Aotearoa Fale malae

Preliminary Design ESD Report

Fale Malae Trust

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Bringing ideas to life

Document control record

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Executive Summary

This report outlines where the current design is against the Fale Malae sustainability principles. It discusses current sustainable ambitions & sustainability performance of the project. The project is aiming to provide a building that will be a place of belonging for all Pasifika peoples and meet its sustainability ambitions outlined in the project's Sustainability Guiding Principles.

The current design is showing significant reductions in key areas including energy use, Greenhouse Gas (GHG) emissions and water use which highlights the designs commitment to its sustainable aspirations. Analyses during Preliminary Design highlights reductions of up to 30% in both operational Energy and GHG emissions, and 40% in potable water use in the Fale Malae compared to the calculated reference building (with fossil fuel fired heating systems).

Introduction

During Preliminary Design, the Sustainability Team worked with the design team to ensure that these principles and their strategies are being holistically incorporated into the design to achieve a robust outcome. As the design continues to progress Aurecon will monitor and guide the design against the project's Sustainability Guiding Principles. Workshops and guidance sessions will also continue to take place to further develop ESD aspects of the design and general sustainability outcomes. During Developed Design Aurecon will continue to confirm that the sustainability strategies are being captured in the design and are documented and designed accordingly.

Figure 0-1: Sustainability Strategies
(drawing source: Jasmax)

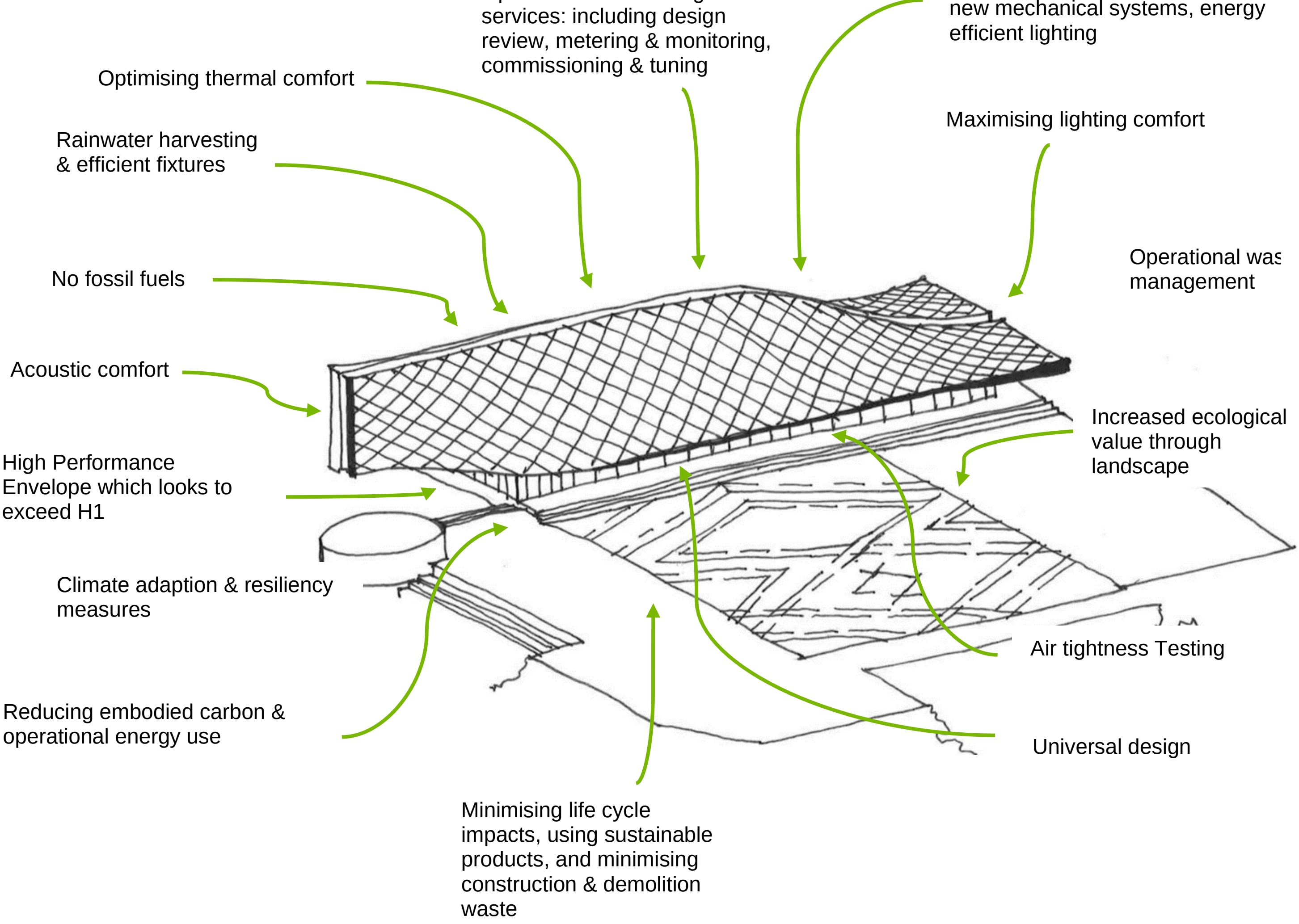


Figure 0-1 highlights some of the key sustainability strategies captured in the Sustainability Principles that are aiming to be implemented in the design of the Fale Malae. This report discusses the work undertaken to date and discusses progress points for each principle.

1 Reduced Environmental Impact

Design, construct and manage a building that limits its environmental impact through material selection, low operational carbon, water reuse.

1.1 Operational Carbon

1.1.1 Green House Gas Emissions and Peak Electricity Demand Reduction

Preliminary energy modelling has been completed for the Fale Malae building based on architectural sketches (WIP-2022-10-03) and using the latest mechanical engineering design inputs. The modelling compared the proposed Fale Malae design (*H1/VM2 – proposed building*) with a benchmark compliant NZBC design (*H1/VM2 – reference building*).

- The results show the model achieving a 30% reduction in operational energy and GHG emissions.
- The proposed design also achieved a 20% reduction in peak energy demand

The modelling is used to assess the energy performance of a proposed building by using a simulation of the building to predict its space heating loads and cooling loads. This is compared with the space heating loads and cooling loads of a reference building that is the same shape, dimensions, and orientation as the proposed building, but has building elements with construction R-values, and shading elements which differ. The results of the thermal modelling should not be construed as a guarantee of the actual energy use of the building. These numbers are indicative and will change as the design develops.

1.1.2 High Performance Envelope

A high-performance envelope, which looks to exceed NZBC Energy Efficiency (H1) requirements where possible, will have higher capital costs but better whole of life performance and cost. As the design develops Aurecon will work with Jasmax to provide building performance advice on the project.

To achieve minimum performance and compliance under H1/VM2 Aurecon propose the following strategies:

- The skylight needs to meet an insulative value of R1.0 with a shading coefficient of 0.3 – this would likely require the system to be triple glazed, thermally broken, and with a high-performance coating.
- The facade glazing elements need to have an insulative value of R0.77 for lobby and café sections with a shading coefficient of 0.3 – this would likely require the suite to be double glazed, thermally broken and gas filled, with a high-performance coating. For the fale façade glazing R0.37 is required – this would likely require the suite to be double glazed and thermally broken.
- Reducing the highly glazed ground floor elevations may lower the performance required of the façade and skylight for H1 compliance and overall thermal performance. (This could potentially be achieved through reducing the skylight width to 1m from 1.5m, lowering the head hight of the glazing down to 2.5m and/or by adding some solid wall areas potentially between grid lines B & C and E & F on the southern elevation.
- Warm wall construction (R3.4) – right down to the basement slab level. Below grade concrete basement walls to be insulated externally with 50mm of XPS closed cell insulation (Climafoam)
- Insulating the ground floor slab system internally (R2.2). Key concern is space to include this, further development required during early developed design.
- Warm wall roof system (R6.5) performance. This is critical to the overall results as the ‘roof’ make up a large portion of the envelope area because of its shape. The complexity of roof shape means that traditional warm roof systems will be difficult to implement. Aurecon recommend that in early Developed Design a roof build-up workshop should be undertaken. Critical issues include:
  – Insulative value of the build-up including all structural elements

- Dew point analysis of any build up options that are outside of normal practice
- Vapour control layer location – warm side of the insulative layer
- Insulation selection – impact of closed cell/vapour impermeable foam vs fibrous insulation/vapour permeable

- Thermally broken joinery. Window frames can have a large impact on overall performance - especially when performance and insulative value is high performing elsewhere within the envelope. It is critical that the joinery is aligned with any adjacent insulation layers
- Consider airtightness strategies within all building envelope decisions, integrate an airtightness strategy from the outset of preliminary design and plan to undertake airtightness testing during construction.
- Warm construction techniques, continuous insulation layers, and the use of vapour control/airtightness layers to the warm side of the insulation

1.1.3 Airtightness Testing

Though airtightness testing has a capital expenditure to undertake test ($15-$25K), ongoing health and cost benefits can be significant. Undertaking airtightness testing can also be a great quality assurance measure to ensure high quality construction which then facilitates efficient services design. Further investigation and detail required during early developed design.

1.1.4 Efficient Building Services

The current design includes an efficient building services design selected for the unique use of the building. Efficient features include:

- HVAC system which allows independent use between spacing (café/community/fale)
- Displacement diffusers,
- Heat transfer systems,
- No fossil fuel use

Some efficient design feature yet to be coordinated and confirmed include:

- Solely LED lighting,
- Efficient plumbing fixtures.

1.1.5 Energy Source

The design of the Fale Malae has ensured the absence of reliance on fossil fuels to operate its services from. There was original discussion around potential where solar panels could be integrated into the proposed roof design. No feasibility study has been undertaken to date considering onsite renewable energy generation. Aurecon can complete this early in developed design when requested.

1.2 Embodied Carbon

1.2.1 Life Cycle Analysis

An initial Life Cycle Analysis (LCA) assessment for the Fale Malae is to be conducted during Developed Design using the quantity data pulled from the Preliminary Design issue. It is important to track and analyse the lifecycle impacts of the building and continue to target the highest level of embodied carbon reductions for the overall sustainability aspirations of the project. The site selection, complex architectural design, and the potential natural hazards risks including liquefaction, the expected carbon reduction potential is reduced. These issues have a direct impact on the strength of the buildings structure and thus the amount of material (carbon) used in the building.

1.2.2 Low Carbon Design

As the design develops Aurecon will undertake optioneering of materials to establish low embodied carbon design. As a start the following strategies should be implemented to the design:

- Retain as much timber structure as possible.
- Use best practice Cementitious Reduction Materials (CRM) in all concrete elements. Work with suppliers to establish what best ratio of CRMs.
- Investigate use of Carbon fibre rebar options.
- Reuse of elements from existing car park where possible, aiming for at least 25% of aggregate be from recycled sources.

1.3 Responsible Building Materials

1.3.1 Construction and Demolition Waste

It is important that this project achieves a high level of reduction in the amount of waste generated or diversion from landfill for as much of the waste generated as possible. To achieve this the project must work closely with the council to ensure best practice demolition waste diversion strategies. As the design of the building develops, it is important to consider buildability and how the design can minimise construction waste. Aurecon understand that a diversion rate of between 50-80% is achievable in the Wellington region.

1.3.2 Product Transparency and Sustainability

As the design develops, the project team is to investigate and specify products with Environmental Performance Declarations (EPD) to reach a Project Sustainability Value (PSV) that is between 3 & 9% of the Project Contract Value (PCV).

1.3.3 Sustainable Timber

As the design develops it is important that all timber specified in this project is Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC) certified timber.

1.3.4 Question Unnecessary Components

As material and finishes start to be considered and confirmed it is important that the design teams questions potentially unnecessary components.

1.4 Water

The project is currently including provision for rainwater collection (42,000 litre storage), water efficient fixtures, and no water-based heat rejection. Due to these factors, the initial potable water calculations currently show a 40% reduction in potable water use in the Fale Malae building compared to the reference building with standard design. The potable water calculations have assumed the following design features and parameters.

Table 1-1 Approximate Hours Occupied

Space	Approximate Hours Occupied
Fale	9am - 12pm and 5pm – 8pm
Cafe	7am - 3pm
Community Room	9am - 12pm and 5pm – 8pm

Kitchen	6am – 9pm

The following Water Efficient Labelling Scheme (WELS) ratings have been applied to the initial calculation; therefore, it is important that the project aims for these WELS rating as a minimum.

Table 1-2 WELS Ratings Used

Space	Approximate Hours Occupied
Toilets	5 Star
Handbasin Taps	5 Star

Next steps for the Water strategy include:

- Continue to update the Potable Water calculator as design develops.
- Ensure the specification of water efficient fixtures and appliances.

2 Prioritisation of Human Health & Wellbeing

Design, construct and manage a building that is healthy and comfortable for its occupants by introducing biophilic design principles and providing excellent thermal/acoustic comfort and indoor air quality.

2.1 Human Health & Wellbeing

2.1.1 Enhanced Beauty & Biophilia

The Fale Malae design beautifully enhances biophilia through its connection to the moana, its clear line of sight over the harbour and the selection of natural materials for the feature ceiling finish. This finish has the opportunity to potentially adopt biomorphic forms and/or patterns. The skylight and the views of the water will enable the view of non-rhythmic sensory stimuli as clouds pass over the building and/or light hits moving water in the harbour. It is important that the design continues to draw from the use of traditional Pacifica design principles and also investigate traditional detailing like traditional Pacifica lashing techniques.

2.1.2 Universal design

It is critical the project undertakes a needs analysis to determine how to acknowledge the needs of persons regardless of age and ability. Some of the tools which may be used for conducting the needs analysis include a specific design review process, surveys of project users or engaging with experts in the field. The information gathered from a needs analysis is to be used to help define goals to make the place accessible, safe, and convenient for everyone.

2.1.3 Thermal Comfort

As the design further refines, the Aurecon team (in coordination with Jasmax) will conduct thermal comfort modelling to ensure high levels of thermal comfort can be achieved relevant to each relevant key space noting their different uses. The target for the community room will remain being for 98% of the year, the Predicted Mean Vote (PMV) levels are between -1 and +1. Due to the type of use, the café and fale areas will be more difficult to achieve this level of advanced thermal comfort. However, thermal comfort still needs to be considered to ensure these spaces have a high level of comfort possible relative to their use type.

2.1.4 Acoustic Comfort

Design team to continue to work with Marshall Day to ensure high levels of acoustic comfort through:

- Ensuring internal ambient noise levels in key spaces kept to best practice minimums.
- Ensuring reverberation time in the key spaces is below the best practice maximums.
- Ensuring the project addresses noise transmission between the café, community room, and the fale space.

2.1.5 Daylight & Glare

Aurecon have conducted daylighting analysis to determine the level of useful day lighting within the fale and café spaces. Due to the size of the skylight the café and fale spaces receive exorbitant amount of daylighting and glare.

Daylight modelling was conducted to determine the amount of ‘useful’ daylight within the café and fale through Useful Daylight Index (UDI). Reflectance levels for the relevant finishes are yet to be coordinated and confirmed with Jasmax, however, for the initial modelling the following levels were used.

Table 2-1 Modelled Reflectance Levels

Element	Materiality	Reflectance Value
Fale/café ceiling	Lattice timber ceiling finish	0.4
Fale/café floor	Polished concrete floor	0.3
Fale/café internal wall	TBC	0.4

The design team need to work to consider the risk of glare through the skylight and façade on low sun winter days (potentially from light reflecting off the water).

Modelling Results

The amount, and usefulness, of daylight is affected by the choice of glazing. Within the café the modelling results illustrate that only 38.4% of the floor area has daylighting within a useful range of between 300-2000 Lux over the relevant timeframe (08:00-18:00). The fale space has daylight within a useful range of 300-2000 Lux for 66.5% of the floor area. 50% is considered the benchmark so we recommend refining the design to reduce the amount of daylight within the café space. Regardless of the fale reaching the percentage benchmark, glare may still be an issue for both spaces. This will need to be considered during further design stages as these percentages are aggregated across the relevant timeframe.

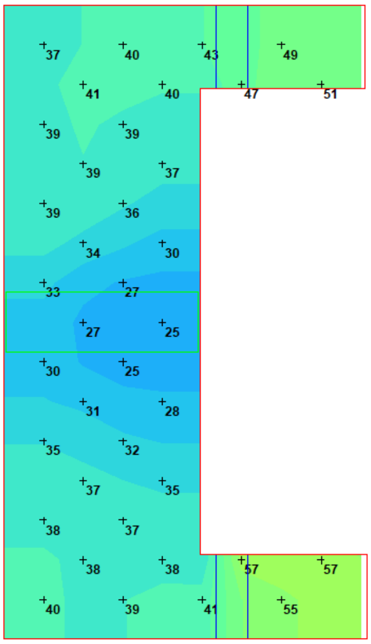


Figure 2-1 Cafe modelling results diagram

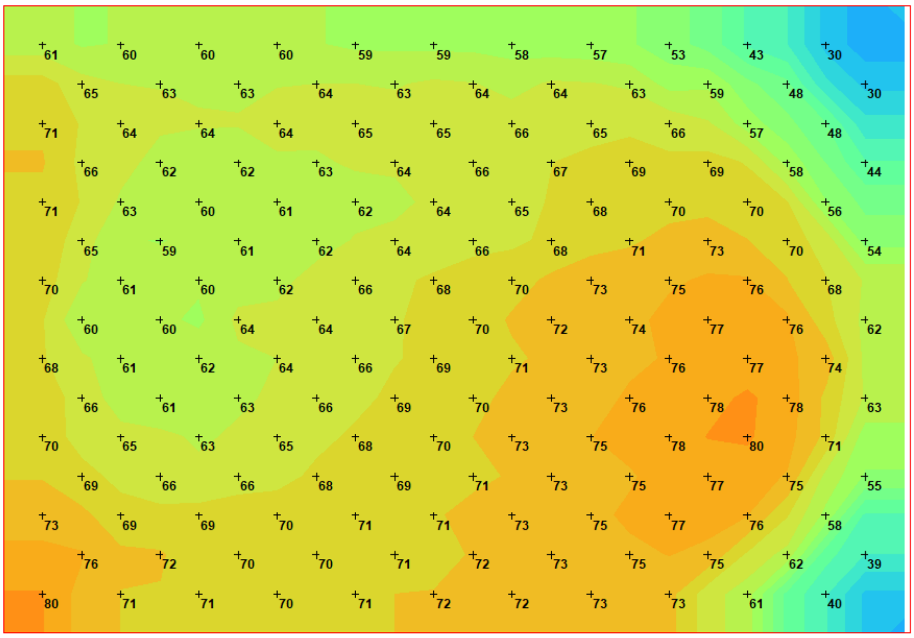
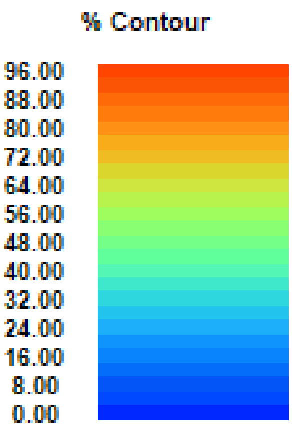


Figure 2-2 Fale modelling results diagram



2.1.6 Nontoxic materials

As the Architectural specification develops, it is important that it considers healthy building materials. The Architectural specification should include Redlist free materials for example ensuring that 90% of all permanent formwork, pipes, flooring, blinds, and cables either do not contain PVC, or meet best practice guidelines for PVC.

3 High Level of Durability & Adaptability

Design, construct and manage a building that is durable, actively responds to climate change, and can operate over an extended lifetime.

3.1 Durability & Adaptability

3.1.1 Climate Change Risk Assessment & Adaptation Strategy

The project team is developing a project specific Climate Change Adaptation Plan (CCAP) in accordance with AS 5334:2013 and implementing solutions to address the identified risks. Aurecon have facilitated two climate change workshops with the wider project team (all disciplines). During the first workshop specific climate risks were identified, and their associated risk rating established. The number of risks at each level for each timeframe are shown in Table 3-1. Workshop two involved the project team discussing and debating adaptation risk treatment strategies and how they could be refined and integrated into the design. Table 3-2 shows several of the adaptation strategies being implemented to mitigate and minimise the effect of the 'severe' risks identified for the Fale Malae and adaptation yet to be included in the design.

Risk Rating	2040	2090	2130 (sea level rise risks only)
Low	16	10	0
Medium	24	25	5
High	4	5	9
Severe	0	4	8

Table 3-1 Summary of Identified Climate Risks

Some key areas of concern in the current design include:

- Potential flood damage to the plant in undercroft currently located below the flood line.
- Outside plant space which is also currently located below the flood line and unable to be bunded due to the required louver space.

To reach a level of best practice resilience these issued must be addressed.

The plan is considered as a live document and will be continually reviewed and updated as the project progresses through each phase.

Table 3-2 Current and suggested design responses for the identified 'severe' climate change risks

Risk #	Result / Consequence - Risk Impact Statement	Rating at 2090	Possible adaptation strategies	Current adaptations/comments in *Red*
10	Basement external access point becoming flow path due to extreme rainfall and storm surge causing flooding of basement and damage within.	Severe	1. Drainage system sized for climate projections 2. Filtration devices where flood water may enter building 3. Develop flood prevention plan (sand bad strategy etc) 4. Divert of flow path to key drainage point 5. Further raising ground floor & basement level 6. Catchment assessment of the surrounding area 7. Easily replaceable mechanical design	1. External entrance to basement removed 2. Initial raising of ground floor & basement level
12	Flooding of surrounding due to storm surge and extreme rain causing damage to the mechanical plant and or intake and discharges and therefore damage to or failure of plant.	Severe	1. All services to be raised above 2870mm WVD or has bunding to at least 2870mm WVD. 2. All plant in basement (including electrical) to be lifted onto plinths (higher than standard) or located at ground floor or mezzanine 2. Develop flood prevention plan (sand bad strategy etc) 4. Divert of flow path to key drainage point 5. Penetrations and louvers to all plant space need to be raised above 2870mm WVD 6. Drainage system sized for climate projections 7. Ensure threshold drainage around vents 8. Add drains into ductwork to allow water to be removed post flooding. 9. Further raising ground floor & basement level 10. Catchment assessment of the surrounding area 11. Easily replaceable mechanical design 12. Inspections after major events	1. Initial raising of ground floor & basement level 2. Penetrations to basement are above 2870mm WVD. ***Undercroft plant currently not protected from flood waters:*** *1. Commercial kitchen outside air ventilation system* *2. Commercial kitchen extract system including electrostatic filters* ***Outside plant currently with louvers below flood level (at risk to flood damage):*** *1. Hot water heat pump* *2. Coldwater heat pump* *3. Hybrid VFR heat pump* *4. Domestic hot water heat pump* *5. Transformer*
23	Flooding of basement through penetrations due to storm surge and extreme rain causing damage to main electrical infrastructure including switchboards.	Severe	1. Drainage system sized for climate projections 2. Develop flood prevention plan (sand bad strategy etc) 3. Future proofing for additional pumps 4. Inspections after major events 5. Divert of flow path to key drainage point 6. All services (HVAC and Electrical) in basement to be lifted onto plinths (higher than standard) or located at higher levels 7. Further raising ground floor & basement level	1. Penetrations to basement are above 2870mm WVD. 2. Initial raising of ground floor & basement level
24	Flooding of surrounding due to storm surge and extreme rain causing damage to main electrical infrastructure (transformer).	Severe	1. Divert of flow path to key drainage point 2. Transformers to be externally rated 3. Catchment assessment of the surrounding area	1. Transformer currently positioned below the flood line with no line of protection

3.1.2 Natural Hazards Risk Assessment & Adaptation Strategy

The project team is developing a project specific natural hazard strategy and implementing solutions to address the identified risks. Aurecon with input from Tonkin+Taylor facilitated two risk workshops with the wider project team (all disciplines) which included looking at natural hazards. During the first workshop specific risks were identified, and their associated risk rating established. The number of risks at each level for each timeframe are shown in Table 3-3. Workshop two involved the project team discussing and debating adaptation risk treatment strategies and how they could be refined and integrated into the design. Table 3-4 shows all the 'high' risks identified for the Fale Malae and adaptation brainstormed to be included in the design.

Table 3-3 Summary of Natural Hazard Risks

Risk Rating	2040	2090
Low	8	2
Medium	17	14
High	0	9
Severe	0	0

Table 3-4 Current and suggested design responses for the identified 'high' natural hazard risks

Risk #	Risk Driver / Event	Result / Consequence - Risk Impact Statement	Rating at 2090	Possible adaptation strategies
4	**100mm lateral displacement 100mm settlement relative to fale building**	Failure of connections for services to the building due to ground deformation causing building to become not operational.	High	1. Design to focus on ease of repair/ ease of access. 2. Design flexible connections to cater to movement. 3. Minimise number of entry exit points and locate in lower risk locations.
5	**100mm lateral displacement 100mm settlement relative to fale building**	Access damaged due to ground deformation resulting in limited or no access to building.	High	1. Create access details to tolerate deformation and to be repairable. 2. Work with WCC to create park access design that will be low cost to repair. 3. Design to focus on ease of repair/ ease of access.
6	**100mm lateral displacement 100mm settlement relative to fale building**	Damage to basement tanking due to ground deformation causing seepage and associated damage.	High	1. Design basement to include drainage space between basement structural walls and basement walls. 2. Detail tanking to resist ground deformation.
8	**100mm lateral displacement 100mm settlement relative to fale building**	Damage to project site due to ground deformation but little to no damage to sites on the other side of Jervois Quay. This could raise questions of the sustainability of continued occupation of this site.	High	1. Effectively respond to other risks items to improve resilience.
9	**100mm lateral displacement 100mm settlement relative to fale building**	Misfit between building (1000yr) and ground (100yr) strength. Objectives of resilience for the building not met.	High	1. Effectively respond to other risks items to improve resilience.
12	**100mm lateral displacement 100mm settlement relative to fale building**	Ground deformation effecting people's perception to feel safe or continuing to use the building/park even after repair.	High	1. Effectively respond to other risks items to improve resilience.
1	**30mm lateral displacement 50mm settlement relative to fale building**	Post event WCC budget constraints may leave repair low priority leaving untidy Malae.	High	1. Work with WCC now to create a Malae design that will be low cost to repair.
3	**30mm lateral displacement 50mm settlement relative to fale building**	Constraints on landscaping design to respond to risks resulting in a compromised landscape design.	High	1. Work with WCC now to create a Malae design that will be low cost to repair
20	**100'smm lateral displacement 200mm settlement relative to fale building**	Site being red zoned or needing to retreat due to land deformation causing the building to need to be demolished.	High	1. Recyclability of building fabric. 2. Consideration of deconstructability. 3. Design building to be relocated in future.

3.1.3 General Durability & Adaptability

The following strategies aim to be confirmed as the design develops:

- Design & build to a longer design life which also considers land deformation return period
- Low Damage Seismic Design - Client and project team to determine if design Is targeting to achieve Low Damage Seismic Design levels.
- Designing for simple maintenance – Ensure that all plant space, and roof and gutters etc are easily accessible.
- Specify easy to replace/upgrade plant – specify systems that can easily be added to and maintained.
- Specify easily replaceable building envelope elements.
- Design for disassembly/deconstruction, especially structure.

4 High Level of Operational Usability

Design, construct and manage a building that supports operational flexibility and efficiency and is fit for purpose for its current and any future uses.

4.1 Design & Facility Management

4.1.1 Operational user guides

It has been identified that a well-developed user guide could provide significant benefit, ease of use and efficiency and potentially reduced operational costs. Toward the end of detailed design, it will be important to consider how this guide could be prepared to ensure accessibility and engagement from those user groups likely to frequently use the spaces.

4.1.2 Independent Commissioning

Aurecon recommend the Trust commits to engaging an Independent Commissioning Agent to (ICA) give initial comments and guidance. Commissioning would include HVAC, electrical, plumbing and drainage, vertical transportation, and fire services. ICA would review 50% or 100% Developed Design package with comments to be prepared and integrated into Developed or Detailed Design.

4.1.3 Services & maintainability review

Aurecon recommend the Trust commits to engaging a potential facilities manager to provide a services and maintainability review of the Developed Design issue. This process will help ensure easy use and maintained of the building by future facilities management staff. In-lieu of identifying a suitable facilities management expert, this scope can be included within the ICA scope of works.

4.1.4 Soft Landings

Undertaking a soft landings framework can ensure that the building is managed effectively and consistently post occupancy. This can result in improved operational performance and a reduction in the performance gap, providing a more comfortable, more efficient building, in addition to cost savings. The client needs to determine whether they want to commit to soft landing for this project and if so, ensure the design process aligns with the soft landings framework.

4.1.5 Metering, Monitoring & Reporting

This project needs to ensure the implementation of effective energy and water metering and monitoring systems. Accessible metering should be provided to monitor building energy and water consumption, including all energy and water common uses, major uses, and sources. The metering is to be accurate and to inform energy consumption practices and reduce wasted energy. A monitoring system should be included that can capture and process the data produced by the installed energy and water meters, and accurately and clearly presenting data consumption trends. Ideally this data would be displayed on display screens with dashboards for water and energy allowing occupants to engage with the energy and water use trends of the building. Additionally, this display screen may also include waster use/storage, renewable energy generation, internal CO_2, and relative humidity levels.

4.1.6 Operational Waste

The design of the Fale Malae needs to consider how to provide best practice operational waste systems. This involves ensuring that there is adequate space allocated to waste storage and at least five waste streams (glass, plastic recycling, paper, compost, landfill) managed in the building.

5 Sustainable Site Integration

Design, construct and manage a building that is sustainably integrated into the context of the Frank Kitts park redevelopment.

5.1 Landscaping & Site

5.1.1 Contamination and Hazardous Materials

As demolition and construction is undertaken, it is important that systems and plans are in place so if a significant contamination is identified, the best practice remediation can be completed.

5.1.2 Increased Native Biodiversity

The Fale Malae design team needs to continue to work with Wraights to ensure the Malae and surrounding area adds a net increase to native biodiversity.

5.1.3 Light Pollution to Night Sky

The Fale Malae design team needs to work with Wraights to ensure that the external lighting in the Malae and surrounding area meets best practice requirements for pollution to the night sky. Ensuring no external luminaire have an Upward Light Output Ratio that exceeds 5%.

5.1.4 Sustainable Transport

The Fale Malae design team needs with Wraights and WCC and develop a transport plan for the building considering future transport plans for the area. One which considers bike, eBike and eScooter parking/charging, and connection to future transport options e.g. Let's Get Welly Moving.

5.1.5 Reduced Storm Water Pollutants

The Fale Malae design team needs to work with Wraights/WCC to ensure that the drainage of the Malae and surrounding area meets best practice requirements for reducing runoff stormwater pollutants.

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