

Waterfront Auckland | Climate Change Adaptation Pathway

February 2015

Introduction

The climate is changing and Auckland can expect to see hotter average temperatures, more extreme weather events with more frequent heavy rainfall, more frequent storm inundation and higher storm surges and waves, and rising sea levels. Waterfront Auckland [WA] has recognised that the potential impacts of a changing climate are an issue of strategic significance for the current and future operations of the organisation and its roles in redevelopment of the waterfront.

The response to the issue of a changing climate considers both mitigation and adaptation. Mitigation focuses on reducing greenhouse gas emissions through low carbon development, passive design and renewable energy generation. Adaptation focuses on understanding the risks of a changing climate, being well informed of climate science and impacts on the waterfront and continually evaluating the waterfront's resilience and effectiveness of adaptation responses and taking action when needed.

The focus of this pathway is on climate change adaptation and it documents what is known now about the potential risks and the adaptation responses already being implemented. It sets out what is required for the organisation to operate in the dynamic and continuously evolving environment that characterises climate change.

1.0 Purpose of the climate change adaptation pathway

Waterfront Auckland acknowledges that it needs to plan for and adapt to a changing climate. The purpose of this pathway is to:

1. Identify the risks to Waterfront Auckland assets as we understand them today and the adaptation measures already in place, based on the knowledge we have available to us.
2. Set out the approach by which Waterfront Auckland will seek to manage assets and future projects in the dynamic and continuously evolving environment that characterises climate change (including further analysis of vulnerabilities).
3. Identify the range of opportunities for Waterfront Auckland from operating in a coastal context into the future.
4. Enable Waterfront Auckland to implement appropriate adaptation measures over time.

As a result, the pathway has been structured into three associated action areas which represent the three phases in learning to adapt to a changing climate:

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| Action Area One | Reacting Our current understanding of risks |
| Action Area Two | Reframing Working in a dynamic and continuously evolving environment |
| Action Area Three | Transforming Opportunities long-term and more broadly |

2.0 Background

Climate change was identified in the Waterfront Auckland Sustainable Development Framework [SDF]¹ as a critical element of sustainability for the waterfront, in particular minimising risk associated with climate change and ensuring resilience of the waterfront community. Responding to climate change is a mix of mitigation and adaptation and as such Waterfront Auckland (WA) has committed to addressing both in the following ways:

Mitigation – with a focus on reducing greenhouse gas emissions through low carbon development, passive design and renewable energy generation [see Box 1 for more detail on mitigation actions]

Adaptation – with a focus on undertaking analysis of the risks of climate change, being well informed of climate science and impacts on the waterfront and continually evaluating the waterfront’s resilience and effectiveness of adaptation responses and taking action when needed. This is the focus of this pathway.

There is a clear economic imperative for WA to take climate change seriously. WA owns (on behalf of Council and the community) over \$550 million worth of assets, extending from Harbour Bridge Park in the west to Teal Park in the east, comprising public spaces, marina assets and commercial property. WA derives just over \$20 million of income from these assets. By 2022 WA will have completed the planned delivery of \$440 million worth of public sector infrastructure investment to leverage what will amount to over NZ\$1 billion of private sector investment, and importantly, WA retains land ownership.

In addition the costs associated with responding to climate change related events are increasing and becoming significant. The storm event in April 2014 alone caused damage in the Westhaven Marina of nearly \$300,000, including \$200,000 to repair the harbour edge boardwalk, \$20,000 to replace electrical switch gear and wall mount the equipment above flood levels, and \$50,000 to modify the stormwater pipes with backflow prevention. Auckland Council has indicated that the costs associated with repairing coastal infrastructure following storm events are increasing and that Local Boards are becoming very concerned about the implications to budgets from more frequent storm events².

| Box 1 - Mitigation | |
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| The Sustainable Development Framework (SDF) sets out the development expectations of WA for climate change mitigation, as follows: | |
| Greenhouse gas emissions | All developments will be low carbon. This will primarily be achieved through being energy efficient, incorporating renewable energy, promoting sustainable transport modes and minimising waste to landfill. |
| Precinct passive design | Designs of new developments will maximise microclimate, solar access, natural ventilation and natural light to minimise the need for heating, cooling and artificial lighting. |
| Precinct renewable energy | Building design optimises the roof space available for solar generation and makes this space available for installation of solar panels to maximise the provision of on-site renewable energy. |
| In addition to the SDF, the Wynyard Central Sustainability Standards were put in place to ensure that development of Wynyard Central delivers on all the sustainability aspirations, including climate change mitigation. WA works actively with the development partners to ensure the designs are meeting the standards. WA also continues to develop the transport strategy for the Wynyard Quarter, which will support the shift towards sustainable transport. | |

¹ 2013 Sustainable Development Framework. Waterfront Auckland.

² For example, replenishing the sand, which acts as a storm buffer, at Orewa Beach following a storm event costs between \$30,000 and \$100,000 per event; maintaining the vertical timber sea wall at Maraetai costs in the order of \$80,000, with an additional cost of \$8,000 to \$10,000 per event; and with the increasing frequency of 1:100 storm events over a 12 month period, repairing the grouted masonry rock wall at Huia Domain costs around \$150,000.

WA acknowledges that the impacts of climate change are a significant issue, and as such has prepared this climate change adaptation pathway to demonstrate the approach the organisation will take in managing the potential risks. Given the dynamic and continuously changing context within which climate change needs to be addressed, this pathway represents both a point in time in relation to how WA is responding now, as well as an approach the organisation will take over time to ensure the impacts of a changing climate are integrated into our work. Current guidance from central government through the New Zealand Coastal Policy Statement is for planning in the coastal area to consider at least 100 years and given that the ground leases with the development partners are for 125 years then WA needs to consider a timeframe of at least 125 years when discussing the potential impacts of climate change.

The structure and contents of this pathway has been the result of gathering and analysis of a range of information, input from multi-disciplinary workshops and an external peer review process which included written feedback and a workshop with WA Directors and key staff to discuss and debate content [see Appendix One for more detail].

3.0 Action Area One | Reacting

This aspect of the pathway represents our current understanding of the risks associated with a changing climate on the assets which are owned by WA and on the role WA plays in redeveloping Wynyard Quarter, based on the knowledge that we have available to us now. It also documents the adaptation measures and approaches that are already being utilised by WA.

3.1 Current understanding of impacts of climate change

The Auckland Plan³ and Waterfront Auckland Sustainable Development Framework (SDF)⁴ set out the impacts of climate change for Auckland as being:

Based on current knowledge, and under moderate projections, it is likely over the next century that Auckland could experience:

- *hotter average temperatures, increasing between: 0.2°C and 2.5°C by 2040, and 0.6°C and 5.8°C by 2090*
- *an additional 40-60 days per year where maximum temperatures exceed 25°C, and more evaporation*
- *lower average annual rainfall patterns (decreasing between -1% and -3% by 2040, to -3% and -5% by 2090)*
- *more drought conditions: by 2080, drought with a severity that is currently only encountered on average every 20 years, could occur as often as every five years*
- *more extreme weather events with more frequent heavy rainfall events, westerly winds and coastal storm inundation*
- *more frequent storm inundation and higher storm surge and waves*
- *sea-level rise – Auckland is presently tracking towards a rise in sea level of 80cm by the 2090s or 1 metre by 2115, but it could be lower or higher: 0.7m or 1.85m by 2115 – depending on ice-sheets*

The SDF then goes on to indicate that based on current knowledge, Auckland could experience more extreme variability in its local climate in the short, medium and long term, and is likely to see hotter average temperatures, changes in wind and rainfall patterns, more frequent extreme weather events such as droughts and floods, and rising sea levels, with higher storm surge and waves. This will create risks and uncertainties for the natural environment, biodiversity, the built environment, the economy, public health, and lifestyles.

³ The Auckland Plan, 2012

⁴ Waterfront Auckland Sustainable Development Framework, 2013

In addition, we have drawn on other information available to WA including:

- Office of the Chief Science Advisor, July 2013. New Zealand's changing climate and oceans: The impact of human activity and implications for the future. An assessment of the current state of scientific knowledge.
- Ministry for the Environment, May 2008. Climate change effects and impacts assessment: A Guidance Manual for Local Government in New Zealand – 2nd Edition.
- NIWA, MWH, GNS and BRANZ, 2012. Impacts of Climate Change on Urban Infrastructure and the Built Environment: Toolbox Handbook.
- Auckland Council, May 2014. Auckland Council Climate Change Adaptation Guidelines.
- Auckland Council, July 2014. Low Carbon Auckland: Auckland's Energy Resilience and Low Carbon Action Plan.
- NIWA, September 2013. Coastal inundation by storm-tides and waves in the Auckland region. Prepared for Auckland Council.
- Technical advice from a range of consultants including mpm projects, NIWA, Beca and Tonkin and Taylor.

This collectively represents the knowledge that WA has available on which to base the current understanding of and response to climate change.

3.2 Current understanding of the risks of climate change

In line with the emerging advice from the IPCC and work by both the Ministry for the Environment⁵ and NIWA⁶, Auckland Council has released Climate Change Adaptation Guidelines⁷. These guidelines set out three steps in the process for assessing the impacts of climate change:

- Step 1 **Screening assessment.** The purpose of this is to determine if any of the functions or services of an organisation are sensitive to natural climate variability and hence to climate change.
- Step 2 **Gathering more information.** The purpose of this is to identify and gather further information and research about the preliminary risks identified through the screening assessment.
- Step 3 **Detailed risk assessment.** A comprehensive risk assessment is fundamental to ensuring that significant potential effects of climate change are considered in planning and decision-making processes. It identifies in more detail the risks and hazards caused or exacerbated by climate change and evaluates their effects and likelihood.

Refer to Appendix One which contains more detailed information on the process followed by WA.

WA undertook a screening assessment which allowed WA to determine which functions or services of the organisation are sensitive to natural climate variability and hence to climate change. The risks identified as high are shown in Figure 1. The risks identified as moderate are shown in Figure 2.

⁵ 2008. Climate change effects and impacts assessment. A Guidance Manual for Local Government in New Zealand – 2nd Edition. Ministry for the Environment.

⁶ May 2012. NIWA, MWH, GNS and BRANZ (2012) Impacts of Climate Change on Urban Infrastructure and the Built Environment: Toolbox Handbook. Available from <http://www.niwa.co.nz/climate/urban-impacts-toolbox>

⁷ Auckland Council. 2014. Auckland Council Climate Change Adaptation Guidelines. May.

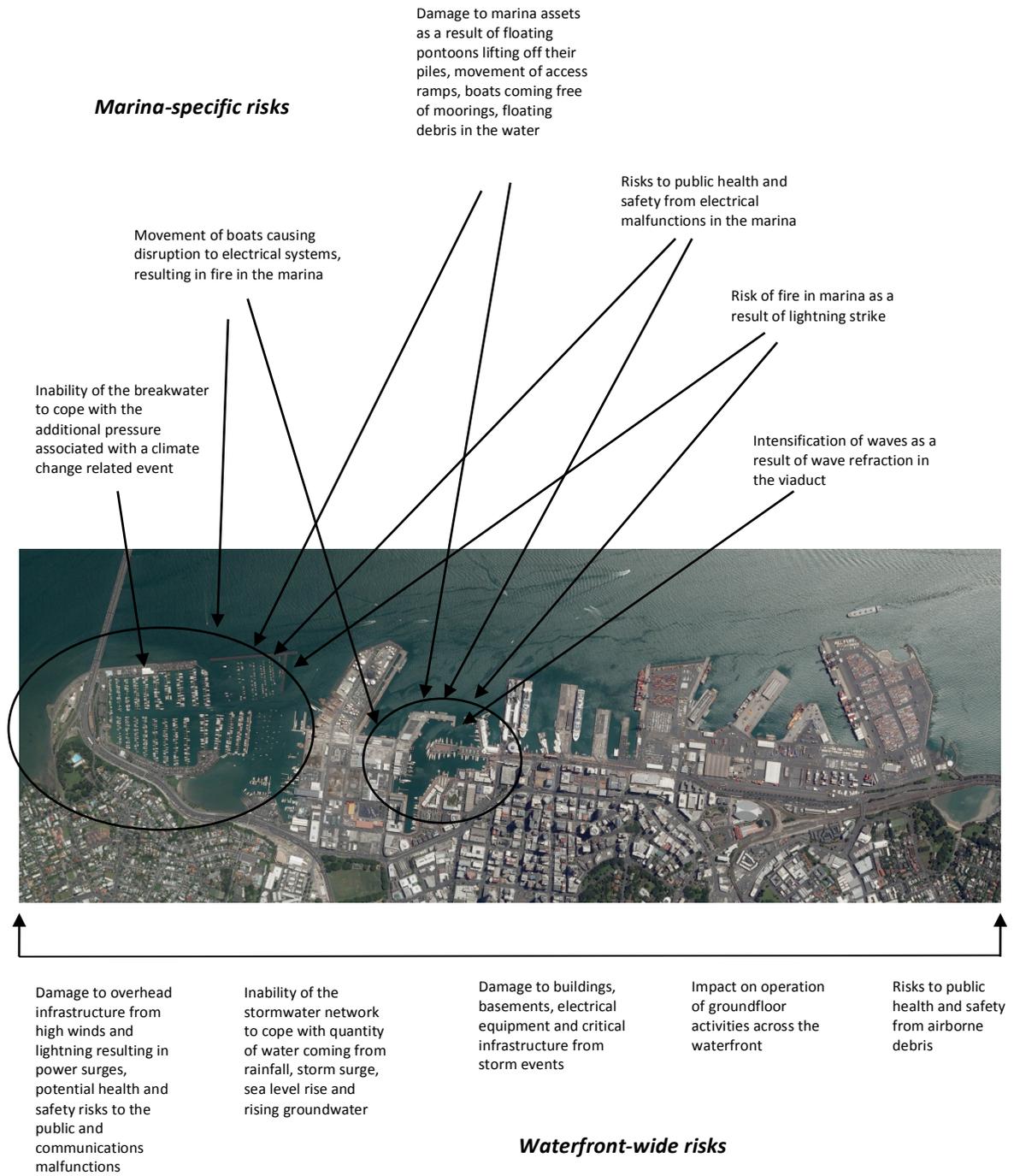


Figure 1 Climate-related risks identified as 'high'

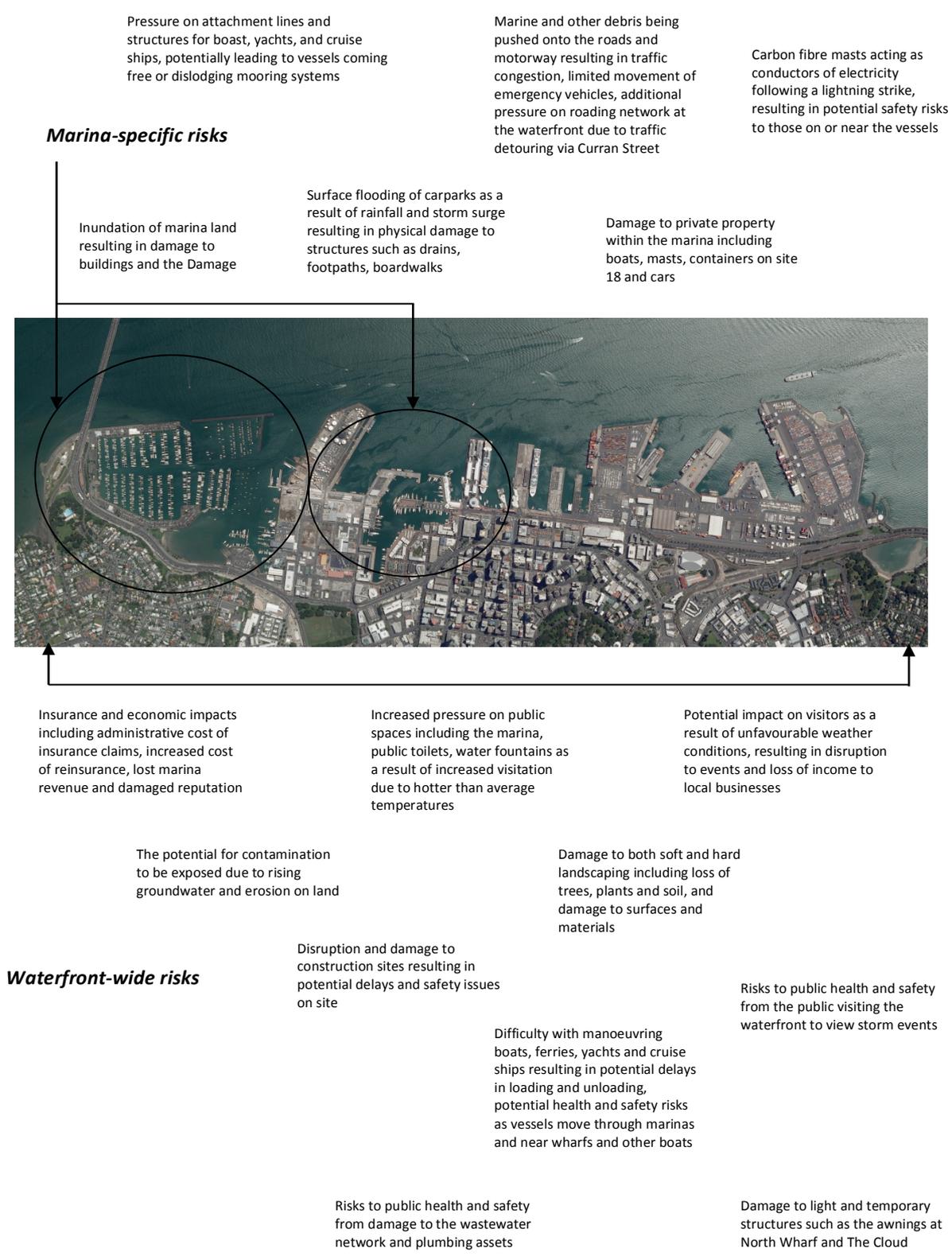


Figure 2 Climate-related risks identified as 'moderate'

3.3 Current adaptation and response measures

WA already has in place a range of adaptation and response measures:

1. Adaptation of infrastructure – a range of approaches are already being implemented as shown in 3.3.1
2. Sustainable urban development requirements – these have been set out for the next phase of development as shown in 3.3.2
3. Ongoing repair and maintenance. This includes actions such as regular removal of debris from the water and land, repairing and maintaining of infrastructure including seawalls, breakwater, armour and rock walls and ensuring moorings are safe and assets are properly secured. WA's Asset Management Plan (2015-18) is currently under development and will include consideration of climate change.
4. Awareness and communications. This includes the use of early warning systems to advise marina customers of upcoming weather events and reminders to secure boats; advising the public of the postponement or cancellation for events due to unfavourable weather conditions; and notification of tenants of possible ground floor flooding.
5. Standard Operating Procedures. These are WA procedures that set out the emergency management provisions ensure rapid recovery from storm events.
6. Restrict Access. WA is able to restrict access to the waterfront if it considers that there are risks to public safety.
7. Risk Transfer. WA requires all berth holders in the marinas to have up to date insurance. WA has insurance for its own assets.
8. Working with others and across sectors. Where the risks to WA assets are outside the mandate or control of the organisation, then we need to work with the relevant organisations. This includes Watercare for risks associated with wastewater discharges, Auckland Council for risks associated with the stormwater networks, and Auckland Transport and New Zealand Transport Agency for risks associated with the roading network and movement of traffic. WA also acknowledges the importance of working alongside Auckland Council's Civil Defence and Management team, particularly around the need for rapid recovery following a climate change related event.

3.3.1 Adaptation of infrastructure

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| Design of Westhaven Promenade | Simulation modeling which takes into account sea level rise, storm surge and wave action confirmed that the existing level would be rarely exceeded. However, it was decided to raise the deck by 300mm so that the underside structure would also rarely become wet. It has also been decided to begin raising the associated landside footpaths within the marina. |
| Design of stormwater network on Daldy Street | The primary pipe network has been designed to convey the 5% AEP ⁸ storm events as per Auckland Council standards. As the site topography is virtually flat and the development high profile, the overland flow paths are designed for 1% AEP flows in excess of the primary reticulation capacity. The overland flow path is designed to be situated along the park edge coinciding with the linear raingarden so as to provide additional treatment of stormwater in addition to accommodating the overland flows. The lowest finished floor level along Daldy Street set for all future buildings in the development is 3.45m RL. The maximum flood level is designed to be at 3.2m RL to avoid flooding of the main carriageway. The 4.5m wide |

⁸ The Annual Exceedance Probability (AEP) is the chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage. Bigger rainfall events occur (are exceeded) less often and will therefore have a lesser annual probability. A 5% AEP rainfall event has a 5% chance of occurring in a year, so once every 20 years.

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| | <p>Daldy Street raingarden located along the park edge of Daldy Street, is designed to constrain flows from most storm events. During a 1% AEP storm event, the overland flows raise up to a maximum of 3.2m RL flooding the adjacent footpath to east and tree pit raingardens along the eastern edge of Daldy Street without flooding the main carriageway.</p> <p>To restrict the mobilisation of soil contaminants through groundwater infiltration, the stormwater system will be separated from groundwater by a combination of clay liners and mudcreting. The stormwater pipes will be fitted with rubber ring jointed pipes with rubber rings designed to withstand the petrochemical contaminants in the soil.</p> |
| New fuel jetty | A 500mm freeboard was designed into the new fuel jetty in the Westhaven Marina to take account of sea level rise |
| Marina pile replacement programme | The new piles at Y Pier were raised by 1m to take into account the impacts of climate change |
| Wave surge attenuation | Currently investigating a proposal to mitigate wave surge under Hobson Wharf, and re-fixing surge panels under Halsey Wharf extension |
| Transformers | Raising the levels of transformers in basements of buildings in Westhaven Marina to protect from flooding and resulting electrical malfunction |

3.3.2 Sustainable urban development requirements

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| Wynyard Central Sustainability Standards 2014 | <p>The WA expectations for development by private sector partners are:</p> <ul style="list-style-type: none"> - Developments will adopt resilient design principles and be adaptable to predicted climate effects including more severe and frequent weather events and predicted sea level rise and associated potential rise in water table. This will involve consideration of risk and resilience to both flooding and drought. - Design of residential and non-residential buildings will ensure the comfort of occupants in a future climate that may be warmer. - Developments will adopt a low impact urban design and development approach. - Designs for the public realm incorporate shade, shelter and green space. <p>And the performance standards are:</p> <ul style="list-style-type: none"> - Buildings will be designed to be wet-proof and incorporate resilient design principles to ensure adaptability to changes in future climate and aid recovery from any flooding at ground or basement levels. - Consideration will be given to: location of critical infrastructure, plant and equipment to avoid potential damage from flooding in extreme weather events; provision of emergency power and the ability to use the solar photovoltaic system in the event of a prolonged mains power failure; provision of fillable emergency water storage and pumping equipment in conjunction with rainwater harvesting system; allowance for manual control of the interior environment in prolonged power outages in an extreme weather event; protectable entry points to buildings and basement either by temporary sandbagging or by a designed solution (e.g. ability to fit storm boards); provision of waterproofed basement pumping stations for potential pump out of basements after an extreme weather event; consideration of more extreme wind and rain loading effects than current code requirements; buildings on external sites exposed to the coast to incorporate appropriate protection from storm surges. |
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| | <ul style="list-style-type: none"> - Developments will adopt a low impact urban design and development approach. - Stormwater infrastructure to be sized to accommodate extreme weather and flooding events - Landscaping designed to be resilient to cope with potential flooding events as well as drought conditions |
| Agreements with development partners at Wynyard Central | <p>WA used the process of negotiating the development agreements with private developers to ensure that the issue of inundation as a result of a changing climate was considered by both parties. The development agreements incorporate provisions to ensure that the functionality of the building is preserved, that there is money available to respond if issues arise and that there is continual investment in the building over its lifetime. In this way, WA has sought to proactively address potential issues going beyond what the commercial property market would typically do. Ground conditions and contamination have also been addressed in this way.</p> |

4.0 Reframing

WA appreciate that a climate change adaptation pathway needs to reflect the dynamic and continuously evolving nature of climate change and the level of uncertainty that is inherent in climate science.

The actions in this area are:

1. Building our knowledge base
2. Integrating climate-related risk into organisational processes
3. Building organisational capacity
4. Monitoring and review
5. Communications
6. Being leaders

4.1 Building our knowledge base

The peer review process identified some areas that WA needed more information in order to develop and implement adaptation responses, including:

- Engineering/Planning Design Standards/Guidelines

The collation, development and promulgation of a consistent set of design and hazard input data or information that all parties should use as design inputs so that all parties are designing for the same climate change assumptions. The input data/information should include:

- Datum of choice to use (AVD-46 or Chart Datum)
- Consistent set of present-day tide levels e.g. MSL, MHWS, Highest Astronomical Tide
- Present-date extreme storm-tide levels e.g. 10%, 5%, 1%, 0.5% AEP
- Wave height/period values for different AEPs
- Agreed sea-level rise for different design timeframes
- Present-day rainfall intensities
- Future rainfall intensities with climate-change for different design timeframes
- Wind speed extremes

- Temperate (minimum, mean, extremes)
- An agreed LiDAR or surface topography/levels for ground or structures (seawalls, breakwaters, wharves) in waterfront area for general design (compare with precise levelling required when it comes to constructing/positioning a project)

Note: This work has been commissioned.

- Vulnerability/threshold analysis and mapping

This work will need to be done in stages and to be prioritised. It includes:

- Updating the current coastal inundation maps of 1:100 and 1:50 AEP to include wave run-up and overtopping which is often the most significant part of inundation on the back of an elevated storm-tide
- Extend the above maps which would require re-developing or extending existing coupled hydrodynamic and wave models of the Waitemata Harbour (Heads to Bridge), and using these to develop present-day scenarios for extremes (storm-tide and waves) and then future climate-change altered extremes to run up to and over the assets, structures and lands around the Waterfront.
- The vulnerability analysis would then assess, for various sections along the waterfront, when (in terms of sea-level rise above present) each section might be affected unduly – and thereby determine the relative exposure and where the hotspots are likely to be.

WA intends to work with Auckland Council to advance this work. There is also the potential to integrate with other waterfront projects including the Central Rail Link and Central City Integration, and to build on existing work and approaches.

4.2 Integrating climate-related risk into organisational processes

WA will ensure that climate change adaptation is an integral to operation of the organisation and to the delivery of the Waterfront Plan.

The opportunities to integrate climate-related risk include:

- Incorporating climate-related risks into Asset Management Planning – the Asset Management Plan is currently being drafted and climate-related risks are being included
- Incorporating climate-related and adaptation measures into WA's Enterprise Risk Management Framework
- Ensuring that climate-related risks and adaptation measures are considered early on in planning and design of future projects, including:
 - Street upgrades and public spaces in Wynyard Central
 - Wynyard Point planning
 - The marine centre at Platform 2
 - As a consideration in the seawall survey planned for 14/15
 - As part of seawall upgrades including Headland, Hamer Street and Quay Street seawalls which are planned in next couple of years
 - Refurbishment of the Vos Building
 - Redevelopment of Site 18
 - Renewal of Curran Street Bridge in 15/16
 - Repair of Wynyard Wharf on east side of future headland park
 - Replacement 'Te Wero' bridge
 - Remedial work planned for Bascule Bridge
 - Redevelopment at Queens Wharf

- Reviewing the implementation of the Wynyard Central Sustainability Standard requirements and amend as necessary for future projects

4.3 Building organisational capacity

Building organisational capacity is a way to ensure that this climate change adaptation pathway is integrated into the work of the organisation. The ways to build organisational capacity include:

- Demonstrating leadership through adoption of a climate change adaptation pathway
- Running lunchtime learnings on climate change – including climate science and how the organisation is responding
- Inviting guest speakers to provide varying perspectives and to continue to challenge us to ensure we are up to date with best and emerging practice. These sessions could be internal or a mix of internal/external people.
- Sending regular emails to staff to update them on what we are doing about climate change adaptation
- Joining national networks such as LGNZ and other international networks in addition to Auckland Council's network
- Establishing and facilitating a climate change adaptation network with a waterfront focus

As part of the pathway, WA will continue to identify the most effective ways to build organisational capacity.

4.4 Monitoring and review

In recognition that this is a living document, the monitoring and review process will include:

- Reporting to the Board of Directors every six months or when new information of interest becomes available.
- Reviewing the data on climate change every 5 years.
- Monitoring changes in the environment and tipping points. This includes reviewing the impact of storms and king tides [including financial information] to understand damage and implications and opportunities to build in resilience.
- Ensuring new climate change risks are included in the WA Risk Register when appropriate.

4.5 Communications

WA understands the challenges of adapting to climate so feel it is important that the organisation shares knowledge and expertise with others. WA will develop a communications plan as a key component of implementing this Climate Change Adaptation Pathway.

4.6 Being leaders

WA can play an important leadership role in adapting to a changing climate. This role includes:

- Actively working with the City Rail Link team at Auckland Transport, Central City Integration group and Ports of Auckland to find opportunities to collaborate and build joint understanding and action.
- Using the climate change adaptation pathway to educate the public and stakeholders on what a changing climate means, what we are doing about it and what we expect others to do. This will include some simple illustrations showing the potential impacts of a changing climate.
- Demonstrating smart and nimble leadership in making decisions and taking action in response to new information about the potential risks and impacts of a changing climate.

- Taking action to adapt to a changing climate based on an understanding of risk and opportunity.
- Making information on the organisation's approach to adapting to climate change available to a wide audience on the WA website.
- Being an active participant in Auckland Council's Climate Change Adaptation Champions Network, the purpose of which is to inspire climate change adaptation actions across Auckland Council by engaging with departments and promoting the Climate Change Adaptation Guidelines.
- Being an active participant in other climate change networks locally, nationally and internationally and contributing to work being done on climate change adaptation to ensure that guidance being developed at a national level is of value in assisting in making decisions on adaptation actions at an operational level.

5.0 Transforming

Both the 'react' and 'reframe' action areas primarily focus on how to ensure the operations of WA take account of the potential impacts of a changing climate – it is about getting the organisation ready to adapt as needed.

Given that it is predicted that the impacts of a changing climate will occur over decades then there is time to consider how to move beyond business as usual and to look at things differently. This is the focus of the 'transform' action area which will identify how the organisation can more proactively position itself to take advantage of the strategic opportunities that come with operating in the context of a changing climate over the longer term.

The 'transform' action area is the least well defined action area in the pathway and whilst it will evolve and be shaped over time, at this stage discussion of what it could mean for the organisation is best done through the identification of possible opportunities. These include:

- Designing for a changed future. In addition to designing and building infrastructure now that is future-proofed for the potential impacts of a changing climate, there is the opportunity to think more cleverly about how a changing climate could more fundamentally change the way infrastructure and urban communities are designed. For example elevated walkways between buildings could serve not only as ways for people to move between the building but also as important movement paths if land underneath is inundated; tidal turbines could be used to harness wave energy during storm surges which could then be used for additional lighting during the weather event.
- Adaptive Urbanism. There is a growing body of research being done to explore the potential for ecological responses to softening the edges between water and land and accommodate natural hazard events such as storm surge and inundation. Wetlands for example not only provide some protection from storm surges through dispersing energy but the bringing back of ecology into built environments supports biodiversity outcomes and can contribute to climate change mitigation. Adaptive urbanism seeks to develop urban response strategies that, when applied early, can lead to resilient and better living environments.
- SmartCity technology. Being able to measure, monitor and report on environmental performance can be a powerful tool to inform and engage citizens about intentions, trends and updates. WA is already exploring the potential for technology to assist with reporting progress on implementing sustainability through the Smart Precinct project, so there is potential to broaden the scope to more explicitly report climate change related data.
- Participatory processes. Given that climate change is a societal issue not just a technical issue, then participatory processes which move beyond the conventional realm of engineers and scientists to draw on a more holistic knowledge base are likely to become a key part of considering how to adapt to a changing climate. Adaptation will be important across New Zealand and increased public dialogue will be essential. It will involve hard decisions and many

measures may be costly to implement. However, as Sir Peter Gluckman stated in his 2013 report⁹, the cost of not acting is significant.

Through the networks being established by WA at this point in time it seems that many other development agencies and local governments are uncertain about how to adapt to a changing climate [see summary below], so WA is well-placed to be showing leadership by actively considering opportunities.

For WA this means that we need to ensure we are active participants in local, national and international networks, that we advocate for Auckland Council to become part of the international networks being established to focus on climate change, and that we are actively keeping up to date with both the science and impacts as well as doing what we can to educate and inform citizens about the challenges that lie ahead.

But perhaps the biggest opportunity WA has as an organisation is to ensure that climate change becomes a key component in how the future of Wynyard Point is determined. The next two years are going to see WA engage with Aucklanders to determine the future use for Wynyard Point. This is our chance to do everything differently with regard to the processes, values and disciplines that are applied to shaping the built environment in order to move decisively away from business-as-usual and secure the delivery of high-value sustainable resilient urbanism. The intention is to build on the experience in developing the rest of Wynyard Quarter and lead the way in showcasing a transparent, creative, inclusive, bold and genuine process.

The coastal, exposed nature of Wynyard Point provides perhaps the best opportunity in Auckland to educate and inform Aucklanders about what the future holds in terms of a changing climate and what future urban development might conceivably look like in the future.

Summary of climate change adaptation responses

The desktop analysis of how other cities are responding to the issue of climate change adaptation suggests:

- Whilst a few cities have climate change adaptation plans in place, most of them are focused on monitoring the risks but have not implemented specific adaptation responses.
- Options being considered are classified as either hard/grey [e.g. walls and barriers] or soft/green infrastructure [e.g. green roofs, permeable pavements] and either protection, adaptive, emergency or ecosystem-based.
- Protection systems may lead to infrastructure lock-in, where the city commits to renew and update the infrastructure [e.g. barriers]
- Adaptive systems may be more efficient due to their flexibility to adapt to the risks [e.g. floating urbanisation, bio-mimicry, flood zones, living in water]
- Emergency plans are usually adopted along with other options and urban waterfronts should have plans in place to effectively manage the first 48 hours of a disaster
- Many cities seek to reduce the risks of flooding in the short term and sea level rise over the long term
- Local authorities set the framework for implementation [policy, research, engagement] and developers implement the actions at the property level

In addition, both New York and London are taking the issue seriously given the impacts they are already experiencing from a changing climate. Both the processes underway and the funding needed to implement adaptation measures are significant.

And recent participation in the International Society of City and Regional Planners conference in Poland suggests that whilst climate change is being discussed by many cities, it is only those who face immediate impacts [in particular flooding and inundation] who are taking action and this seems to be limited to protection works. Climate change is considered by most to be highly complex with there being great uncertainty about how to respond.

Wellington City Council | Released a Sea Level Rise Options Analysis in June 2013. The study was limited to assessing the impact of sea level rise rather than being more broadly about the full impacts of changing climate. The recommendation from the analysis was to develop a Sea Level Rise Adaptation Strategy which would identify adaptation measures. WCC have also developed a web based interactive modelling tool. The tool uses

⁹ Office of the Prime Minister's Science Advisory Committee (2013). New Zealand's changing climate and oceans: The impact of human activity and implications for the future. July.

outputs from sea level rise modelling and the user is able to 'slide' the level up or down to view the effects of changing sea levels.

Metropolitan Redevelopment Authority, Perth | Conducted a climate change risk assessment and considered that the management of risks largely sat with other organisations. Their adaptation response is limited to ensuring occupied ground floor space is above the 0.9m projection set by state government and that landscaping considers potential inundation.

City of Melbourne | Produced a Climate Change Adaptation Strategy in 2009. The strategy was based on a risk assessment process and focused on areas of direct influence and control. As a way to show leadership, and in recognition that they are not able to address many of the risks, they have set up the Inner Melbourne Climate Adaptation Network. They are in the process of updating their 2010 Action Plan.

Appendix One | Process for developing the pathway

The process for developing this climate change adaptation pathway comprised three steps:

1. Information Gathering – this comprised of gathering all the information WA had available on climate change [outlined in Section 3.1]
2. Assessed the impacts of climate change – see below for more information on this risk-based approach
3. Peer Review of the Draft Climate Change Adaptation Pathway. The peer reviewers were:
 - a. Dr Rob Bell, NIWA
 - b. Professor Martin Manning, Victoria University Climate Change Research Institute
 - c. Judy Lawrence, Victoria University Climate Change Research Institute
 - d. Bernd Gundermann, Urbia Group

A Risk-Based Approach to Climate Change Adaptation

The guidance developed by Auckland Council sets out three steps in the process for assessing the impacts of climate change:

- Step 1 **Screening assessment.** The purpose of this is to determine if any of the functions or services of an organisation are sensitive to natural climate variability and hence to climate change.
- Step 2 **Gathering more information.** The purpose of this is to identify and gather further information and research about the preliminary risks identified through the screening assessment.
- Step 3 **Detailed risk assessment.** A comprehensive risk assessment is fundamental to ensuring that significant potential effects of climate change are considered in planning and decision-making processes. It identifies in more detail the risks and hazards caused or exacerbated by climate change and evaluates their effects and likelihood.

WA has been working through this process since April 2014, as follows:

1. Prepared a sensitivity matrix with functions and potential climate impacts.
The functions were:
 - Marinas (Westhaven, Viaduct Marina berths, Silo Marina, Beaumont St Marina)
 - Public Space (Sea Walls, Wynyard Crossing, Wharves, Public Space, Buildings)
 - Commercial Property (Carparking, Wharves, Buildings)
 - Future Projects

The potential climate impacts considered more relevant to WA were:

- Rainfall
 - Flooding/Surface Flooding
 - Sea Level Rise
 - Storm Surge
 - Coastal Erosion
 - High Winds/Storms
 - Extreme Temperatures
 - Drought
 - Ocean Acidification
 - Lightning
2. Populated the sensitivity matrix at a workshop with senior staff managers, included asset managers, from across the organisation.
 3. Sought feedback from workshop participants on the completed matrix after the workshop.
 4. Grouped the risks in cases where they were the same but across a number of potential climate impacts.

5. Reconvened the workshop to allocate a traffic light screen to each cell to indicate risk and to capture information on existing and planned adaptation measures. The traffic light system is as follows:
 - Red for high risks and need for response (which may include a need for further information)
 - Amber for moderate risk or variable or uncertain occurrence of risk
[Note: The high and moderate risks are noted in Section 4.2 of this document]
 - Green for no or low risk
[Note: The low risks are noted in Appendix Two]
6. Reviewed each of the red and orange risks against the following criteria to help with prioritisation:
 - High risk exposure in relation to all or part of the asset or area of responsibility
 - High levels of uncertainty about climate change and how it might impact on the asset or area of responsibility
 - Major Council investment is proposed and climate change effects are likely to be a material consideration

And identified where the following conditions were relevant to WA as instances where climate related risk should be considered as part of a risk assessment:

 - Prior to significant renewal of an asset or major developments of an asset class
 - Planning for new infrastructure or development with a lifetime of more than 20 years
 - Preparing or reviewing a plan or planning document
7. Sought feedback from workshop participants on the completed traffic light screen document after the workshop.
8. Met with staff across the organisation to fully capture the range of existing and planned adaptation measures.
9. Researched national and international best practice climate change adaptation strategies and measures.

This work led to the development of the Draft Climate Change Adaptation Pathway which was peer reviewed in August/September 2014.