to price:

- We have assumed that all meetings for Deliverable 1 apart from an initial site visit will be conducted via video conferencing.
- We have allowed for one round of consolidated review comments from KCDC on Deliverable 1. Any additional rounds will be subject to a variation.
- All disbursements including travel are at cost.
- Deliverable 2 rates are set for the 31st December 2021. Any work beyond this date will be subject to an annual rate review.
- Based on the RfP we understand there may be need for attendance at the 6 weekly Community Assessment Panel Meeting in Deliverable 1. At this stage we do not know the number of assessment panel meetings that require attendance. As such we proposed an optional sum of $1,920 per meeting basis (excluding GST) which includes travel costs. If required, this can be incorporated into the contract on a as needed basis.
- Jacobs also proposes as an option to the fixed price, to conduct a workshop with KCDC and CAPs on the final outputs relating to deliverable 1. This would be an additional cost of $4,420 (excluding GST).

4. Proposed Contract

Having read and understood the Proposed Contract, in the RFP Section 5, I confirm that these terms and conditions are acceptable. If successful, I agree to sign a Contract based on the Proposed Contract, or such amended terms and conditions of Contract as are agreed with the Buyer following negotiations, subject to the Professional Indemnity and Public Liability Insurance levels being capped at $1 million.

5. Referees

First referee	
Name of referee:	Peter Kingsbury
Name of organisation:	Christchurch City Council
Goods/services provided:	Preparation of a Shoreline Protection Structure and land condition inventory for the East side of the Avon-Heathcote Estuary post the 2010-2011 Christchurch Earthquake Sequence, followed by investigation and recommendations on how to manage shoreline future erosion protection for communities and public recreation space along the earthquake damaged estuary edge environment that has suffered subsidence and liquefaction. Includes assessment and design of best possible repair or replacement options to meet community expectations for ongoing erosion protection. External Technical Reviewer of Christchurch Coastal Hazards Assessment project.
Date of provision:	2019-2020
Address:	53 Hereford St, Christchurch Central, PO Box 73011 Christchurch 8154
Telephone:	03-9418487
Email:	Peter.kingsbury@ccc.govt.nz
Second referee	
Name of referee:	Lucy Baker
Name of organisation:	Greater Wellington Regional Council
Goods/services provided:	Coastal Water Quality Science Services (investigation and review) Catchment Water Quality and Hydrological Modelling Hydrogeological and Contaminated Land Services
Date of provision:	2013 – Present
Address:	Fryatt Quay, Wellington
Telephone:	04 384 5708
Email:	Lucy.baker@gw.govt.nz

Please contact me before you approach a referee for a reference	Yes

6. Our declaration

Respondent's declaration		
Topic	**Declaration**	**Respondent's declaration**
RFP Process, Terms and Conditions:	I/we have read and fully understand this RFP, including the RFP Process, Terms and Conditions (shortened to RFP-Terms detailed in Section 6, as amended by Section 1, paragraph 1.6. if applicable). I/we confirm that the Respondent/s agree to be bound by them.	**Agree**
Collection of further information:	The Respondent/s authorises the Buyer to: a. collect any information about the Respondent, except commercially sensitive pricing information, from any relevant third party, including a referee, or previous or existing client b. use such information in the evaluation of this Proposal. The Respondent/s agrees that all such information will be confidential to the Buyer.	**Agree**
Requirements:	I/we have read and fully understand the nature and extent of the Buyer's Requirements as described in Section 2. I/we confirm that the Respondent/s has the necessary capacity and capability to fully meet or exceed the Requirements and will be available to deliver throughout the relevant Contract period.	**Agree**
Notices:	I/we confirm receipt of Notices to Respondents No(s): NONE other than "Q&A" and confirm that my/our Proposal includes full allowance for these notices.	**Agree**
Ethics:	In submitting this Proposal, the Respondent/s warrants that it: a. has not entered into any improper, illegal, collusive or anti-competitive arrangements with any Competitor b. has not directly or indirectly approached any representative of the Buyer (other than the Point of Contact) to lobby or solicit information in relation to the RFP c. has not attempted to influence, or provide any form of personal inducement, reward or benefit to any representative of the Buyer.	**Agree**

Offer Validity Period:	I/we confirm that this Proposal, including the price, remains open for acceptance for the Offer Validity Period stated in Section 1, paragraph 1.6.	**Agree**
Conflict of Interest declaration:	The Respondent warrants that it has no actual, potential or perceived Conflict of Interest in submitting this Proposal or entering into a Contract to deliver the Requirements. Where a Conflict of Interest arises during the RFP process the Respondent/s will report it immediately to the Buyer's Point of Contact.	**Agree**

Details of conflict of interest: Not Applicable

DECLARATION

I/we declare that in submitting the Proposal and this declaration:

a. **the information provided is true, accurate and complete and not misleading in any material respect**
b. **the Proposal does not contain intellectual property that will breach a third party's rights**
c. **I/we have secured all appropriate authorisations to submit this Proposal, to make the statements and to provide the information in the Proposal and I/we am/are not aware of any impediments to enter into a Contract to deliver the Requirements.**

I/we understand that the falsification of information, supplying misleading information or the suppression of material information in this declaration and the Proposal may result in the Proposal being eliminated from further participation in the RFP process and may be grounds for termination of any Contract awarded as a result of the RFP.

By signing this declaration, the signatory below represents, warrants and agrees that he/she has been authorised by the Respondent/s to make this declaration on its/their behalf.

Signature:	
Full name:	Vanessa McGrath
Title / position:	Section Lead - Cities and Places Solutions – Strategic Planning, Engagement, Climate and Sustainability
Name of organisation:	Jacobs New Zealand Limited
Date:	15th July 2020

Appendix A: CVs

Derek Todd

TECHNICAL TEAM LEADER

EDUCATION/QUALIFICATIONS

MSc (Hons) Geography, University of Canterbury, 1983

BSc (Geography, Mathematics), University of Canterbury 1981

Certified RMA Hearings Commissioner

REGISTRATIONS/ CERTIFICATIONS

Commissioners Re-Assessment, 2016

MEMBERSHIPS AND AFFILIATIONS

New Zealand Coastal Society

Australian Coastal Society

Adjunct Griffith Centre for Coastal Management

AREAS OF EXPERTISE

- **Coastal Hazards:** Coastal erosion assessment and mapping, Inundation risk assessment, tsunami risk assessment, assessment of the effects of climate change on coastal hazards.
- **Coastal Planning and Management:** Shoreline management plans, regional coastal plans and submissions, coastal land use strategy planning, beach gravel extraction management planning, dune conservation management strategies, coastal consents and AEE's, consent auditing,

Derek is a coastal geomorphologist with over thirty-five years' experience in managing coastal resources, monitoring and investigating coastal processes and hazards, and assessing the potential future changes in coastline and river mouth stability. This experience includes time working in consultancy, local and central Government, and universities in both New Zealand and Australia. Derek's professional career started as the Coastal Investigations Officer for the South Canterbury Catchment Board in 1984, changing to Coastal Resources Scientist in the Canterbury Regional Council as a result of Local Government Reform in 1989. In 1996 he left local government for consulting, taking up a role of Coastal and Environmental Scientist with Tonkin & Taylor before starting his own specialised coastal consultancy, DTec Consulting Ltd, in 1999.

Over a 12-year period, as the principal consultant for DTec, Derek worked on over 100 projects throughout New Zealand for a wide range of clients including regional and territorial councils, port companies, private companies and engineering and planning consultancy practices. Over this period Derek was also contracted to the geography department of the University of Canterbury to facilitate and deliver a practical post graduate course in resource management, and as a guest lecturer on coastal hazards and coastal management. He also acted as an expert witness at a number of Environment Court hearings and as a Certified Resource Management Consent Hearings Commissioner at consent hearings of a coastal nature.

In 2011, Derek relocated to Australia to work as a Principal Coastal Scientist for the Queensland Government Department of Environment and Resource Management before switching in 2013 to a role of Senior Research Assistant at the Griffith University Centre for Coastal Management. This role involved running various research and planning projects relating to coastal management of Gold Coast beaches.

In 2016, Derek returned to New Zealand and joined Jacobs in his current role, being involved in a number of coastal hazard, adaptation and management projects throughout New Zealand, Australia and the Pacific.

Relevant Project Experience

- **Coastal Erosion and Inundation Hazard Assessment with sea level rise for the Clutha Delta Coast and Lower Clutha Food Protection and Drainage Scheme for ORC, NZ.** Technical lead for assessment of sea level rise impacts on the shoreline of the Clutha Delta including impacts on the efficiency and lifetime of river mouth structures and flood banks of the LCFPS. The outputs of this assessment are to be used to guide future shoreline and asset management decision making.
- **Coastal Erosion Assessment with sea level rise for the Timaru District, NZ.** Technical lead for assessment of coastal erosion with sea level rise over the next 100 years for the shoreline of Timaru District which includes a range of coastal morphologies from sand and mixed sand & gravel beaches, perched beaches, river mouth lagoons, unconsolidated

independent consent hearings commissioner.

- **Coastal Protection:** Beach nourishment design and review, dune contouring design, assessment of effects of coastal protection structures such as groynes, sea wall, revetments and artificial reefs.
- **Coastal Processes:** Wave run-up and erosion processes, sediment budgets, dune development, coastal responses to climate change.
- **Coastal Monitoring and Mapping:** Design, implementation and interpretation of coastal monitoring programmes for change in beach morphology, stability and beach health.
- **River Mouth Processes:** Assessment of mouth stability and critical flow limits for mouth closure.
- **Environment Education:** University lecturer, civil defence adviser, public consultation, presentation to professional and non-technical groups.

OFFICE LOCATION

Christchurch

alluvial and loess cliffs, basalt headlands. The hazard mapping outputs from this project will be used for land use planning and policy, and council infrastructure and asset management

- **Coastal Hazards and Risk Assessment with sea level rise for the Hurunui District, NZ.** Technical lead for hazard and risk assessment of coastal erosion, inundation and rising groundwater with sea level rise for the six coastal settlements and key infrastructure within Hurunui District as first stage of preparation of future climate change adaptation plan for these settlements. Now moving into community engagement of hazard risk and adaptation options.
- **Coastal Hazards Assessment with sea level rise for the Waimakariri District, NZ.** Technical lead for hazard assessment of coastal erosion and inundation hazards with sea level rise over next 100 years for review of land use planning policies and rules within District Plans. Included investigation of flood risk from combined coastal, fluvial, pluvial and groundwater sources. recommendations on policies and rules for areas affected by these hazards over 100-year period.
- **Multi-Hazards Investigation, Christchurch NZ for CCC.** Technical lead for the first two stages of a multi-hazards investigation for coastal catchments for Christchurch City involving a gap analysis of existing hazard knowledge, overseeing gap filling studies. Hazards considered included fluvial & pluvial flooding; sea level rise effects on coastal erosion, inundation, & groundwater levels; tsunami; earthquake, liquefaction, and mass movement. The third stage of this project is on-going, being the development of a suite of modelling to understand the changing baseline of flood risk with climate change and "shocks" of non-flood hazards such as earthquakes and tsunami.
- **Independent Technical Peer Reviewer of Coastal hazards assessments with sea level rise**. Have undertaken these technical peer review roles for sea level rise hazard assessments for Porirua City and Christchurch City Councils. Also undertook an independent audit of coastal hazards for proposed Redcliffs School site to advise consent authority whether post-earthquake relocation of school to this site was a justifiable over the next 100 years with sea level rise.
- **Coastal Hazards Assessment, New Brighton Hot Pools Development, Christchurch NZ.** Assessment of coastal hazards and sea level rise effects likely to affect a hot pools development on the beach at New Brighton. Included recommendations on coastal protection options for the development and adjacent sand dunes and preparation of Coastal Protection Management Plan for ongoing occupation of the beach front site.
- **Reducing Coastal Hazards Risks in Tokelau, project for Government of Tokelau and NZ MFAT.** Assessment of future coastal hazard impacts with sea level rise on the coral atolls of Tokelau for the development of a focused resilience strategy and adaptive pathways for coastal hazards, and business case for investing in a management plan.
- **Erosion management investigations for Southshore, Avon-Heathcote Estuary, Christchurch for CCC.** Investigations into how to manage

shoreline erosion protection for communities and public recreation space in earthquake damaged estuarine environment that has suffered subsidence and liquefaction. Includes condition assessment of existing damaged protection structures, assessment and design of best possible repair or replacement options to meet community expectations for ongoing erosion protection.

EDUCATION/QUALIFICATIONS

Bachelor of Science (Hons) in Marine Biology (2.1). Swansea University (2008 – 2011)

REGISTRATIONS/ CERTIFICATIONS

Chartered Environmentalist (CEnv)

MEMBERSHIPS AND AFFILIATIONS

Full Member of Institute of Environmental Management and Assessment (MIEMA)

LANGUAGES

English

French (basic)

OTHER

Based in Wellington Office

Anthony Kubale

PROJECT MANAGER

Anthony is an Environmental Consultant with 10 years' experience specialising in Environmental Science and Environmental Management Services from detailed design through to decommissioning for both private and public sector clients. Anthony has worked with KCDC on previous projects including the Kenakena Stormwater Upgrade project and as part of the Jacobs team that undertook regular stormwater sampling programme. Anthony has also been a core member of project teams delivering coastal resilience and adaptation in the Pacific for Kiribati and Tokelau and is excited to bring this experience to this project. Anthony is experienced in coordinating and managing large multidisciplinary teams and delivering complex projects that meet client expectations whilst ensuring any potential environmental issues are identified and mitigated. He has excellent communication skills ensuring efficient co-ordination of the project team as well as liaising with clients, contractors, regulatory bodies to ensure smooth delivery of projects to time and budget.

Relevant Project Experience

Kenakena Stormwater Upgrade Project – Kapiti Coast, Wellington

Client: Kapiti Coast District Council

Start/End Dates: October 2019 – March 2020

Responsibilities: Project lead undertaking the water and sediment quality sampling programme and associated technical report within the Kenakena stormwater drain and wetland. The programme of works is supporting the KCDC consent application for the proposed stormwater pump station.

Pakiri Sand Extraction – Pakiri, North Auckland

Client: McCallum Brothers' Limited

Start/End Dates: September 2018 – Present

Responsibilities: Project Manager and marine water quality lead responsible for undertaking water quality sampling and preparing a technical assessment report associated with the consenting application for an offshore sand extraction area in North Auckland.

Bayfair to Bay Park – Greenroads

Client: New Zealand Transport Agency

Start/End Dates: July 2017 – Present

Responsibilities: Responsible for managing and delivering the Green roads sustainability accreditation for the B2B road infrastructure upgrade project ensuring it attains bronze certification. The role includes co-ordination and close liaison with the design and contractor team as well as Green roads.

Temaiku Land and Urban Development – Tarawa, Kiribati

Client: New Zealand Ministry for Foreign Affairs and Trade

Start/End Dates: January 2017 – June 2018

Responsibilities: A feasibility study relating to the proposed reclamation and urban development of a 328-hectare area within the Temaiku Bight, South Tarawa, Kirabati. Anthony is the marine environment lead responsible for undertaking marine and freshwater environmental baseline surveys to feed into the ESIA report. In addition, he is the lead author of the marine

impact assessment volume of the ESIA written in accordance with World Bank Environmental and Social Framework. The marine volume principally focuses on dredging related impacted associated with the reclamation. As part of the fieldwork role Anthony was responsible for managing sub-contractors and ensuring fieldwork was delivered to scope whilst ensuring health and safety was maintained at all times.

Tokelau – Coastal Hazard Risk Assessment – Tokelau

Client: New Zealand Ministry for Foreign Affairs and Trade

Start/End Dates: January 2018 – September 2019

Responsibilities: Environmental lead looking at environmental risks and constraints resulting from the coastal hazard options being presented across three atolls in Tokelau.

Riau Power Plant – Central Sumatra, Indonesia

Client: PT Medco Ratch Power Riau (MRPR)

Start/End Dates: June 2017 – Present

Responsibilities: ESIA lead and project manager for a combined cycle gas power plant and associated 40 km gas pipeline development. The role includes preparation of the Environmental and Social Management System, Environmental and Social Management Plan and ESIA in accordance with Equator Principles, ADB Safeguards and IFC Performance Standards, co-ordination of environmental and social specialists and close liaison with the engineering team, Project Sponsors and Lenders. Additional technical assessments prepared as part of the ESIA includes: Critical Habitat Assessment & Biodiversity Action Plan.

Comoros Geothermal Exploration Drilling – Comoros Islands, East Africa

Client: New Zealand Ministry for Foreign Affairs and Trade

Start/End Dates: November 2018 – September 2019)

Responsibilities: Lead author of ESIA, Environmental and Social Management System and Plan for a geothermal exploration drilling programme on Grande Comore, Comoros Islands. The role includes preparation of the ESIA in accordance with Equator Principles and IFC Performance Standards, co-ordination of environmental and social specialists and close liaison with the engineering team.

Environmental and Social Management Framework - Biomass Energy Programme – Fiji and Papua New Guinea

Client: GIMCO

Start/End Dates: June 2017 – December 2017)

Responsibilities: Project manager and lead author for an Environmental and Social Management Framework (ESMF) relating to a Biomass Energy Programme (power plants and wood pellet plant) across Fiji and Papua New Guinea. The ESMF was written in partnership with the Korean Development Bank (KDB) and in accordance with requirement of the Green Climate Fund (GCF) The ESMF included a strategic environmental and social assessment and the development of a management plan for the execution of project specific ESIAs within the programme.

Bruce Clarke

PROJECT DIRECTOR

EDUCATION/QUALIFICATIONS

Bachelor of Science (Biochemistry), Victoria University, Wellington, 1981

Diploma of Safety Management (with distinction), Massey University, Palmerston North, 1988

Royal Society of Health Diploma for Public Health Inspectors, Wellington Polytechnic, 1984

Registered Environmental Auditor (Institute of Environmental Management and Assessment, United Kingdom)

MEMBERSHIPS AND AFFILIATIONS

Affiliate Institute of Environmental Management and Assessment

Bruce is a Senior Principal Environmental Consultant with over 30 years' experience in environmental and social impact assessment, environmental auditing, environmental management, environmental monitoring, hazardous substances management, risk assessment and in developing environmental policies and strategies. He has undertaken work for a range of municipal, industrial and state sector clients in the Pacific Islands, South East Asia, New Zealand, Australia and the United Kingdom.

Bruce has successful managed facilitated environmental risk assessment and analysis projects for industrial, oil terminals, power, roading and infrastructural projects. Bruce is an experienced Project Director at ensuring clients requirements are being met, a good communicator and is a trusted adviser for a number of clients.

Areas of Expertise

- Environmental and Social Impact Assessments
- Environmental compliance
- Environmental management systems
- Environmental risk management

Relevant Project Experience

Pakiri Sand Extraction Consenting

Client: McCullum Brothers Limited

Responsibilities: Project Director for the Jacobs team preparing resource consent applications for two offshore sand extraction activities at Pakiri where beach erosion as a result of the extraction process is seen as a potential significant effect. The sand extraction process is a key resource for Auckland's building and construction industry provided around 42% of their requirements.

Temaiku Land Reclamation and Urban Development

Client: Ministry of Foreign Affairs and Trade

Responsibilities: Environmental Technical Lead for the team preparing the ESIA, for the land reclamation and urban development project in the Temaiku Bight, South Tarawa, Kiribati. The Project will assist Kiribati in adapting to climate change through raising the height of the land by 2 m within 290 ha of land, which is estimated to provide protection against sea level rise over the next 200 years. Jacobs under took a Feasibility Study for the land reclamation, Master Planning for the urban development and ESIA for the whole development to meet World Bank Environment and Social Framework.

Review of TTR Seabed Ironsands Mining EIA

Client: Fisheries Inshore New Zealand

Responsibilities: For a proposed seabed iron sands mining project of the Taranaki Coasts prepared and presented a statement of evidence for the DMC hearing on the adequacy of the risk assessments, Impact Assessment (IA), evidence supplied by Trans-Tasman Resources Limited specialists and on issues identified in the impact assessment approach against recognised

international good practice for environmental impact assessments on behalf of a submitter. Covered air quality impacts, oil spills, environmental risk of the operation and adequacy of the baseline sampling (seasonality and length).

Hazardous Substances and Contaminated Land Assessments for the Ngawha Geothermal Power Plant Expansion

Client: Top Energy

Responsibilities: Prepared two technical reports which assessed the potential environmental effects from the storage and use of hazardous substances the effects of from potentially contaminated land for the proposed expansion (construction and operation) of the Ngawha Geothermal Power Complex. Prepared a statement of evidence and presented this evidence at the resource consent hearing.

Lenders Environmental and Social Consultant Sarulla Geothermal Power Plant Development, Indonesia

Client: Sarulla Operation Limited/ADB

Start/End Dates: 2017 – Present

Responsibilities: Environmental Lead of an LESC undertaking reviews of reports, conduct site visits on behalf of the lenders to assess the level of compliance with the environmental, health, safety and social laws and permits and international standards including ADB Safeguards and the IPC Performance Standards and WBG EHS guidelines through construction and operation of the Sarulla SIL and NIL power plants which have a combined generating capacity of 330MW.

Lenders Environmental and Social consultant for Jawa -1 1760 MW Thermal Power Plant Development, Indonesian

Client: Societe Generale

Responsibilities: Environmental Lead responsible for conducting an environmental due diligence review of the Jawa -1 1760 MW proposed thermal power plant and LNG FSRU against the requirements of the Equator Principles and IFC Performance Standards for potential financiers of the development.

ESIA for Riau 275 MW CCGT Power Plant Development, Indonesian

Client: Medco Ratch Power Riau

Responsibilities: Technical Director leading a multi-international team of environmental specialists in the preparation of an Environmental and Social Impact Assessment (ESIA) to meet the requirements of the Equator Principles, ADB Safeguards and to obtain an AMDAL approval under the Indonesian environmental regulations for a 275 MW CCGT Power Station to be constructed in Riau, Indonesia.

ESIA and AMDAL for Cirebon Unit 2 Coal Fired Power Station Expansion, Indonesia

Client: Cirebon Energi Prasarana Consortium

Responsibilities: Technical Manager leading a multi-international team of environmental specialists in the preparation of an Environmental and Social Impact Assessment (ESIA) to meet the requirements of the Equator Principles, and to obtain an AMDAL approval under the Indonesian

environmental regulations for a 1000 MWe Thermal Power Station to be constructed in Cirebon, Indonesia. The project involved analysis of climate change effects, in particular sea level rise on the proposed power plant platform and the change to the flooding regime as a result of the elevated platform in the coastal flood plain.

Review of Air Discharge Permit Application Alliance Levin

Client: Horizons Regional Council

Responsibilities: Air Quality Technical Reviewer for Horizons of air discharge permit application and associated assessments of effects of discharges to air for the Alliance Levin meat processing and rendering plant. Included preparation of technical report to support officers report, preparation of evidence and presentation of evidence at a hearing.

Review of Air Discharge Permit Applications

Client: Environment Waikato

Responsibilities: Air Quality Technical Reviewer for Environment Waikato of air discharge permit applications and associated assessments of effects of discharges to air for Te Rapa and Waitoa Dairy plants.

Odour Evaluation

Client: Porirua District Council

Responsibilities: Project Manager of a series of trials to control/reduce odours from a sewer main and wet well by the use of various chemicals additives. The level of sulphides, dissolved oxygen and pH of the effluent was measured as well as the level of H2S and odour released. Changes in the dosing rates of the additives were also evaluated.

Adam Hosking

TECHNICAL ADVISOR

Adam is Global Director for Water Resources Solutions, with responsibility for Water Resources and Ecosystem Management, including stormwater, flood and coastal risk management, and climate change adaptation services. With a background in coastal geomorphology, he is a Fellow of the Chartered Institute of Water and Environmental Management and Chartered Scientist with more than 23 years' experience in projects and programs addressing resilience. He has led coastal resilience projects globally, including New York City DEP's wastewater infrastructure resilience strategy following Hurricane Sandy, and has delivered projects in the UK, USA, Middle East, Singapore and Caribbean.

Areas of Expertise

- Resilience and Climate Change adaption planning
- Preparation of long term strategic coastal management plans and the development of plan formulation and decision-making frameworks
- Stakeholder engagement to create consensus and successfully deliver project outcomes

Relevant Project Experience

Thames Estuary Asset Management 2100, UK, Environment Agency

Start/End Dates: 2018 – Present

Responsibilities: Leading delivery of geomorphology studies for sections of the River Thames in support of the Asset Management programme, to provide improved understanding of changes in estuary form and consequent impacts on flood protection assets, including the Thames Barrier. Part of the programme to deliver the first 10 years implementation of the long-term resilience plan for flood risk management in London.

Coastal Change Specification, UK, UK Government Committee on Climate Change (CCC) Adaptation Sub-Committee (ASC)

Start/End Dates: 2018 – Present

Responsibilities: Providing overall technical oversight and strategic direction to research project commissioned by the UK Government Committee on Climate Change (CCC) Adaptation Sub-Committee (ASC) to investigate the challenges posed by climate change in respect of coastal change management. In particular, the project seeks to improve understanding around the economics associated with adapting to coastal change and examples of how adaptation at the coast may be taken forward in a variety of settings.

Pilot Second Generation Shoreline Management Plan's, UK, UK Environment Agency and multiple Local Authorities

Start/End Dates: 2004 – 2007

Responsibilities: As Project Manager, Adam Led the development of one and contributed to two other pilot second generation SMPs, trailing the implementation of new SMP Procedural Guidance. Captured lessons from pilots to feed back into finalization of Guidance. Extensive stakeholder and client engagement to develop and refine approach through pilots.

EDUCATION/QUALIFICATIONS

MSc, Coastal Zone Management, Bournemouth University, 1994

BSc (Hons), Geographical Science University of Portsmouth, 1992

REGISTRATIONS/ CERTIFICATIONS

Chartered Water and Environmental Manager (C.WEM) and Chartered Scientist (C.Sci)

MEMBERSHIPS AND AFFILIATIONS

Fellow of Chartered Institute of Water and Environmental Management (CIWEM)

Chairman of the CIWEM Climate Change Network Steering Group

AWARDS/HONORS

Individual of the Year 2008/9: Commended, British Expertise International Awards

Presidents National Environmental Excellence Award, 2008, National Association of Environmental Professionals, USA

SELECTED PUBLICATIONS

Hosking A, von Lany P & Korteling B (2018) 'Applying Adaptation Pathways and Robust Decision Making in Strategic Coastal Planning in the face of change and uncertainty'. State of the Coast conference, New Orleans, USA. May 2018.

Hosking A (2017) 'Delivering Flood Resilience in the UK'. Invited dinner

speaker at Louisiana Smart Growth Summit, Baton Rouge, USA, November 2017.

Hosking A (2017) 'Sustainable Coastal Resilience: Using Technology to Underpin Sound Decision-Making'. Presentation to Inter-American Development Bank Caribbean Coastal Resilience Forum, Nassau, Bahamas, September 2017

Hosking, A, (2016) 'Global Experience with Coastal Resilience. Plenary presentation to Coastal Zone Canada Conference, Toronto, Canada, June 2016'

Shoreline Management Plan Procedural Guidance, UK, UK Department of Environment, Food and Rural Affairs

Start/End Dates: 2004 – 2006

Responsibilities: Adam was project manager responsible for leading the development and piloting of national guidance for the development and implementation of strategic coastal risk management plans, liaising directly with national government. Planning framework takes explicit account of future climate change projections.

Support for Improving Disaster and Climate Resilience in Sustainable Tourism, Corozal District, Belize, Inter-American Development Bank

Start/End Dates: 2016 – 2018

Scope/Description: Project to develop a comprehensive coastal resilience plan for the Corozal District of Belize, including development of concept designs for a series of demonstration ecosystem-based stabilization measures.

Responsibilities: As team leader, providing overall leadership and client facing liaison for multi-disciplinary team, including extensive field data collection campaign, asset surveys, innovative satellite derived data analysis, and numerical modelling, to inform plan development and the prioritization and development of the demonstration project concepts. Includes extensive stakeholder engagement activities.

National Trust Future Coast and Shifting Shores +10, UK, National Trust

Start/End Dates: 2014 – 2015

Responsibilities: Lead two studies for the National Trust to inform the long-term management of their coastal estate. Shifting Shores +10 is a review of the progress of NT and other agencies in applying adaptive approaches to managing coastal climate change in the period since 2005, and the definition of policy recommendations for future management. Future Coast is focused on defining approaches and opportunities to deliver coastal habitat biodiversity in the face of climate change.

David Cobby

TECHNICAL ADVISOR

David is a Chartered Scientist and Water and Environmental Manager with over sixteen years' experience in consultancy and academic research environments. His technical expertise encompasses many areas of water and environmental management, focussing particularly on the sustainable management of flood risk (stormwater and groundwater) and interactions with other natural hazards. As a project manager, he has consistently achieved client satisfaction scores between 90% and 100%, client commendations and Value+ financial savings.

Up to 2015, he was a Technical Director in Jacobs' Climate Resilience and Adaptation Group, with a key role in growing and delivering Jacobs business with Lead Local Flood Authorities. He also led development of a range of Flood Risk Management and Water Resource Management tools based in GIS and other industry standard packages.

David relocated to New Zealand between 2015 and 2019 to deliver complex land drainage, economic and strategic multi-hazard projects required as a result of the Christchurch earthquakes, and to drive adaptation to future climate change and, particularly, sea level rise.

David relocated back to Jacobs UK in June 2019, but continues to lead key projects in New Zealand. He presents work at international conferences and has authored numerous journal papers.

EDUCATION/QUALIFICATIONS

1999-2002 : PhD, Use of Airborne Remote Sensing for Improved River Flood Modelling, University of Reading

1997-1998 : MRes Research in the Natural Environment (Distinction), University of Edinburgh

1993-1996 : BSc Mathematics and Physical Oceanography (1st Class Joint Honours), University of Wales, Bangor

MEMBERSHIPS AND AFFILIATIONS

C.WEM CEnv CSci

Areas of Expertise

- Climate change adaptation
- Management of flooding, including interactions with other natural hazards
- Sustainable surface and groundwater flood risk management (strategy, policy and schemes)
- Economic appraisal

Relevant Project Experience

Broadland Futures Initiative (BFI)

Client: Environment Agency

Title: Broadland Futures Initiative (Phase A)

Start/End Dates: July 2019 - ongoing

Scope/Description: BFI is a partnership for future flood risk management in the Broadland area. The main goal is to agree a framework for future flood risk management that better copes with the changing climate and rising sea level. The project will produce a plan defining flood risk management policy and implementation measures. The plan will consider the next 100 years and will aim to manage flood risk to a level accepted by key stakeholders, which can be achieved using agreed and realistically-fundable actions.

Responsibilities: Technical Lead, with a role in delivering and/or overseeing all deliverables

Christchurch Multi-Hazards

Client: Christchurch City Council, NZ

SELECTED PUBLICATIONS

Parsons, T., Todd, D., Cobby, D. Hart, D. and Kingsbury, P. (2018) Christchurch Multi-Hazard Analysis Approach. WaterNZ Stormwater Conference, Queenstown, May 23 – 25, 2018

Cobby, D. M., Christensen, P., Wiseman, I., van Lammeren, B. (2018) The Realities Of Adaptive Flood Risk Management. WaterNZ Stormwater Conference, Queenstown, May 23 – 25, 2018

Cobby, D. et al. (2016) Making Better Decisions: Calculating the Benefits of Stormwater Infrastructure. Presented at Water NZ Annual Conference and Expo, Rotorua, October 19 – 21.

Title: Christchurch Multi-Hazards

Start/End Dates: April 2017 – ongoing

Scope/Description: David is technical lead in this cutting-edge high profile study to develop an approach to adaptive flood management for the tidally-influenced areas of the city. The approach is considering multiple natural hazards and their influence on the viability of offering flood management which is adaptable to climate change and, in particular, sea level rise. David acts as the key technical liaison with the peer review panel of internationally-recognised experts. As a connected project, David was asked to develop the Floodplain Management section of the Council's Integrated Water Strategy.

Responsibilities: Technical Lead

Groundwater Level Assessment

Client: Waimakariri District Council, NZ

Start/End Dates: February 2018 – June 2018

Scope/Description: David led this study to understand and map how high groundwater levels could change with climate within the coastal area of Waimakariri District. Mapping of current and future depth to groundwater maps were produced based on an analysis of borehole records across the study area, and latest projections of sea level rise. This study was undertaken in parallel with the Jacobs study of coastal inundation and erosion hazards in the same area, which demonstrated the benefits of a multi-hazard approach to management.

Upper Heathcote River Floodplain Management Plan

Client: Christchurch City Council, NZ

Start/End Dates: November 2016 – November 2017

Scope/Description: David technically led this study to develop an adaptive floodplain management strategy for this key rural/urban catchment in Christchurch (NZ) which will be impacted by climate change induced rainfall and sea level increases. David coordinated numerous technical inputs to produce a draft strategy which led to Council agreeing $77M investment in flood management infrastructure in October 2017, following high profile flooding across the catchment in July 2017. Between July and October 2017, David acted as a close advisor to Council to develop its response to the flood event.

Stormwater Infrastructure Economics

Client: Christchurch City Council, NZ

Start/End Dates: February – October 2016

Scope/Description: David was overall technical lead for this strategic project for Council to develop a tool and methodology to appraise stormwater infrastructure schemes across the city. David coordinated joint working between Jacobs resources in Christchurch, UK and Australia to deliver a cutting-edge GIS-based calculation and viewing tool, based on international best practice in flood economics. The study included a number of workshops and is facilitating closer working between Council, NIWA and other parties.

SELECTED PUBLICATIONS

Cobby, D. and Sheppard, M. (2016) UK Flooded Again: What Lessons can NZ Learn? Presented at Water NZ Stormwater Conference, 18 – 21 May 2016, Nelson.

Taylor, G., Cobby, D. and Bensberg, S. (2016) Developing the Concept of an Active Flood Risk Management System in Christchurch. Presented at Water NZ Stormwater Conference, 18 – 21 May 2016, Nelson.

Cobby, D., Falconer, R. and Rogers-Wright, A. (2015) Experiences of the Planning and Deployment of Temporary Defences During the February 2014 Floods in the UK. Presented at the European Water Association Spring Days 2015 Budapest Water Conference. March 4 - 6, Budapest, Hungry

Upper Heathcote Storage Options Analysis

Client: Christchurch City Council, NZ

Start/End Dates: March 2016 – November 2016

Scope/Description: David technically led this strategic study to appraise large flood storage options in the upper part of this important catchment to best manage flooding experienced lower down towards the tidally-influenced estuary. The study built on previous appraisal work and ongoing design/construction to hydraulically model and design a concept which may include actively managing storage areas to optimise downstream river flow reduction.

Stormwater Masterplans

Client: Selwyn District Council, NZ

Start/End Dates: August 2015 – August 2017

Scope/Description: David provided technical leadership for the development of Stormwater Masterplans for Southbridge, Hororata, Coleridge and Doyleston. With limited budgets available due to the size of the towns, David has led the team to develop masterplans, adopting a cost effective approach, of visual on-site inspections to identify both small and large scale physical works, as well as proposing changes to Council policy which could have long-term benefits in sustainable flood management.

Cranford Basin Active Management

Client: Christchurch City Council, NZ

Start/End Dates: July 2015 – June 2016

Scope/Description: David technically led this project to develop a strategic plan for actively managing the system of drains, pump stations and storage basins to assist in the mitigation of flooding in the Dudley catchment. Through workshops with key staff and modelling, the project team gained an understanding of the complex interaction and function of the whole system in substantial detail. This detailed understanding has led to a robust conceptual understanding of the whole land drainage network. David has also led detailed analysis of the function of Horseshoe Lake and Pump Station 205 which has paved the way for an adaptive management plan for this significant flood risk asset in the context of climate change and sea level rise.

Supporting Communities that Remain at Risk

Client: Environment Agency

Start/End Dates: 2013 - 2015

Scope/Description: David was Technical Lead and then Project Principal in the identification of communities across England which could be protected by temporary defences. Specifically, Jacobs was commissioned to deliver deployment maps and plans in the EA Areas of Essex, Norfolk and Suffolk, Hertfordshire and North London, West Thames and Devon and Cornwall. He held a lead position on the Technical Review Group comprising the EA and suppliers. This follows his involvement in the Environment Agency Planning Cell during the widespread flooding of the River Thames in February 2014, where he was responsible for directing the army to construct temporary defences.

SELECTED PUBLICATIONS

Morris, S, Cobby, D, Zaidman, M and Fisher, K (2015) Modelling and Mapping Groundwater Flooding at the Ground Surface in Chalk Catchments. Journal of Flood Risk Management

Cobby, D. (2012) Local Flood Risk Management. Presented at the joint CIWEM/ICE SE Branch Meeting, Gatwick, 31 May 2012

Falconer, R. H., Cobby, D., Smyth, P., Astle, G., Dent, J. and Golding, B. (2009) Pluvial fooding: new approaches in flood warning, mapping and risk management. Journal of Flood Risk Management, 2, 198-208

Cobby, D., Falconer, R., Thompsett, S. and Horlor, R. (2011) Lessons Learned from Surface Water Management Studies in the UK and Ireland. Presented at Urban Flood Risk Management Conference Graz, Austria. September 2011.

Major Incident Planning (Temporary Defences and Incident Management Map Viewer)

Client: Environment Agency

Start/End Dates: October 2013 – July 2014

Scope/Description: The River Thames Scheme: Datchet to Teddington proposes to reduce flood risk to 15,000 properties between Datchet and Teddington on the River Thames but will take 15-20 years to complete. David was a key member of a small team commissioned by the EA to investigate opportunities for deploying temporary defences to reduce flood risk in the Lower Thames area in a major event. Towards the end of this scoping study, southern England experienced the wettest winter on record. A Planning Cell was set up alongside the Area Incident Room in Wallingford to assess locations for deployment of temporary defences where these might be suitable to mitigate flood impacts. David and two colleagues were integrated into this Planning Cell for a number of days to lead the recommendation for deployment of temporary defences. Defences were deployed at South Hinksey, Windsor, Datchet, Egham Hythe, Staines and Chertsey. The teams expertise, commitment, resourcefulness and agile response were regularly recognised by the Environment Agency team, summed up by one leader of the planning cell who stated "Your help has been invaluable".

Provision of Flood Risk Management Services

Client: Buckinghamshire County Council and other Councils

Start/End Dates: 2010 - 2015

Scope/Description: Following the introduction of the Flood Risk Regulations in 2009 and the Flood and Water Management Act in 2010, Buckinghamshire County Council (BCC) has had responsibility for managing local flood risk. For over five years, following the introduction of the legislation, David has project managed and technically led Jacobs' involvement as the sole provider of a full range of flood risk management services to, and on behalf of, BCC. The services have ranged from high level preparation of a strategy for flood risk management across the county, Surface Water Management Plans in major urban centres, successful funding applications for delivery of flood management schemes and detailed design of these schemes. Overall, £750k of external funding has been secured between 2012 and 2013 following Jacobs' initiatives, to design/construct schemes and undertake cutting-edge studies. David acted as Lead Officer for BCC to cover a period of staff turnover.

Devon Surface Water Management Plan

Client: Devon County Council

Start/End Dates: 2011 - 2015

Scope/Description: Devon is the third largest county in England and contains a range of built and natural environments which are at varying levels of local flood risk. David has managed and acted as Project Principal for, the delivery of Surface Water Management Plans for Devon which has moved in different phases from a county-wide scoping study to delivering individual SWMPs for Exeter, Braunton, Sidmouth and Ilfracombe. Delivery has utilised a phased approach to maximise use of limited resources on

SELECTED PUBLICATIONS

Cobby, D., Morris, S. and Donovan, B. (2014) Before and After: Analysing and Communicating Inputs and Outputs to Flood Models. Presented at CIWEM Rivers and Coastal Group Spring meeting: Seeing is believing – visualising flood risk. London, 22 May 2014

Morris, S.E., Cobby, D.M. and Donovan, B. (2011) Developing indicators to detect changes in the seasonality, frequency and duration of medium and high river flows. Water and Environment Journal, 26, 38-46

Cobby, D., Morris, S., Parkes, A. and Robinson, V. (2009) Groundwater Flood risk management: advances towards meeting the requirements of the EU Foods directive. Journal of Flood Risk Management, 2, 111-119

areas of greatest risk, has involved extensive Partner consultation and is seeking options to manage flooding which are sustainable and provide environmental and social benefits. In a client satisfaction survey, the client noted that "Iain Blackwell and David Cobby are first class".

Catchment Flood Risk Assessment & Management

Client: Office of Public Works (Ireland)

Start/End Dates: 2010 - 2015

Scope/Description: Following assisting in the preparation of a successful bid for this project to model, map, assess the risk of flooding and develop management options across the River Shannon basin in South Western Ireland, David developed a number of ArcGIS, Excel and Word macros to streamline processes and enable the project team to efficiently produce the significant number of deliverables. This has included the EcMap tool to implement the industry standard Multi-Coloured Manual methodology for calculating flood damage to properties and other receptors. The streamlined ArcGIS tool provides rapid calculations of flood damage on large datasets and visualisation of results, considering surface water, fluvial and coastal flooding.

Local Flood Risk Management Strategy

Client: Lancashire County Council

Start/End Dates: 2013-2014

Scope/Description: David developed the Flood Risk Management Strategy for local flood risk covering the administrative areas of Lancashire and Blackpool councils. The Strategy focussed on development of a number of actions which Jacobs are now supporting the council in delivering.

Climate Change Indicators

Client: Environment Agency

Start/End Dates: 2010 - 2011

Scope/Description: David project managed and provided expert GIS input into this innovative project which developed and demonstrated indicators specifically designed to detect changes in the seasonality, frequency and duration of medium and high river flows to monitor river flow regimes. Four primary methods to display and interpret the indicator results were developed to meet the needs of different target audiences. Changes in the distribution of indicator values were consistent with those anticipated to arise as a result of climate change. The project was published in the Journal of Flood Risk Management.

Scoping Tools and Techniques for Groundwater Flood Risk Assessment and Provision of Interim Advice

Client: Environment Agency

Start/End Dates: 2010 - 2011

Scope/Description: The Flood Risk Regulations 2009 require all sources of flooding to be considered in developing a preliminary flood risk assessment (PFRA), identifying flood risk areas, undertaking hazard and risk mapping, and developing flood risk management plans. Building on Jacobs comprehensive understanding and mapping of groundwater flood risk, David project managed and technically led development of interim

SELECTED PUBLICATIONS

Cobby, D. M., Morris, S. E. and Parkes, A. (2008) Groundwater Flood Risk Management: Advances in Data Management, Mapping and Warning. Presented at WGF Mapping Workshop, Dublin, September 2008

Cobby, D, Astle, G., Dent, J., Falconer, R., Forbes, G. Golding, B. and Widgery, N. (2008) A Potential Form of Pluvial Flood Warning Service. Presented at Defra Flood Risk Management Conference, July 2008

Cobby, D. M., Coupe, S., Morris, S. E., Parkes, A., Robinson, V. and Widgery, N. (2007) Towards improved groundwater flood risk management. Presented at Defra Flood Risk Management Conference, July 2007

guidance for the Environment Agency to assist Lead Local Flood Authorities in carrying out their duties under the Regulations. This guidance was published in the Living Draft Guidance for Lead Local Flood Authorities.

Woking and Byfleet and Epsom and Ewell Surface Water Management Plans

Client: Surrey County Council

Start/End Dates: 2011 - 2012

Scope/Description: David managed and technically lead preparation of a Surface Water Management Plan for the Borough of Epsom and Ewell, as well as subsequent development of options and submission of funding bids. The small team received the following commendation from the Epsom & Ewell client following Jacobs facilitation of the Options Workshop "Mark [Head of Planning] has been raving about the workshop and sees it as a great success. He is really pleased with the work done so far." David provided key technical input to the Woking and Byfleet SWMP, as well as subsequent funding bids.

Dover, Deal and Canterbury Surface Water Management Plans

Client: Kent County Council

Start/End Dates: 2009 - 2011

Scope/Description: David project managed development of Surface Water Management Plans for the town of Dover and District of Cantebury, as well as providing technical direction for the Deal SWMP. David subsequently provided expert GIS and economic appraisal input into two feasibilities studies led by Jacobs which further developed two options proposed in the Dover SWMP. Based on information collated primarily during the Preparation phase of the Dover SWMP, David led the Partnership to a successful bid to Defra/EA for £113,00 to protect 30 properties at risk of surface water flooding. The client agreed that we had re-couped our fee and turned it into actual property protection and signed off the Value+ idea.

First Edition Surface Water Management Plan

Client: London Boroughs of Richmond and Kingston

Start/End Dates: 2008 - 2009

Scope/Description: Working closely with the technical lead, David helped develop a unique approach to delivering the First Edition SWMP for the London Boroughs of Richmond and Kingston which was well received, both by the local authority and by Defra. At the final stakeholder workshop, the methodologies developed and results of the preliminary risk assessment received very positive feedback and some aspects were included in the subsequent Defra Technical Guidance.

Making Space for Water (MSfW)

Client: Environment Agency/Defra

Start/End Dates: 2006 - 2007

Scope/Description: David managed the Making Space for Water HA5 Groundwater Flooding project which has obtained three client satisfaction survey scores of over 95% and RF5 Expanding Flood Warning which obtained a client satisfaction survey score of 99%. The comprehensive HA5 project provided recommendations for effective monitoring and collation of

SELECTED PUBLICATIONS

Bailey, S., Cobby, D. and Rylands, D. (2007) FDES Flood Depth Estimation System. An ArcGIS v9 Extension for Flood Inundation Risk Assessment. Presented at the EA/Defra Flood & Coastal Risk Management conference. July 2007

Morris, S.E., Cobby, D.M. and Parkes, A.J. (2007) Towards Groundwater Flood Risk Mapping. Quarterly Journal of Engineering Geology and Hydrogeology. July 2007.

groundwater flooding information to inform the direction for the Environment Agency's strategic overview role for groundwater flooding. The RF5 project made a significant contribution to the debate driven by the MSfW consultation, the Foresight report, the Pitt Review, the EU Floods Directive and PPS25 to widen the scope of the Environment Agencys Flood Risk Management business to account for other sources of flooding, including groundwater. The Jacobs project was nominated for the Environment Agency Project Excellence award in 2008.

Flood Risk Review

Client: Kent County Council

Start/End Dates: 2008

Scope/Description: David project managed and provided key technical input to assess the risk of flooding from all sources to Kent Highway Services assets. This included innovative assessment of the risks of surface water and groundwater across the county. Rapid GIS screening successfully identified locations at greatest risk of surface water flooding, as verified by site inspections and comparison with historic records of flooding.

Thames Estuary 2100: Other Sources of Flooding

Client: Environment Agency

Start/End Dates: 2007 - 2008

Scope/Description: Jacobs was commissioned to assess the flood risk along the Thames Estuary from other sources of flooding - groundwater, surface water/pluvial and flooding from sewers and the impact of the high level options designed to mitigate increased fluvial and tidal flood risk. David and colleagues developed innovative solutions to assess groundwater, surface water and sewer flooding, the interactions between them and the overall interaction with various TE2100 high level options. The greatest risk of groundwater flooding was demonstrated to be through the permeable superficial gravels and David led development of a technique to map susceptible areas and the impact which raised estuary levels could have.

Water Situation Report Macros

Client: Environment Agency

Start/End Dates: 2007 - 2015

Scope/Description: David has developed numerous automated data preparation and display tools for both internal and external clients. David has project managed and, at the client's request, been sole developer of a suite of macros to automate preparation of the Environment Agency's Water Situation Reports through linking Excel, Word and ArcGIS via VBA. These macros have been continually developed and refined over the past seven years and the projects have received two client satisfaction scores of 100%, as well as a Value+ saving of £200k for saved time by Environment Agency staff.

Flood Depth Estimation System (FDES)

Client: Environment Agency

Start/End Dates: 2004 - 2007

Scope/Description: David project managed and co-developed a customised ArcGIS suite of tools to analyse and map depth of flooding at the property

level. FDES is able to rapidly calculate and visualise the economic damages from depth frequency data. FDES makes available detailed information on flood depth at any receptor, or interactive maps of flood depth throughout the floodplain, in near real time through interpolation of previously modelled design flood events.

Groundwater Flooding Scoping Study

Client: Defra

Start/End Dates: 2003 - 2004

Scope/Description: David worked closely with the technical lead and undertook the GIS analysis to establish the cause, scale and extent of groundwater flooding within England. In order to produce a series of Groundwater Emergence Maps (GEMs) depicting areas where groundwater levels are likely to be at or close to the surface during exceptionally wet winters, the project created a national database of groundwater flooding incidents. The database comprised Environment Agency records, which were supplemented by data from environmental groups, Local Authorities and Fire Service Callout databases.

Sam Watkin

EDUCATION/QUALIFICATIONS

BEng (Hons) Civil & Environmental Engineering, Edinburgh University

MSc (Eng) Coastal Engineering, Plymouth University

MEMBERSHIPS AND AFFILIATIONS

Institution of Civil Engineers, MICE CEng

AREAS OF EXPERTISE

- Coastal Engineering
- Maritime Engineering
- Coastal Structures
- Seawall Design
- Breakwater Design
- Scour Protection Design
- Physical Modelling
- Coastal Modelling
- Metocean Analysis
- Dredge Dispersion
- Coastal Processes
- Water Quality
- Mooring Analysis
- Navigation Simulations
- Coastal Management
- Coastal Hazards
- Climate Change Adaptation
- Outfall Design and Analysis
- Thermal Dispersion Modelling
- Site Supervision
- Project Management

COASTAL ENGINEERING TECHNICAL ADVISOR

Sam is Jacobs Coastal Engineering Technical Director for the APAC region and is a Chartered Civil Engineer (CEng) with extensive experience in the field of Coastal/Maritime engineering and modelling.

Sam has led the delivery of strategic coastal hazard management strategies and the design of coastal erosion and inundation mitigation designs to support the sustainable management and development of coastlines around the World.

Sam has significant experience in the design of both coastal protection and management solutions including rock and armour unit breakwaters, rock revetments, wave return and vertical walls, beach renourishment, scour protection, groynes and natural vegetation solutions.

Sam has good knowledge of dredging and reclamation operations and has managed multi-disciplinary teams to develop sustainable dredging and reclamation solutions for our clients.

Sam developed Jacobs APAC coastal modelling capability and has led the delivery of coastal processes and modelling projects, to assess wave climates and hydrodynamics of numerous locations around the world. These studies have driven and supported both engineering design and environmental approval of major engineering infrastructure projects.

Sam has extensive international site experience including the construction works of the world's largest offshore caisson breakwater in Costa Azul, Mexico, constructing coastal defences in Tarawa, Kiribati and developing artificial beaches in Doha, Qatar.

Relevant Project Experience

Temaiku Reclamation Feasibility Study, Tarawa Kiribati

Client: MFAT

Title: Design Manager

Responsibilities: Design manager responsible for engineering disciplines contributing to the Temaiku reclamation feasibility study. The New Zealand Ministry for Foreign Affairs and Tourism (MFAT) is supporting the Government of Kiribati (GoK) in the consideration of undertaking a land reclamation project in the Temaiku Bight, South Tarawa. The Project will assist Kiribati in adapting to climate change through raising the height of the land by 2 m within 328 hectares, which is estimated to provide protection against sea level rise over the next 200 years. Other benefits of the Project would include reclamation of low-lying land for development, which will to some extent help to address overcrowding on South Tarawa in the short-term. Preliminary estimates are that this will require 8.5 million cubic metres of fill with the intention that this material will be dredged from the lagoon and piped as a slurry, a distance of approximately 6 km, to Temaiku where it will be distributed and compacted/consolidated. The proposed land reclamation is a significant Project and has been estimated to have a capital cost of more than NZ$300M.

Tokelau Coastal Hazard Risk Mitigation Plan

Role: Technical reviewer for the strategic project to reduce the coastal hazard risks of three low lying coral atolls in the Pacific Ocean. The project scope included tropical cyclone modelling, assessment of the coastal

inundation risks, including wave overtopping modelling and development of the risk mitigation options.

Coastal Reclamation Study, Gibraltar

Title: Coastal Engineer

Scope/Description: Assessment of options for coastal defences for an extension to an existing residential development, including wave data analysis and the use of numerical wave modelling techniques to derive indicative sediment transport rates and assess the potential environmental impacts.

Seaton Carew Coastal Strategy, UK

Role: Project Manager for the development of a coastal strategy for the long term management of a 9km stretch of coastline. The study comprised of a series of coastal process, environmental and economic studies and was carried out in close consultation with key stakeholders. A Strategy Appraisal Report was produced and successfully taken to the Environment Agency National Review Group.

Evans Bay Cycleway Detailed Design - Coastal Hazards Assessment, NZ

Client: Wellington City Council

Title: Technical Coastal Engineering Lead

Scope/Description: Jacobs were commissioned by Wellington City Council to provide engineering services in support of the Evans Bay Cycleway from Little Karaka Bay to the NIWA driveway at Greta Point. As part of this study, Jacobs was engaged to undertake a desktop coastal hazards assessment for the cycleway. This included an overtopping assessment to investigate current overtopping volumes along the extent of the existing seawall, and likely changes due to sea level rise over the next 50 (2070) and 100 (2120) years. For sections of the cycleway where seawalls are not present the potential for shoreline erosion due to sea level rise was also investigated.

Kiribati Adaptation Project Phase II, Kiribati

Client: World Bank

Title: Senior Coastal Engineering Consultant

Scope/Description: Senior Coastal Engineering Consultant to the World Bank climate change adaptation project in Tarawa, Kiribati. Kiribati is one of the most vulnerable countries in the world to the effects of climate change and sea level rise. Sam spent over a year in South Tarawa working with the Kiribati Government to build capacity within the Government for coastal management, coastal condition assessment and construction of coastal defences.

Southshore Erosion Management Design, NZ

Client: Christchurch City Council

Title: Technical Coastal Engineering Lead

Scope/Description: The Christchurch City Council commissioned Jacobs in January 2020 to undertake an investigation into the erosion management options along the Southshore Red Zone. The Estuary edge within the Southshore Red Zone consisted of seawall structures, which were left behind in various states of disrepair since the clearance of properties following the Canterbury Earthquake Sequence. Sam was the technical coastal engineering lead for the design of erosion management protection options

which included rock revetments, gabion seawalls, natural cobble beach and perched beach options.

Weno Seawall Design, Weno Micronesia

Client: World Bank

Title: Lead Coastal Engineer

Scope/Description: Lead coastal engineer for the development of the assessment and design of coastal erosion mitigation measures for a site in Weno, Micronesia to protect critical communications infrastructure at risk of erosion damage. Coastal erosion risk was assessed analysing the extreme wave climate and water level conditions and how these will be impacted by the effects of climate change into the future. Erosion mitigation designs were developed to suit reduce the risk of erosion to acceptable levels throughout the proposed design life of the structure and utilised design configurations to match the local construction capability and sustainable local materials. The preferred design recycled existing concrete slabs which were freely available to the project to provide a low cost solution which still met the performance criteria of the project. This resulted in a significant saving to the client.

Mandorah Ferry Terminal and Marine Facilities Design, NT

Client: DIPL

Title: Maritime Design Lead

Scope/Description: Maritime design lead for the development of a harbour facility at Mandorah to facilitate safe operations of a passenger ferry, boat launching and retrieval operations and future Ro Ro ferry operations.

Responsibilities: The study includes the planning of the marine facility to service existing and future operations. The analysis of the options included input from a multi-disciplinary team to ensure that the proposed design was sustainable. This included detailed wave and sediment modelling to assess the standard of protection provided by the breakwater and the impact of the facility on sediment transport trends. Design aspects included the design of a rock armour breakwater, ferry pontoon and access, ro ro ramp and boat ramp.

SH16 Causeway Coastal Engineering Review, NZ

Title: Technical Coastal Engineering Lead

Scope/Description: Technical coastal engineering lead for the review of the temporary and permanent works of the State Highway 16 Causeway Upgrade Project being carried out by Causeway Alliance. As part of this review, overtopping and rock sizing calculations were undertaken to check the proposed design of the seawalls and groynes.

Toll Bass Strait Ferry Terminal, Webb Dock (Melbourne) and Burnie (Tasmania)

Client: Toll Shipping

Title: Coastal Engineering Lead

Scope/Description: Jacobs were commissioned by Toll Shipping to undertake the design of the upgrade to their ferry terminal infrastructure at Webb Dock (Melbourne) and Burnie (Tasmania) to accommodate thir new class of Bass Strait ferries. This included upgrade of all of the marine berthing infrastructure, strengthening of the existing quay walls and the deepening and expansion of the berth pockets. Coastal engineering assessments included mooring analysis and the assessment of propeller induced scour at the sites. Undermining of the existing structures was a

key risk to the project which required the development of scour protection solutions which could be constructed within a short timeframe in-between existing ferry operations. Scour protection included interlocked pumped concrete scour mattresses in the berth pockets and sloped grout mattresses under the suspended wharf deck.

Amrun Ferry Terminals, QLD

Client: Rio Tinto

Scope/Description: The Amrun project included the development of 2 ferry terminals to enable the construction and operation of the Amrun Bauxite mining operation in far north Queensland. The ferry terminals support both high speed passenger ferry operations from a tidal pontoon facility and the transfer of heavy industrial plant and supplies via a RoRo operation. The RoRo facility included a large scale floating linkspan to enable ferry access during all states of tide. Coastal engineering support included the design of the dredging and reclamation and the coastal edge protection solutions. Coastal support also included the assessment of extreme cyclone induced wave conditions to inform the basis of design.

Webb Dock Rock Revetment and Scour Protection Design, Vic

Client: Port of Melbourne/McConnell Dowell

Title: Coastal Engineering Lead

Scope/Description: Coastal engineering lead for the design of the rock revetment components of the Webb Dock project in Melbourne. Design included the assessment of scour in the berthing areas from propeller wash, overtopping assessment, rock sizing and geotextile design.

Lucky Bay Transhipment Facility, SA

Client: Sea Transport

Title: Technical lead

Scope/Description: Technical lead in the dredge channel design for the Lucky Bay mineral exporting facility which is proposed for the loading, transporting and transferring minerals by barge for transhipment to offshore vessels. Jacobs assessed the dredge volume required to deepen the basin and entrance channel of Lucky Bay Harbour. The investigations determined the minimum channel depth required for safe operations.

Salina Cruz Breakwater Design, Mexico

Client: Pemex

Title: Design Manager

Scope/Description: Design manager for the development of the detailed design for a 1.6km breakwater expansion of the Salina Cruz Outer Harbour. Breakwater was founded in >20m water depth in a high seismic zone. Design included optioneering of design concepts, overtopping analysis, rock sizing, coastal modelling, physical modelling, specification and construction sequencing.

Port Hedland Tug Harbour Breakwater Design, WA

Client: BHP

Title: Lead Coastal Engineer

Scope/Description: Lead coastal engineer for the design of a rock breakwater for the Port Hedland inner harbour tug harbour.

Responsibilities: Design works included wave penetration modelling to develop and refine the performance of the breakwater layout and

alignment. Wave transformation modelling to determine design wave conditions around the proposed site. The rock breakwater layout and cross-section design were developed to meet the operational and extreme design criteria.

Iron Road Causeway and Tug Harbour Design, SA

Client: Iron Road

Title: Lead Coastal Engineer

Scope/Description: Lead coastal engineer for the development of the preliminary design for the reclamation of a large causeway, materials offload facility (MOF) and Tug harbour for the Iron Road Iron Ore export facility in the Spencer Gulf. The design included wave modelling to determine wave design criteria for the coastal infrastructure including wave penetration assessment to assess the level of protection provided by the proposed breakwater arrangements. Breakwater designs were developed to protect both the MOF facility and the tug harbour. Design concepts included rock armour and concrete armour unit solutions.

Port Hedland Boodarie Stockyards Storm Surge/Wave Modelling, WA

Client: BHP

Title: Project Manager and Principal Numerical Modeller

Scope/Description: Project manager and principal numerical modeller for the numerical modelling of the wind generated wave climate across a storm surge flood plain for a number of key design scenarios. Modelling provided design parameters for key stockyard infrastructure.

Port Hedland Inner Harbour Coastal Modelling, WA

Client: BHP

Title: Project Manager and Principal Numerical Modeller

Scope/Description: Project manager and principal numerical modeller of coastal modelling and engineering components of a series of confidential projects in the Port Hedland Inner Harbour. Modelling included hydrodynamic (MIKE HD) extreme and ambient wave generation and transformation (MIKESW) and wave penetration modelling using a Boussinesq wave model (MIKEBW).

Cape Lambert Tug Harbour Upgrade, WA

Client: Rio Tinto

Title: Technical Lead

Scope/Description: Technical lead in the numerical Boussinesq wave penetration modelling (MIKE21BW) to assess the performance of the existing tug harbour. The modelling resulted in layout recommendations to improve the cyclonic and operational conditions within the harbour. Recommendations were then developed into engineering conceptual designs including caisson, rubble mound and retaining wall breakwater extension options.

South of Embley Bauxite Export Port Facilities, QLD

Client: Rio Tinto

Title: Lead Coastal Engineer

Scope/Description: Provided coastal engineering and coastal processes support to the river and marine port facilities including review of ADCP

wave and current data and design support to the river works bank protection configuration.

Manila Bay Wave Modelling, Philippines

Client: Tiger Energy

Title: Project Manager and Principal Modeller

Scope/Description: Project manager and principal modeller for coastal modelling of Manila bay to support the engineering studies for a 2400MW power station. Modelling included wave transformation modelling (MIKESW) to generate extreme cyclonic and ambient wave conditions at the project site. Analysis also included extreme weibull analysis to average recurrence interval conditions for key design events.

DTRA Marine Facility Breakwater and Dredging Design, Vietnam

Client: DTRA

Title: Design Lead

Scope/Description: Design lead for the tender design of a breakwater and associated dredging to protect a marine facility from operational and extreme wave conditions. Analysis included wave modelling and desktop navigation assessment to define the layout of the harbour basin and the design analysis to define a suitable rock armour breakwater to withstand extreme typhoon events.

Costa Azul Breakwater, Ensenada Mexico

Client: Sempra Energy

Title: Assistant Resident Engineer

Scope/Description: Assistant resident engineer for the construction of the worlds largest caisson breakwater in Costa Azul, Mexico.

Responsibilities: Role included the assessment of the rock quarry sources and designing and managing the quality control process for all of the armour and core materials for the project. The role also included the quality control of the fabrication and placement of the coreLoc armour system to ensure that the construction was aligned with the design specifications and placement patterns.

North of Weipa Coastal Processes Assessment, QLD

Client: Rio Tinto

Scope/Description: Reviewer of the North of Weipa coastal processes assessment. Study developed a conceptual model of a large section of coastline to the north of Weipa. The model included the complex interaction of cross-shore, longshore and estuary flushing of sediments to assess the historical and predicted movements of estuary entrance bars.

Eden Cruise Terminal Detailed Dredge Plume Modelling, NSW

Client: DoI NSW

Title: Project Manager

Scope/Description: Project Manager for the hydrodynamic and dredge plume modelling of the Eden breakwater wharf expansion project. A detailed hydrodynamic modelling system was developed to simulate the complex ocean current driven circulation of Twofold Bay. The model was used to assess a number of dredge dispersal scenarios associated with construction. The model was also used to assess the dispersion of the proposed cruise terminal operations as a result of propeller wash generated

from the cruise ship and support tugs. The modelling was a critical component of the Environmental permitting and application process.

Wallaroo Coastal Processes Assessment, SA

Client: Sea Transport

Title: Technical Lead and Project Manager

Scope/Description: Technical lead and project manager for the coastal processes assessment of a port development in Wallaroo. The purpose of the study was to identify the dominant coastal processes in the area and assess the potential impacts of a proposed rock-fill causeway structure on the prevailing coastal processes. This included the review of relevant information and literature that describe the coastal processes and physical setting of Wallaroo Bay; development of a wave model to assess the nearshore wave climate in the vicinity of the proposed development site; an empirical analysis of the longshore sediment transport regime at the site using wave model results and the assessment of the potential impact of the proposed causeway structure on the local coastal processes to inform the development of potential mitigations

Norman Creek Wave and Siltation Analysis, QLD

Client: Rio Tinto

Title: Technical Lead

Scope/Description: Technical lead for the review of existing investigations of siltation for the proposed Boyd Point Iron Ore berth facility. Analysis included the review of wave datasets and maintenance dredge records to investigate whether a correlation between the wave climate and assumed siltation rates could be adopted to estimate the siltation rates at the proposed Boyd Marine Terminal.

Francis Bay Development Sedimentation Review, NT

Client: Tasmanian Seafoods

Title: Coastal Lead

Scope/Description: Coastal Lead for the desktop analysis of the hydrodynamics and sediment transport to assess whether a reclamation development was likely to have a significant impact on the local hydrodynamic and sedimentation regime. Analysis was required as part of the planning process.

Seaton Carew Coastal Strategy, UK

Client: Hartlepool Borough Council

Title: Project Manager

Scope/Description: Project Manager for the development of a coastal strategy for the long term management of a 9km stretch of coastline. The study comprised of a series of coastal process, environmental and economic studies and was carried out in close consultation with key stakeholders. A Strategy Appraisal Report was produced and successfully taken to the Environment Agency National Review Group.

Garden Island Dredge Plume Modelling, Australia NSW

Client: DoD

Title: Project Director

Scope/Description: Project Director for the hydrodynamic and dredge plume modelling of a wharf expansion project on Garden Island. A hydrodynamic modelling system was used to examine the hydrodynamic

impact of the proposed development and assess dredge dispersal scenarios associated with construction. The modelling was used as an input to the Environmental permitting and application process.

OQYANA Islands, Dubai

Client: Nakheel

Title: Coastal Engineer

Responsibilities: Coastal engineer responsible for the design of beaches, groynes and revetments, and validation of master plan for a US$6 Billion artificial island development 4km off the coast of Dubai. The design was based on an assessment of waves and water levels and the results of numerical modelling for extreme waves, wave penetration and flushing.

The Pearl Island Development, Qatar

Client: UDC

Title: Coastal Engineer

Responsibilities: Coastal Engineer responsible for the testing and stabilisation of the artificial beaches on the Pearl Island development in Qatar. Testing included sediment sampling, measurement of pore pressure cone penetration tests. Stabilisation included the placement of a beach veneer to improve the beach drainage properties.

Bahrain Water Gardens Marina, Bahrain

Title: Technical Lead

Scope/Description: Technical lead for numerical modelling studies and beach design to support the concept design of the Bahrain Water Gardens development, a project located on a site of 400 hectares to be reclaimed from the sea to the north of Bahrain. The numerical modelling studies assessed wave penetration to ensure suitable wave conditions within the marina and also produced design wave and water level conditions for the design of the reclamation and edge protection structures.

Kangaroo Island Desktop Wave Climate Analysis, SA

Title: Technical lead

Scope/Description: Technical lead for the desktop analysis of the wave climate for the proposed port locations on the north east coast of Kangaroo Island. The study included an analysis of existing wave and wind data to provide an indication of swell and wind generated wave conditions at the potential sites. The study supported a port options study commissioned by New Forests Asset Management Pty Limited to undertake a port options scoping study to identify and evaluate potential port sites for exporting forest products (log or woodchip) and possibly general cargo.

Amrun Offshore Synthetic Cyclone Wave Modelling, QLD

Client: Rio Tinto

Scope/Description: Provided extreme wave modelling to support the detailed design of a large Bauxite export facility in Northern Queensland. Extreme synthetic cyclones were generated in the wave model using a calibrated Holland wind model to assess the range of directional approach at the site. The study enabled the design team to reduce the structural lateral loads on the structure offering substantial design savings to the client.

Bamin Offshore Port, Brazil

Title: Numerical Modeller

Scope/Description: Numerical Modeller for the hydrodynamic and wave modelling studies to support the design and EIA of a new US$1.5 Billion iron ore offshore export facility in the state of Bahia, Brazil. Studies include the modelling of waves, hydrodynamics and sediment transport to assess the relative impact on the ambient environment.

Tidal / Flood Assessment for Upgrade of Sir Francis Drake Drive Crossing of Schooner Creek, USA

Scope/Description: Developed the methodology and provided coastal engineering support for the development of a 1D hydrodynamic model (MIKE 11) which was generated to investigate the affect the Sir Francis Drake Drive Crossing has on the tidally-influenced behaviour Schooner Creek. This included determining coastal inputs into the model, such as tidal boundary data and sea level rise information.

Port Philip Bay Wave Modelling (Webb Dock), Vic

Client: Port of Melbourne

Title: Principal Modeller

Scope/Description: Principal modeller for coastal modelling of Port Phillip Bay to support the design of the expansion of the Melbourne Webb Dock port facility. Modelling included wave transformation modelling (MIKESW) to generate extreme and ambient wave conditions at the project site. Analysis also included extreme weibull analysis to average recurrence interval conditions for key design events.

Abbot Point Coal Terminal Expansion, QLD

Client: Adani

Title: Technical Coastal Engineering Lead

Scope/Description: Technical coastal engineering lead for the development of the metocean design criteria for the Abbott Point terminal expansion. Jacobs partnered with Adani in this project to undertake the design of the port expansion. The design included a single trestle jetty and conveyor connecting to two offshore berths and two ship loaders which are 2.8 km offshore.

Port Hedland Temporary Tug Mooring Metocean Assessment, WA

Client: BHP

Title: Technical Lead

Scope/Description: Technical lead for the coastal modelling studies to investigate the design wave conditions to support the analysis of a temporary tug swing mooring arrangement. Wave transformation modelling was undertaken using DHI's MIKE21 Spectral Waves module (MIKE21SW).

Broadwater Cruise Terminal, QLD

Title: Technical Coastal Engineering Lead

Scope/Description: Technical coastal engineering lead for the conceptual design and cost estimation of the Broadwater cruise terminal and marina development. Included the conceptual dredge footprint, edge protection and marina design.

Salina Cruz Wave Modelling, Mexico

Client: Pemex

Title: Principal Modeller

Scope/Description: Principal modeller for the coastal modelling to support the reference design of the Salina Cruz breakwater expansion reference design. Modelling included wave transformation modelling (MIKESW) to generate extreme and ambient wave conditions at the project site. Analysis also included extreme weibull analysis to average recurrence interval conditions for key design events. Wave penetration analysis was also undertaken (MIKEBW) to assess the residual operational conditions in the proposed harbour basin and to refine the design layout.

HMAS Waterhen and Chowder Bay, NSW

Client: DoD

Scope/Description: Review of metocean criteria for the design of the remediation of the Waterhen and Chowder Bay wharf facilities in Sydney.

Port Development EIA, Angola

Client: Sonangol

Title: Project Lead Numerical Modeller

Scope/Description: Project lead numerical modeller for the assessment of proposed reclamation development for the Oil Service Centre at Luanda Port. Flow characteristics were investigated using the MIKE21HD modelling system. The results of this study were used to provide information for input to the Environmental Impact Assessment.

Dunoon Marina Feasibility Study, UK

Title: Project Manager

Scope/Description: Project Manager for the assessment and development of a marina design in Scotland. Assessed a number of marina layouts to find the optimum configuration. Nearshore wave conditions were modelled to assess wave penetration into the marina berthing area. The impact of the proposed development on sediment transport and the potential of siltation were also included in the study.

Muara Tawar Power Station Thermal Plume Modelling, Indonesia

Title: Project Manager and Principal Modeller

Scope/Description: Project manager and principal modeller for the seawater thermal dispersion study to identify key environmental and operational issues associated with the proposed cooling water operation of a proposed 1600MW gas fired power station in West Jawa. This included the development of 3D hydrodynamic model in order to assess the potential thermal impacts of the proposed effluent discharge and assess the likely degree of thermal recirculation at the proposed intake facility.

Muara Tawar Power Station Tsunami and Flood Risk Assessment, Indonesia

Title: Project Manager and Study Lead

Scope/Description: Project manager and study lead for the assessment of the tsunami and flood risk at the proposed Jawa 1 power plant site (1600MW gas fired). The assessment included the assessment of tsunami risk, as well as the risk of flood inundation due to tides, storm surges, wave overtopping and overland flood flows.

Manila Bay Outfall Thermal Plume Modelling, Philippines

Scope/Description: Peer review and study management of thermal plume modelling for the feasibility design and EIS application for an outfall for the cooling system of a 2400MW power station.

Misamis Power Station, Thermal Plume Modelling Review, Philippines

Scope/Description: Review of thermal plume modelling for the detailed design of an outfall for the cooling system of a 405MW power station.

Therma Visayas Power Station, Thermal Recirculation, Morphology and Metocean Review, Philippines

Scope/Description: Review of thermal plume modelling, morphology and met-ocean studies for the detailed design and configuration of the intake and outfall infrastructure for the cooling system of a 300MW power station on the northern coast of central Cebu Island.

Limay Coal-Fired Power Plant, Thermal Plume Modelling Review, Philippines

Scope/Description: Review of thermal plume modelling studies for the outfall infrastructure for the cooling system of a 600MW coal fired power station on the Bataan Peninsula, Manila Bay.

GNPower Mariveles Coal Plant, Thermal Plume Modelling Review, Philippines

Client: GNPower

Scope/Description: Review of thermal plume modelling studies for the outfall infrastructure for the cooling system of a 600MW coal fired power station on the Bataan Peninsula, Manila Bay.

GNPK Coal-Fired Power Plant Outfall Design Review, Phillipines

Client: GNPower

Title: Design Review Team Lead

Scope/Description: Design Review team lead to review the proposed alternative outfall design proposed by the contractor to repair the installed outfall line. Review included assessment of scour potential, hydraulic stability of the outfall line and maritime constructability.

Al Jubail, Berri Islands EIA Coastal Modelling, Saudi Arabia

Client: Saudi Aramco

Title: Project Manager

Scope/Description: Project manager for the hydrodynamic modelling and wave modelling to support the environmental impact assessment and concept design of a series of artificial Islands offshore from Al Jubail. The modelling will assess the hydrodynamic impact of the proposed development and assess dredge dispersal and oil spill scenarios associated with construction. Wave modelling was also undertaken to provide extreme design conditions to the engineering design team.

Aminat, Outfall Advection Dispersion Modelling, Saudi Arabia

Client: Huntsman

Title: Project Manager

Scope/Description: Project manager for the advection dispersion modelling of the Al Jubail Industrial City outfall to assess thermal plume dispersion and dilution of contaminants. A hydrodynamic modelling system was used to examine the dispersion behaviour of the outfall discharge to assess the potential impacts of effluent disposal on the receiving coastal waters of Jubail Bay. This modelling system consisted of two nested hydrodynamic models, namely a regional model of the Arabian Gulf and a local three-dimensional (3D) model of the Jubail Bay area.

Iron Road Environmental Impact Coastal Modelling, SA

Client: Iron Road

Title: Project Manager and Principal Coastal Modeller

Responsibilities: Project manager and principal coastal modeller for the coastal engineering studies to support the environmental impact assessment of a proposed bulk iron ore port facility in the Spencer Gulf. Numerical coastal modelling included hydrodynamic current (MIKE21HD), wave transformation (MIKE21SW) and longshore sediment transport (LITPACK) to assess the relative impact of the proposed port infrastructure on the marine environment. Models were calibrated accurately against recorded data collected with an ADCP device.

Milingimbi Desalination Plant Feasibility Study, NT

Client: PWC

Title: Outfall Package Lead

Scope/Description: Outfall/Intake infrastructure advisor for the development of a desalination plant to support the community on the island of Milingimbi with potable water supply. This included the assessment of suitable intake and outfall locations and potential configurations to service the plant. Challenges included shallow water and high tidal ranges associated with the site and a fragile freshwater lens at risk of saltwater intrusion.

Saibai Outfall Design, Torres Strait Islands

Client: Torres Strait Island Regional Council

Title: Outfall advisor

Scope/Description: Outfall advisor for the design of the upgrade of the Saibai STP. The study was part of an initiative to improve the health and wellbeing, and reduce health risks for Torres Strait and Northern Peninsula Area communities through the provision and improvement of their water, sewerage, waste management facilities, roads, drainage and related environmental health infrastructure systems.

The design included the assessment and design of a small scale outfall to discharge effluent from the plant. This included concept analysis for repair of the existing outfall infrastructure and development of a number of alternative replacement solutions.

Viva Energy Intake Select Phase Assessment, Vic

Client: Viva Energy

Title: Design Manager

Scope/Description: Design manager for the selection phase studies to assess the Sea Water Cooling System issues with sedimentation and organic debris. Jacobs undertook analysis to define the likely cause of the issue including specialist coastal processes advice. This provided a sound basis for the development of targeted options to confidently address the key mechanisms of sedimentation in the channel. A number of design options were developed for consideration and comparison including intake channel replacement and upgrade solutions, screening upgrades and an alternative offshore outfall solution.

Safi SPH Desalination Intake Location Assessment, Morocco

Client: OCP

Title: Study Lead

Scope/Description: Study lead for the assessment of a suitable location for the desalination intake for the proposed Safi Phosphate Hub (SPH) facility in Safi, Morocco. Study included the assessment of land constraints, marine constructability and the modelling of effluent dispersion from the existing outfalls from existing process plants.

Safi Long Sea Outfall Modelling, Morocco

Client: OCP

Title: Project Manager

Scope/Description: Project manager for the coastal modelling components of the Safi Long Sea Outfall Phase 1 feasibility study. Modelling included nearfield (Cormix) modelling of various diffuser configurations and 3D hydrodynamic far-field modelling (MIKE3 AD) to assess the dispersion of key contaminants against suitable water quality objectives.

Bicentennial Bikeway Review Brisbane, QLD

Client: BCC

Title: Technical Coastal Engineering Lead

Scope/Description: Technical coastal engineering lead for the peer review for the Brisbane City Council on the bicentennial bikeway upgrade. The design incorporated a number of new structural forms, as well as extending and widening the existing bikeway footpath. Due to the bikeways location on the riverbank a number of maritime components were incorporated into the design. Maritime review tasks undertaken for the bikeway review included rock sizing and design of rock revetments, as well as possible scour issues resulting along the bikeway.

Mariners Reach Riverwalk/Bikeway Brisbane, QLD

Client: BCC

Title: Project Director

Scope/Description: Jacobs were commissioned for the replacement of the Mariners Reach Riverwalk which provides riverside access for pedestrians and cyclists along the Brisbane river. The team developed an innovative FRP solution which enabled BCC to retain the substructure of the original walkway and retrofit with FRP supports and decking. The FRP will reduce the maintenance burden of the structure for BCC throughout the design life of the structure.

Joris Jorissen

COASTAL MODELLING TECHNICAL ADVISOR

Joris is a Principal Engineer who has worked across many parts of the world as an engineer and numerical modeller on port development, mining, oil and gas and (water) infrastructure projects. His experience spans a wide range of specialist fields including natural hazards investigations, coastal processes assessments, coastal management studies, engineering design of coastal structures and dredging programs, and receiving water modelling.

He has extensive experience in the assessment and numerical modelling of coastal and estuarine processes, particularly in relation to waves, (flood) hydrodynamics, sediment transport and water quality issues and has provided technical leadership to numerous challenging engineering projects during all phases of project development, from pre-feasibility, feasibility, design and construction.

Some of his key past projects are the development of shoreline erosion management plans (Cardwell Beach, Tully Heads, Redcliffe, Sunshine Coast and Agnes Water) and coastal processes/hazard assessment investigations (Tweed Sand Bypassing, Bega valley Shire, Rye Beach, Byron Shire, Tweed Shire, Rainbow Shores).

Joris enjoys working with project teams and with our clients to identify solutions that add value to the project and reduce risk over the project's life. He is proud to be part of teams that use market leading engineering and analysis techniques to deliver innovative, client-focused outcomes.

EDUCATION/QUALIFICATIONS

MSc Civil Engineering (Specialisation Coastal Engineering), Delft University of Technology (Netherlands), 2002

Areas of Expertise

- Hydrodynamic Modelling
- Coastal Processes Studies
- Wave Assessments
- Sediment Transport and Sedimentation Studies
- Dredge Studies
- Receiving Water Quality Investigations
- Marine and Coastal Structures

Relevant Project Experience

Agnes Water / Town of 1770 Shoreline Erosion Management Plan, QLD, Gladstone Regional Council (QLD)

Start/End Dates: 2008 – 2009

Responsibilities: Coastal management study at Agnes Water and Town of Seventeen Seventy, Queensland. As Project Manager and Principal Engineer, Joris' responsibilities included assessment of coastal processes, assessment of coastal erosion risks, development and evaluation of management options, and preparation of a management plan. Extensive stakeholder consultation was conducted as part of the project.

Redcliffe Peninsula Shoreline Erosion Management Plan, QLD, Moreton Bay Regional Council (QLD)

Start/End Dates: 2008 – 2009

Responsibilities: Coastal management study at Redcliffe, Queensland. As Project Manager and Principal Engineer, Joris' responsibilities included

assessment of coastal processes, assessment of coastal erosion risks, development and evaluation of management options, and preparation of a management plan. Extensive stakeholder consultation was conducted as part of the project.

Tully Heads and Hull Heads Shoreline Erosion Management Plan, QLD, Cassowary Coast Regional Council (QLD)

Start/End Dates: 2008 – 2009

Responsibilities: Coastal management study at Redcliffe, Queensland. As Project Manager and Principal Engineer, Joris' responsibilities included assessment of coastal processes, assessment of coastal erosion risks, development and evaluation of management options, and preparation of a management plan. Extensive stakeholder consultation was conducted as part of the project.

Programme Design – Reducing coastal hazards risks in Tokelau, NZ Ministry of Foreign affairs and Trades

Start/End Dates: 2018

Responsibilities: Design of an aid programme to build resilience on three coral atolls in the Pacific on behalf of the Government of Tokelau. As the Lead Coastal Engineer, Joris was the main author of the programme design document, provided engineering advice on the existing coastal hazards risks, management issues & community engagement on the islands.

Temaiku Land and Urban Development – Feasibility Investigations, Kiribati, NZ Ministry of Foreign affairs and Trades

Start/End Dates: 2017 – 2018

Responsibilities: Study to examine the feasibility of a 209ha land reclamation for urban land use to assist Kiribati with addressing future climate risks of the Pacific atoll of Tarawa. Joris was the Lead Coastal Engineer for several technical studies to inform the Environmental and Social Impact Assessment, including a natural hazards assessment, a coastal processes assessment and a detailed dredge plume modelling study.

Bega Valley Shire Coastal Hazard Definition Study, Bega Valley Shire Council (NSW)

Start/End Dates: 2014 – 2015

Responsibilities: As Project Manager and Principal Coastal Engineer, Joris' responsibilities included assessment of coastal processes, numerical modelling of waves and shoreline evolution processes and assessment of coastal inundation hazards, including wave overtopping. A series of leading-edge shoreline evolution models were developed to assess potential changes to the shoreline because of projected sea level rise.

Choiseul Bay Climate Change Vulnerability and Adaptation Plan, Solomon Islands, Department of Foreign Affairs and Trade

Start/End Dates: 2014

Responsibilities: As Lead Modeller, Joris' responsibilities included detailed modelling of natural hazards, including tsunami inundation modelling, tropical cyclones and fluvial flooding to determine the existing and likely future level of risk posed to the community on the island.

EDUCATION/QUALIFICATIONS

MSc Irrigation Engineering, University of Southampton, UK, 1993

BA (Hons) Engineering Science, University of Cambridge, UK, 1992

REGISTRATIONS/ CERTIFICATIONS

Chartered Engineer (CEng), Civil Engineering, Engineering Council, 535751, UK, 2006

Chartered Member of the Chartered Institution of Water and Environmental Management (MCIWEM)

KEY SKILLS

Twenty-five years of experience in mathematical and physical modelling, analysis and field investigations on a variety of hydraulic and environmental projects.

OFFICE LOCATION

Wellington

Damian Debski

FLOOD RISK TECHNICAL ADVISOR

Damian is a civil engineer with twenty-five years' experience, specializing in hydraulic modelling, analysis and assessment for a variety of applications from river and coastal flood risk studies and protection works to the detailed design of water and wastewater treatment works and major water conveyance systems. This experience includes two years working with physical models of coastal breakwaters in the hydraulic research laboratory at Bristol University in the UK and over twenty years' experience in international engineering consultancy, working for Halcrow Group Ltd, CH2M HILL and, most recently, Jacobs.

Based in the UK for most of this period, Damian has also worked on consulting projects elsewhere in Europe and in Asia. He relocated with Jacobs to New Zealand in 2018 where he has worked on projects to assess fluvial and coastal flood risk and flood protection measures. Clients include city, district and regional councils, national government agencies, water and power utility companies and commercial property developers.

Areas of Expertise

- River flood modelling and flood risk assessment
- Coastal flood modelling and tidal flood risk assessment
- Open channel and pipe system hydraulics

Examples of Relevant Recent Project Experience

Kāpiti Coast District Council Flood Modelling Queries, New Zealand

Client: Kāpiti Coast District Council

Title: Technical lead

Start/End Dates: August 2019 – Present

Scope/Description: Provision of technical advice and support to Kāpiti Coast District Council (KCDC) in relation to flood risk queries and reviewing resource consent applications. Application and updating of existing DHI MIKE flood models of stormwater catchments to assess flood risk to proposed developments.

Responsibilities: Work directly with KCDC stormwater and coastal engineers to respond to flood enquiries and prepare methodologies to address enquiries. Supervise and review modelling work and reporting done to address queries. Review flood risk assessments prepared by third parties. Participate in meetings with KCDC and consent applicants to support KCDC stormwater and coastal engineers.

Waimakariri Coastal Inundation Modelling, New Zealand

Client: Waimakariri District Council

Title: Technical lead

Start/End Dates: May 2019 – March 2020

Scope/Description: Assessment of the extent of inundation along the coastal floodplain resulting from combinations of extreme tides and fluvial flows in the Waimakariri and Ashley rivers.

Responsibilities: Field visit to identify flood flow routes and understand flooding mechanisms. Developed project scope and methodology, data collection and review, developed tidal storm surge water level boundaries, supervised the development and application of MIKE FLOOD coupled 1D-2D MIKE11/MIKE21FM models of the river channels and floodplains. Developed methodology to account for effects groundwater on coastal inundation under sea level rise. Prepared study report, supervised flood map deliverables and participated in workshops with the client.

Pauatahanui Substation Flood Risk Assessment, New Zealand

Client: Transpower

Title: Project manager

Start/End Dates: May – December 2019

Scope/Description: Assessment of flood risk to the Pauatahanui 100kv/33kv substation and assessment of options to provide protection from combined tidal and fluvial flooding from the Pauatahanui Stream.

Responsibilities: Project management, supervised hydraulic modelling of the Pauatahanui catchment to establish flood levels and extents at the site, carried out site visits to confirm flood mechanisms and establish critical asset protection levels, identified flood protection options and supervised preliminary development of options and cost estimates. Delivered workshop to client stakeholders to present findings of the study.

Humber Strategy Comprehensive Review, UK

Client: Environment Agency

Title: Hydraulics specialist

Start/End Dates: 2017 – 2018

Scope/Description: Comprehensive review of the Humber Flood Risk Management Strategy to manage tidal and fluvial flood risk around the Humber Estuary over the next 100 years.

Responsibilities: Developed scope for hydraulic modelling to inform assessment and selection of strategic flood defense solutions and environmental compensation measures including defense raising, managed realignment of defenses, flood storage areas and tidal surge barriers. Co-ordinated modelling tasks undertaken by sub-consultants and development and validation of new strategic models of the Humber estuary for identification and assessment of solutions.

Bridgewater Tidal Barrier, UK

Client: Environment Agency

Title: Hydraulics specialist

Start/End Dates: 2016 – Present

Scope/Description: Outline design of tidal surge barrier and flood embankments to provide 1 in 200-year standard of protection to town of Bridgewater and surrounding communities over the next 100 years.

Responsibilities: Led development and calibration of a detailed 1D and 2D hydrodynamic model of the tidal river Parrett and inland Somerset Levels and Moors. Provided design information and flood risk analyses for a large range of fluvial, tidal, climate change and system operational scenarios to support barrier design and Transport Works Act Order application.

EDUCATION/QUALIFICATIONS

Grad Dip Emergency Management – Massey University

BSc Geography – University of the Philippines

REGISTRATIONS/ CERTIFICATIONS

NZTA GIS Advisor (2011-2014)

MEMBERSHIPS AND AFFILIATIONS

NZ Esri Users Group Committee Member

Survey + Spatial NZ – Committee Chair (Spatial Stream)

NZ GIS in Conservation – Secretary/Founding Member

Volunteer Service Abroad - GIS Interview Panel

Wellington Region Emergency Management - Volunteer

AWARDS/HONORS

ACENZ Silver Innovate Award – Wellington Region Road Network Earthquake Resilience Study

Jasmin Callosa-Tarr

SPATIAL SPECIALIST

Jasmin is a highly skilled and versatile GIS specialist with more than 25 years of experience in the geospatial industry. She had used GIS in many participatory and community engagement projects in Southeast Asia and Southern Africa. She had successfully documented participatory methodologies in the manual called "Participatory 3D Modelling" which has been used in many countries to engage with communities regarding community issues. She is adept with a variety of GIS applications in applying to digital engineering and (BIM), social sciences, urban and rural planning projects, demographic analysis and environmental management, crop yield analysis, participatory GIS and biodiversity conservation. Aside from gaining extensive experience in New Zealand, she had also worked in South Africa, Lesotho, Mozambique, South East Asia and the United Kingdom. Jasmin was also a member of the Geospatial Standards Advisory Group for the NZ Geospatial Office in 2009.

She is experienced in the use of the ESRI suite of software with the different analysis tools (3D Analyst, Spatial Analyst, Network Analyst, Geostatistical Analyst, Data Interoperability, Space Time Cube and Tracking Analyst). She also has working knowledge of other geospatial tools such as FME, Idrisi, GIS, ENVI, Erdas Imagine, Mapinfo, and GeoMedia.

Areas of Expertise

- ESRI Enterprise Portal Administration; AGOL; web and mobile apps customization

Relevant Project Experience

Wellington Water Resilience Project

Client: Wellington Water

Title: GIS Specialist

Start/End Dates: 2017

Scope/Description: The scope of the project is to prioritise on various wastewater assets as to their criticality and resilience to an earthquake event. Jasmin assessed the resilience of the wastewater network in relation to an earthquake event. Data was collated and analysed to understand the relationship between the different hazards and the network using GIS and expert advice.

Wellington Region Transport Resilience Project, Wellington

Client: NZTA/GWRC

Title: GIS Specialist

Start/End Dates: 2016 – 2018

Scope/Description: This project is an advisory support for the NZTA and the Greater Wellington Region to priorities critical areas that will be needing funding to make region's roads more resilient. GIS was used to analyse the resilience of the road to natural hazards such as earthquake, tsunami and storm/flooding events.

This project is an advisory support for the NZTA and the Greater Wellington Region to prioritise critical areas that will be needing funding to make

region's roads more resilient. GIS was used to analyse the resilience of the road to natural hazards, such as earthquake, tsunami and storm/flooding events. As GIS Specialist, Jasmin was responsible for the compilation of local councils' infrastructure dataset to prioritise and assess critical road segments that may be affected in a hazard event. Analysis and modelling of the dataset is the primary task of this project. The criticality of the different road segments was identified.

National State Highway Resilience Project, Wellington, NZTA

Start/End Dates: 2016 – 2017

Scope/Description: The New Zealand Transport Agency (the Agency) is developing its strategy to understand and enhance the resilience of its state highway network to natural hazards. As part of the strategy, this project main scope was to assess the resilience of the national state highway network for low frequency, high impact natural hazards such as: earthquakes, tsunami, flood/storm and volcanic eruption.

Responsibilities: Jasmin was the GIS Specialist responsible for assessing the resilience of the national state highways in relation to the natural hazards mentioned above. The availability, outage and disruption state were identified and assessed based on the different characteristics of the environment and underlying soil conditions of the road. GIS was used to capture data, analyse and model the information.

Seismic Assessment of Buried Utilities, Wellington, MBIE

Start/End Dates: 2012 – 2016

Scope/Description: This four-year, MBIE-funded research project provided an enhanced understanding of the performance and resilience of underground utilities under seismic loading within the Christchurch area. Recommendations and guidelines will be developed to enable New Zealand to be able to minimise disruption and increase the 'bounce back' capability of communities after a seismic event.

There were areas in Canterbury were the pipelines had tremendously failed after the earthquake. The data was quantified and mapped to visualise the break rates not only for the region but for the whole country based on the soil conditions. Various analysis was done based on the service failure reports that were logged to correlate with the liquefaction observations and the average break rates in the study area.

EDUCATION/QUALIFICATIONS

BSc (Hons), Ecology, Victoria University of Wellington, 1999

PGDipSci, Physical Geography, Hydrology, Victoria University of Wellington, 2011

MEMBERSHIPS AND AFFILIATIONS

Member of New Zealand Hydrological Society (NZHS)

Rivers Group

Kristin Stokes

SENIOR CONSULTANT – FRESH & MARINE WATER

Kristin is a hydrologist and hydraulic modeller with eight years' experience including flood investigations, hydrological and hydraulic modelling and the analysis of hydrological data. Kristin has experience in one- and two-dimensional modelling using hydraulic modelling software MIKE FLOOD, Innovyze ICM and HEC-RAS for flood hazard assessments, dam breaks, bridge replacement and road design. She is skilled in hydrological modelling including rainfall-runoff modelling using HEC-HMS and RORB, baseflow modelling and low flow estimation. She is proficient in using GIS software for preparation of topographic inputs to models, analysis of input information and results and the presentation of output.

Areas of Expertise

- Floodplain Modelling
- Urban Stormwater Modelling
- Catchment runoff modelling
- Flood frequency analysis
- Hydrological Investigations
- Spatial/GIS Analysis
- Water balances

Relevant Project Experience

Pinehaven Stream Improvements

Client: Upper Hutt City Council, Wellington Water & Greater Wellington

Start/End Dates: 2017 – Present

Scope/Description: This project was to design stream upgrades to protect properties in the suburb of Pinehaven, Upper Hutt from flooding. Kristin's role was to update an existing MIKE FLOOD model of the Pinehaven Stream and use it to investigate a range of flood-causing rainfall events, assessing design options, and produce outputs to support preliminary and detailed design. He role also included increasing the model grid resolution to make it appropriate for use in the design phase, representing proposed upgrades such as widened stream cross-sections, and investigating culvert and bridge upgrade options and reporting on the model build and results.

Stormwater Modelling

Client: Wellington Water

Start/End Dates: 2016 – Present

Scope/Description: Kristin is currently the Senior Modeller for Jacobs on the Wellington Water Modelling Panel of modelling experts which is running a multi-year programme to develop stormwater models of all urban catchments in Wellington, Porirua and Lower Hutt. She has been the lead modeller in building models of Titahi Bay, Wilton and Pauatahanui Stream catchments. The process involves building a linked 1D-2D model of the stormwater network, using ArcGIS tools developed by Wellington Water for network clean-up, before importing into Innovyze ICM to finalise the model build and validation. The models are validated against available data including anecdotal flood observations, surveyed flood levels and flow gauges. A range of design events runs, and a dynamic freeboard run are

carried out. The outputs are flood maps that can be used for District Plans and for recommended building levels.

Professional Services Stormwater Support

Client: Kapiti Coast District Council

Start/End Dates: 2016 – Present

Scope/Description: Kapiti Coast has taken a proactive approach to stormwater improvement and hydraulic neutrality. Kristin has provided stormwater support to develop scopes tallow assessment of hydraulic neutrality and flood impacts for a range of proposed developments. Jacobs have developed a suite of MIKE FLOOD coupled models for the urban network and catchments and these are used to understand flooding issues and advise on mitigation options for development.

Baypark to Bayfair Link

Client: CPB for NZ Transport Agency

Start/End Dates: 2017 – 2018

Scope/Description: The upgrade to the Baypark to Bayfair Link involves the building of two flyovers. As part of the project the existing Maunganui-Girven Road intersection will also be upgraded. Kristin was involved in assessing the Principals requirements against the design for both the tender and detailed design phases. This involved updating the MIKE FLOOD coupled MIKE 11/MIKE 21/MIKE URBAN model provided by client with the proposed stormwater infrastructure and flyover bathymetry, assessing the design's performance against the principal's requirements for flooding and reporting on the results.

Waimea River Flood Modelling

Client: Tasman District Council

Start/End Dates: 2016 – 2017

Scope/Description: Kristin was the modeller for the later phases of a project to assess the effects of flooding on the Waimea River, Tasman. Her role was to develop a 2D-only model of the lower Waimea River, in MIKE 21 Flexible Mesh. The model was validated to a range of historic events, including events that occurred during the course of the project, then the model was used to identify flood extents for a range of design events and to understand the effect of changes within the floodplain.

Richmond Stormwater Model Scoping

Client: Tasman District Council

Start/End Dates: 2016

Scope/Description: This was an exercise to assess the scope of an extension of an existing ICM model of the Richmond town centre to cover the surrounding areas, including the township of Hope. Kristin provided expertise to recommend the hydrological approach for the extension and the scope of survey required for the 1-D channels.

Comoros Water Supply Study

Client: Ministry of Foreign Affairs and Trade

Start/End Dates: 2016

Scope/Description: A water supply was required for the development of geothermal power on the island of Grande Comore in the Comoros. Kristin carried out a desktop study of the hydrological regime and the potential for surface water to be extracted or stored to provide a supply of water for the pumps.

SH1 Peka Peka to Otaki

Client: NZ Transport Agency

Start/End Dates: 2016

Scope/Description: This project was to assess the tender design for a SH1 upgrade between Peka Peka and Otaki, crossing a number of catchments. Kristin's role was to modify existing MIKE FLOOD models provided by the client with the proposed tender design and used the updated models to assess the results against the principal's requirements prior to tender submission.

Stokes Valley Stormwater Modelling

Client: Wellington Water

Start/End Dates: 2016

Scope/Description: Kristin was involved in the development of an integrated pipe, 1D and 2D hydraulic model of the Stokes Valley Stream catchment which flows through the suburb of Stokes Valley in ICM software. The model includes a number of structures, including private bridges and culverts in the 1D channel and a detailed mesh of the floodplain as well as a hydrological model of the sub-catchments within the model extent.

Urban Catchments Modelling Assessment

Client: Nelson City Council

Start/End Dates: 2015 – 2016

Scope/Description: Kristin was the lead modeller on a project to develop hydrological and hydraulic models of seven urban stream catchments in Stoke, Nelson. The hydrological models were developed in HEC-HMS and calibrated using measured flows. The main channels and overland stormwater flows were modelled using a coupled 1D-2D MIKE FLOOD model for each catchment, where the catchments were hydraulically linked combined models were created. The effects of climate change were taken into consideration for each catchment. Flood maps and flood animations for a range of events and climate change scenarios were developed based on the model results.

Culvert Catchment Assessments

Client: KiwiRail

Start/End Dates: 2015 – 2016

Scope/Description: Kristin provided technical expertise and supervision for engineers in Pune, India to complete hydrological assessment of 180 culverts on the North Island Main Trunk Line. She delivered a summary spreadsheet reporting on the capacity of existing culverts and any recommended upgrades. The client was happy with the outcomes and quality of this project and so commissioned assessment of a further 920 culverts, which were delivered ahead of schedule in April 2016.

St George Floodplain Modelling, QLD, Australia

Client: Balonne Shire Council

Start/End Dates: 2015

Scope/Description: Kristin lead the development of MIKE 21 Flexible Mesh 2D model of the St George township in Queensland, Australia. The model was used to assess the flow paths for stormwater within the urban area during 1% and 10% AEP rainfall events. The area modelled was a flat flood plain, with the Balonne River which flows through the centre of the town used as a model boundary. A rainfall on grid approach was used to assess the flow paths during the design events and produce maps of the flood depths and flow paths in the township and surrounding areas for use in future development planning.

Manawatu River Rail Bridge Assessment

Client: KiwiRail

Start/End Dates: 2014

Scope/Description: The purpose of this project was to assess water levels and velocities for bridge protection works for the rail bridge across the Manawatu River downstream of its confluence with the Mangatainoka River. Kristin developed a hydrological model in HEC-HMS and calibrated it to the Manawatu River at Gorge flow gauge and also to the contributing flow gauges between the rail bridge and the Gorge flow gauge. She used the calibrated hydrological model to estimate design flows at the bridge site. A 2D only model in MIKE 21 flexible mesh of the river at the bridge crossing was developed from survey and LiDAR to assess the levels and velocities through the bridge for a range of design events.

Pleasant River Rail Bridge Assessment

Client: KiwiRail

Start/End Dates: 2014

Scope/Description: Kristin developed hydrological and hydraulic models for a replacement bridge on the Main South Line south of Oamaru for KiwiRail. This involved using Mike FLOOD to create a hydraulic model of the bridge and channel in 1D and the surrounding floodplain in 2D and assessing the impacts of the new bridge design on water levels at the bridge and the surrounding floodplain, using flows from flow gauges upstream of the bridge, considering the effects of roads and culverts upstream and floodplain storage. After providing preliminary results to the clients= Kristin modelled up to five options for each of three bridges on the Main South Line to assess the best option for each site and worked with a river engineer to provide recommendations for each site.

Barrage Gate Pre-Feasibility Study, Brunei

Client: Brunei Department of Drainage and Sewage

Start/End Dates: 2013

Scope/Description: Kristin developed hydrological and hydraulic models for the Sungai Brunei catchment for a feasibility study on tidal barrage gates to protect the city of Bandar Seri Begawan and the surrounding areas which are low lying and were subject to tidal flooding. This involved using InfoWorks RS to create a linked 1D-2D hydraulic model of the lower part of the catchment and assessing the impacts of a barrage gate on flooding

during low frequency events including assessment of the impacts of sea level rise and climate change on gate operations.

High Priority Bridges and Crossings

Client: Fiji Roads Authority

Start/End Dates: 2012 – 2016

Scope/Description: Over four years Kristin provided hydrological support for the design of bridges and Irish crossings in Fiji for the Fiji Roads Authority. This involved assessment of the catchment hydrology, frequency analysis of any available rainfall or water level data and estimation of design floods. Kristin developed a methodology for assessing each site, assisted with developing the survey brief for each site and then developed hydrological and hydraulic models using survey data and available rainfall data. The hydraulic model was used to estimate design water levels and velocities for use in bridge design, as well as identifying overland flow paths. 36 bridges were assessed along with 29 culverts and Irish crossings.

Mt Webber Minesite Surface Water Assessment

Client: Atlas Iron Ltd

Start/End Dates: 2012

Scope/Description: Kristin completed a hydrological assessment of the Mt Webber Minesite for Atlas Iron Limited. The minesite and access roads were modelled in the hydrological modelling software RORB and provided output for the development of a conceptual surface water management scheme. Kristin provided GIS support for the project. She also completed the Environmental Impacts Assessment and reported on the hydrological aspects of the surface water assessment.

Duchess Paradise Surface Water Assessment

Client: Rey Resources Ltd

Start/End Dates: 2012

Scope/Description: Kristin carried out hydrological modelling using RORB to assess the 100 year and 1000-year ARIs for a proposed minesite. Flows were routed through storage to model the effects of channels on the flows and determine the peak water level and ponding durations. Flood maps of the peak inundation extent for the 100 year and 1000-year ARIs were provided. Kristin also provided GIS support for this project using MapInfo software.

Water Supply Assessment

Client: Todd Energy

Start/End Dates: 2011 – 2012

Scope/Description: Kristin investigated the hydrology of the Mangorei Stream to assess locations for abstraction and discharge of water, associated with a proposed power plant. The project involved data collection and review, a site visit, carrying out a rainfall assessment and then completing a low flow correlation to assess flows at the site. Kristin produced a report outlining the findings of and recommendations from the investigation.

Pardoo Mine Closure Hydrological Investigations

Client: Atlas Iron Ltd

Start/End Dates: 2012

Scope/Description: Kristin prepared the estimates of Probable Maximum Precipitation and Probable Maximum Flood for the mine closure assessment. She also completed 2-D modelling of the minesite and contributed to the mine closure report.

Wailoa Hydroelectricity Feasibility Study

Client: Fiji Electricity Authority

Start/End Dates: 2012

Scope/Description: Kristin analysed rainfall in several catchments in the Wailoa River catchment to enable an assessment of the energy production potential of the various schemes being investigated as part of the feasibility study for additional hydroelectricity generation on the Wailoa River on Viti Levu, Fiji.

Rewa/Navua Climate Change Adaptation

Client: PACC (Pacific Adaptation to Climate Change)

Start/End Dates: 2012 – 2013

Scope/Description: The aim of this project was to assess how climate change and sea level rise will impact on agricultural drainage schemes in the Rewa and Navua deltas and identify adaptation strategies. Kristin developed hydrological and hydraulic models of selected demonstration drainage schemes using survey data and HEC-HMS and HEC-RAS modelling software. The models were used to assess the efficiency of various adaptation options on flooding and to produce indicative floodplain inundation maps and provide inputs to a risk assessment process. Training on how to adapt the models to assess different scenarios was provided to local organisations as part of the project outputs.

Employment Recorded

2016 – Present	Jacobs, Hydrologist
2011 – 2016	MWH Global, Hydrologist and Hydraulic Modeller

EDUCATION/QUALIFICATIONS

Bachelor of Science (Geography and Environmental Studies), Victoria University of Wellington, 2000

Master of Science with Honours (Physical Geography), Victoria University of Wellington, 2003

MEMBERSHIPS AND AFFILIATIONS

New Zealand Hydrological Society
WasteMINZ Member

Member of Australasian Land and Groundwater Association (ALGA)

Tim Baker

SENIOR HYDROGEOLOGIST

Tim is a Senior Hydrogeologist with over 15 years' experience in New Zealand and Europe with groundwater resource evaluation, hydrogeological impact assessments, groundwater and surface water protection, contaminant hydrogeology and environmental site and impact assessments.

He has led or provided technical input into projects related to groundwater resources, ESA & EIA, diffuse and point source contaminant investigations, field hydrogeology and the regulatory management of groundwater resources. He has experience in all aspects of project delivery, including project planning, costing, health and safety, extensive field and site investigation experience, data analysis and interpretation, technical reporting, and client and regulatory liaison.

Areas of Expertise

- Groundwater resource investigations and management
- Contaminated land investigations
- Field investigation management
- Field investigation health and safety
- Drilling procurement and supervision
- Groundwater sampling methodologies
- HAZWOPER 40hr certification
- OSHA 30hr construction certification.

Relevant Project Experience

Closed Landfill Management

Client: Kāpiti Coast District Council

Title: Technical Lead

Start/End Dates: 2014 – Present

Responsibilities: Tim has been the technical lead for the KCDC closed landfill programme since 2014. This has involved providing technical advice around monitoring, consent renewal, capping and landfill gas management.

Levin Wastewater Treatment Plant Discharge to Land Consent Application

Client: Horizons Regional Council

Start/End Dates: 2019

Responsibilities: Tim prepared a technical assessment of the effects of wastewater discharge on groundwater at the Levin WWTP disposal site, also known as 'The Pot'.

Foxton Wastewater Treatment Plant Discharge to Land Consent Application

Client: Horizons Regional Council

Start/End Dates: 2018

Responsibilities: Tim completed a technical review and provided Environment Court Evidence in relation to the application of wastewater to land at Horowhenua District Councils Foxton WWTP.

Kakanui Kauru Catchment Model

Client: Otago Regional Council

Start/End Dates: 2018

Responsibilities: Review of the groundwater flow and catchment modelling architecture and modelling results for ORC. The review was used to assist ORC in making decisions around next steps in the project.

Consent Review and Technical Support

Client: Kāpiti Coast District Council

Start/End Dates: 2018

Responsibilities: Tim completed a joint investigation with ESR assessing the source and generation of E. coli bacteria at a Composting Facility located on a closed Landfill in Kāpiti.

Consent Review and Technical Support

Client: Greater Wellington Regional Council

Start/End Dates: 2016 – 2018

Responsibilities: Tim was seconded into GWRC to provide groundwater consent review and technical advice. Projects have included the review of AEEs related to discharges to land from WWTPs, timber treatments plants and dairy discharges.

Composting Facility, Whakatāne

Client: Whakatāne District Council

Start/End Dates: 2016

Responsibilities: Tim prepared technical assessment and presented evidence at the hearing on the effects on groundwater resulting from the development of a new composting facility on Greenfields land in Whakatne.

Lower Tukituki Stream Flow Depletion Assessment

Client: Horticulture New Zealand

Start/End Dates: 2016

Responsibilities: Tim led the assessment stream flow depletion on the lower Tukituki River for Horticulture New Zealand. The assessment involved developing a conceptual model of the Lower Tukituki aquifer system, and then estimating cumulative stream flow depletion. Tim presented this work as expert witness at the Tukituki PC6 Board of Enquiry.

Kaituna-Maketū-Pongakawa Groundwater Model

Client: Bay of Plenty Regional Council

Start/End Dates: 2015 – 2017

Responsibilities: Tim was Project Manager for this large groundwater modelling project. Tim is responsible for ensuring that the model build is tracking on time and budget. Tim's consulting and regulatory background

allows him to comprehensively understand the client's requirements both from a technical and regulatory perspective.

Feilding Wastewater Treatment Plant Upgrade

Client: Horizons Regional Council

Start/End Dates: 2015

Responsibilities: Tim is currently involved in the review of the Manawatu District Council consent application for the discharge of wastewater to land at the Fielding Wastewater Treatment Plant. The review is focussed on the potential impacts of the wastewater discharge on groundwater quality and the interconnection between the shallow groundwater and nearby river.

Water Resource Evaluation for Geothermal Drilling Supply

Client: Confidential

Start/End Dates: 2015

Responsibilities: Tim undertook a water resource assessment to determine the feasibility of supplying a 100 L/s water supply for a large geothermal drilling operation in the North Island. He undertook the field survey to identify potential water resources and was also responsible for the reporting, and regulatory liaison associated with the project.

Fonterra Pahiatua Discharge to Land Consent Application

Client: Horizons Regional Council

Start/End Dates: 2014

Responsibilities: Tim acted as the Council's Technical Officer and provided expert evidence for the Consent Hearing and Environment Court Appeal in relation to the effects on groundwater of Fonterra's application to discharge wastewater onto land.

Foxton Water Supply Well Performance Assessment

Client: Horowhenua District Council

Start/End Dates: 2014

Responsibilities: Tim recently undertook a performance assessment of the Foxton Beach and Township supply wells. The assessment involved reviewing yields, drawdown, screen design and the results are currently being used to calculate the remaining life of the wells.

Ruakura Development Groundwater AEE

Client: Chedworth Properties Limited

Start/End Dates: 2014

Responsibilities: Tim completed a technical assessment on the potential effects of the proposed Ruakura North Area J residential development on groundwater. The assessment involved analysis of existing groundwater level and flow information, and construction of a seep/W model to assess impacts.

Nick Cooper

SENIOR PLANNER

Nick has 20 years' experience in environmental planning. This has primarily been in the provision of resource consent applications and the management of RMA processes.

The key skills that Nick has in RMA Planning relate to:

- Objective analysis of information for decision making
- Writing of technical documents in plain language
- Project Management of consents and infrastructure projects
- Providing risk assessment and strategy advice
- Practice of effective stakeholder engagement and facilitation
- Forecasting demand and business planning

As a consultant RMA Planner, Nick has been involved in developing work programs, methodology's, briefs of service and proposals. He has worked on a variety of projects requiring statutory approvals ranging from infrastructure networks, improving building and community resilience, new housing, commercial, institutional and cultural facilities.

As a local government RMA Planner, Nick has been involved mainly with the case management of resource consents including completeness checks, notification assessments, preparation of public notices, conducting prehearing meetings, drafting of officer's reports, presenting evidence to Hearings Panels, drafting of conditions, and the provision of evidence to the Environment Court.

Areas of Expertise

- Assessments of effects on the environment for resource consent applications in the coastal environment and coastal marine area
- Statutory Assessment of resource consent proposals against objectives and policies of the National Coastal Policy Statement, Regional Policy Statement, Regional Plans and District Plans,
- Ability to assimilate and engage with coastal scientists and engineers for risk-based assessments of developments within coastal environments,
- Statements of evidence/affidavits for Council Hearings, Environment, and High Court
- Project Management
- Consultation and stakeholder engagement
- Pre-hearing and Environment Court mediation

Relevant Project Experience

Auckland Airport Quarantine and Waste Treatment Facility

Client: International Waste Ltd

Project Dates: 2019

EDUCATION/QUALIFICATIONS

Bachelor of Science (Geology), University of Canterbury

Master of Resource and Environmental Planning, Massey University

REGISTRATIONS/ CERTIFICATIONS

IAP2 Certificate of Engagement (2016-17)

Senior Project Management Training (2015)

Stream Ecological Valuation (2012)

MEMBERSHIPS AND AFFILIATIONS

New Zealand Planning Institute

Scope/Description: Scoped and prepared consent strategy and resource consent application to Auckland Council for Ministry of Primary Industry certified waste transfer and treatment facility on land owned by Auckland International Airport within the Manukau Harbour. Issue related to tangata whenua engagement, hazardous substance risk, urban design, and compatibility with the Auckland Unitary Plan. A non-complying land use consent was granted based on the affected party approvals without notification.

Waikanae River Stop Bank

Client: Greater Wellington Regional Council

Project Dates: 2015 - 2016

Scope/Description: Scoped and prepared resource consents under Regional Plans and a Notice of Requirement (NoR) under the Kapiti Coast District Plans for a stop bank along Jim Cooke Memorial Park, Waikanae. Issues related to flood modelling, mitigation of construction effects, environmental mitigation and remediation, offset of biodiversity losses, and the assessment of cultural values for the Waikanae River. Regional consent and NoR were publicly notified. All submitter issues were resolved and consent decision and NoR were confirmed without a hearing.

Riversdale Beach Community Wastewater

Client: Masterton District Council

Project Dates: 2008 - 2010

Scope/Description: Scoped and prepared the resource consent requirements under Greater Wellington Regional Plans, the Wairarapa Combined and Masterton District Plans. Assisted with stakeholder engagement. Prepared the statutory planning and AEE components of the resource consent applications. Developed an "Agreement in Principle" process with Greater Wellington RC, tangata whenua, private landowners, Wairarapa Public Health, and Department of Conservation). Assisted in the negotiation of conditions. Achieved a non-notified consent decision from the district council and a limited notification decision with no appeals from the Regional Council.

Cape Palliser Road

Client: John and Susan Stephens

Project Dates: 2007 - 2008

Scope/Description: : Scoped and prepared subdivision, land use and wastewater discharge permit for a subdivision of a disused fish factory within coastal hazard area of South Wairarapa District Council. Issues related to reduction of coastal (storm surge/tsunami) and hill slope hazards, on site wastewater, archaeological and cultural values, landscape, traffic and decommissioning of existing factory. Application was notified and went to a hearing. Consents were granted with no appeals

EDUCATION/QUALIFICATIONS

Master of Science in Environmental Science, University of Canterbury, 2019

Postgraduate Diploma in Environmental Science, University of Canterbury, 2017

Bachelor of Science in Geology and Geography, University of Canterbury, 2016

MEMBERSHIPS AND AFFILIATIONS

New Zealand Coastal Society

AWARDS/HONORS

R W Morris Prize in Coastal and Ocean Engineering, 2019 University of Canterbury

George Jobberns Prize in Geography, 2019, University of Canterbury

Best Student Conference Presentation, 2019, New Zealand Coastal Society

Waterways Centre for Freshwater Management Masters Scholarship, 2018, WCFWM

UC Masters Scholarship, 2018, University of Canterbury

NZ Coastal Society Undergraduate Excellence award, 2016, New Zealand Coastal Society

OTHER

Kate MacDonald

COASTAL SCIENTIST

Through years of study Kate has developed a skillset which allows her to view environmental problems with a holistic approach. Kate is a recent graduate from the University of Canterbury where she completed her master's thesis investigating the coastal geomorphological response to earthquakes in Kaikoura. In her role at Jacobs, she has been able to apply a holistic approach to problem solving using her knowledge of GIS and GNSS surveying in a coastal context. Kate is passionate about investigating the effects that sea level rise will have on coastal settlements in New Zealand and developing adaptive pathway solutions for these communities.

Areas of Expertise

- Coastal Geomorphology
- Coasts and tectonics
- Surveying in Coastal Environments
- GIS

Relevant Project Experience

Molyneux Bay – Clutha Delta Climate Change and Geomorphology Investigation
Otago Regional Council

Start/End Dates: May 2020 – Present

Scope/Description: This climate change assessment based along Molyneux Bay is currently determining how the geomorphology of the shoreline is likely to change with sea level rise over the next 100 years. This assessment must consider the prominent shoreline structures and river mouth training walls, which have had a significant impact on sediment transport along the coastline over the past 50 years.

Responsibilities: In this assessment, Kate has played a lead role in calculating the effects of sea level rise, long term trends and short-term storm effects along this section of coastline, as well as mapping the projected future shoreline positions in GIS.

Southshore Erosion Management Strategy
Christchurch City Council,

Start/End Dates: January 2020 – Present

Scope/Description: This project is a follow on from work completed in late 2019 which looked at the pre-post-earthquake shoreline along the south-east estuary edge. This assessment is now looking at conceptual design of appropriate shoreline protection strategies including both naturalized edges and hard engineering structures to provide erosion protection for the next 20 years, with the potential for adaptivity into the future with sea level rise.

Responsibilities: In this assessment, Kate undertook survey work in the early stages to identify where potential options could be placed along the

- Joined Jacobs in April 2019
- Christchurch (New Zealand)

shoreline based on what structures were already there, what material could be reused and encapsulated, and what options could be put in place to enhance the ecological values along the shoreline. Kate has been involved in community engagement during drop-in sessions with the public and has had a strong focus on using GIS to ensure that information is clearly presented to Council and the residents of Southshore.

Timaru District Coastal Erosion Hazard Assessment, Timaru District, Canterbury
Environment Canterbury and Timaru District Council,

Start/End Dates: November 2019 – Present

Scope/Description: This assessment includes identifying the coastal erosion hazard along the entirety of the Timaru district coastline for input into the District Plan. This assessment includes using GIS to identify historical trends and erosion/accretion rates along the coastline, identifying the short-term shoreline movement following storms using historical profile surveys, and using adapted methods for predicting effects of sea level rise to determine how mixed sand and gravel beaches, cliffs, gravel barriers and sand beaches will respond to sea level rise.

Responsibilities: Kate played a leading role in this project by undertaking all GIS components, developing a methodology to undertake and execute a probabilistic approach to map the projected future shoreline positions. Kate also contributed to developing a new methodology to assess the effects of sea level rise on the mixed sand and gravel beach environments and different cliff morphologies.

Hurunui District Council Coastal Hazard Assessment, Hurunui District, Canterbury
Hurunui District Council,

Start/End Dates: July 2019 – June 2020

Scope/Description: This project was a coastal hazard assessment for Hurunui District Council which assessed the groundwater, coastal inundation and coastal erosion hazard at settlements in the district. Kate was part of the coastal team which completed an erosion and inundation assessment for six different settlements along the coastline.

Responsibilities: In this project, Kate was responsible for determining the water levels to use for the 1% AEP events to be inputted into a bathtub model. Kate also undertook volumetric calculations to determine realistic runup scenarios in the settlements. Kate calculated and mapped the erosion hazard lines for the settlements using a deterministic approach and used adapted techniques which were more suited to the mixed sand and gravel beach environment.

Other Projects

- Estuary Edge Condition Inventory – Christchurch City Council, Christchurch (September 2019)
- Barrytown Subdivision Coastal Hazard Review, West Coast (June/July 2019)

- Sumner Revetment Condition Assessment, Christchurch (April 2019)
- Auckland Council Waste Enclosure Inundation Hazard Assessment, Auckland (April 2019)
- Thousand Acre Subdivision Coastal Hazard Assessment, Oamaru (April 2019)

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