CoastAdapt

Snapshot

Barangaroo urban renewal: **accommodating climate resilience**

Summary

Sydney's high-profile urban renewal project, Barangaroo, is being redeveloped with a strong focus on climate adaptation, and provides an exemplar of how a large-scale project can prepare for and adapt to a changing climate. The redevelopment process includes a detailed analysis of climate risks for the Barangaroo site which helped to determine its design.

Adaptation actions at the site included tree plantings and the use of building materials that help to reduce the urban heat island effect, a sea wall and landscaping to buffer against projected sea level rise, the recycling and capture of water onsite, and the development of a centralised control network to monitor and respond to site or city wide electricity outages.

Keywords

Urban design, Sydney, Barangaroo, corporate

Sydney's harbourside area, Barangaroo, is being redeveloped with a strong focus on climate adaptation and demonstrates how a large-scale project can incorporate planning for a changing climate. The redevelopment process being undertaken by Lendlease, a multinational property and infrastructure company, includes a detailed analysis of the climate risks for the precinct that helped inform its design and support planning around the key priority risks.

A container port for much of the past century, 'Barangaroo' was set aside by the NSW Government in 2003 to become a new commercial and residential community. This 22-hectare site between Sydney's CBD and the harbour provided a rare opportunity to extend the city centre. In 2015, after a lengthy redevelopment process for the $8 billion site, the first buildings at Barangaroo were opened. On completion in 2022, Barangaroo will be a mixed-use public and private precinct including residential, commercial, retail, tourism, and cultural buildings and public spaces.

The analysis of climate risk for the site considered three time frames: the current climate, 2030 as a measure of short-term change, and 2070 as a measure of long-term change. Through this process 18 key risk statements were evaluated for the Barangaroo South development. These covered a range of primary and secondary climate change effects

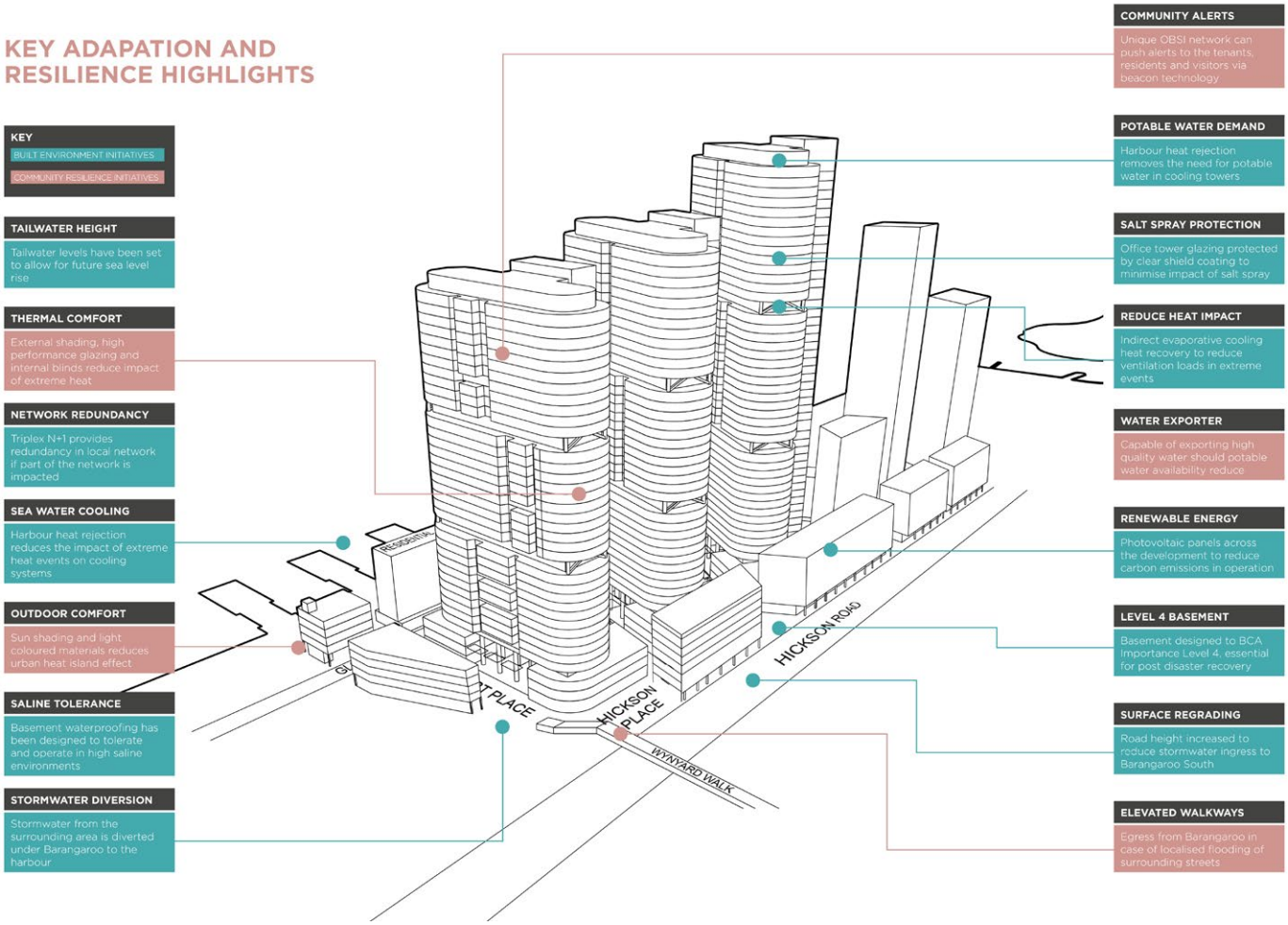

Figure 1: Key adaptation and resilience highlights of the Barangaroo South development. Source: © Lendlease 2015.

including changing temperatures, rainfall and relative humidity, sea-level rise, droughts, bushfires, and severe weather events. These risks were then evaluated for their likelihood and consequences on the built environment and the community, as well as impacts on the surrounding areas.

The next step was to combine the likelihood and consequence of each risk to develop an overall risk priority for the three time frames. Key risk priorities that were identified as 'extreme' and 'high priority' (see Table 1 and Figure 1) were addressed within the design and construction of Barangaroo South.

The site itself has been built to accommodate the 0.9 m projected rise in sea levels by 2100 with an extra buffer provided by a sea wall and landscaping features. The basement structure complies with Building Code of Australia Importance Level 4, which requires structural design to consider higher annual probability of strong wind and seismic events and which is suitable as a structure for post-disaster recovery. The increase in the 'heat island effect' at the site is mitigated, for instance, by building materials that are less reflective as well as shade and cooling devices such as awnings, tree plantings, and drinking water fountains. Building materials have also been selected to tolerate any increases in seawater inundations or salt spray.

To allow for increased rainfall and the potential for localised flooding, the stormwater system has been upgraded within the site and in the surrounding area. There is also a strategy for effective water recycling for reuse where appropriate within the site and potentially to top up water supplies in surrounding areas during dry times. The electrical network is compartmentalised with separate controls for sections which means that power can be selectively turned off during an emergency, allowing for better management of incidents of extreme heatwaves, storm events, etc.

Table 1: Key priority risk scenarios and design responses identified for the Barangaroo South project.

Risk priority scenarios	Design responses
Risk Scenario 3. Increased number of heat days impacts external activities and stakeholders	• Building materials at the waterfront and boardwalk should have a high solar reflectance index. • Reduction of sunlight exposure and wind movement through tree planting, street awnings, drinking water fountains and access to regular public amenities.
Risk Scenario 8. Increased rainfall impacts access and egress	• Stormwater infrastructure upgrades to reduce local flooding within and around the Barangaroo South precinct. • Scenario modelling of a 100-year average recurrence interval storm event with contingency for 50 percent blockage was used to guide stormwater pipe and collection pit sizing. • Surface regrading to increase the height of one adjacent road section by an additional 400 mm as well as installation of new inlet pits to capture overland stormwater flow from the adjacent catchment will ameliorate the risk of flooding within Sussex Street and adjoining access roads.
Risk Scenario 9. Increased rainfall causes localised flooding	• Diversion of offsite stormwater from the broader catchment to minimise the risks of localised flooding within the precinct. • Use of onsite stormwater infrastructure installed within Watermans Quay and Barangaroo Avenue which will funnel surface water from the precinct into tree pits that act as onsite retention basins, before discharging into the stormwater system. • Tailwater levels for all stormwater outlets into the harbour have been set based on an estimated 2100 sea-level rise.
Risk Scenario 11. Decrease in annual rainfall will affect potable water availability	• Site-wide water strategy that includes: demand reduction devices, potable water replaced with recycled water for most non-potable uses, exporting of recycled water, and removal of air conditioning cooling towers. • A blackwater treatment plant will enable all waste water generated within the precinct enabling the site to export recycled water to surrounding areas in times of drought. • Rainwater harvesting and storage within the precinct and building infrastructure has been maximised for use in irrigation of green roof and public realm areas as well as wash down and fire suppression systems.
Risk Scenario 12. Increase in sea level causes permanent inundation	• All basement and building entry and egress points including timber board walks and finished landscaped levels at the foreshore provide additional height to the finished ground plane level. • Stormwater infrastructure has also been designed to take into consideration future sea-level rise risk. This included both the height of the stormwater discharge point located within the seawall sizing contingency based on predicted seawater inundation.
Risk Scenario 13. Increase in salt water inundation / sea spray cause property damage	• Mitigation of salt water inundation and sea spray is done through design elements of basement waterproofing and tanking system; the diaphragm wall construction, including overall dimensions, cover over reinforcing, and concrete mix specification; the basement envelope to safeguard against risks of steel corrosion; building façades which utilise high specification galvanising thicknesses, anodising and powder coating systems; glazing for the International Tower facades are treated to protect the glass from contaminants and resist staining from salt spray.
Risk Scenario 17. Increase in severe storm events cause wind damage	• The central basement structure is designed to Building Code of Australia Importance Level 4 to consider higher annual probability of strong wind and seismic events. • Design of the harbour heat rejection systems will prevent the potential for storm debris to enter the cooling system. • Three penstock values can provide complete isolation of the basement and district cooling plant to the harbour if required for both maintenance or in an emergency situation. • The electrical network is both centralised and compartmentalised to be controlled separately if there is damage or a crisis, while onsite back-up diesel generation is available for power capacity should the network go down.

Community resilience was also an important part of the Barangaroo planning process as it is recognised by Lendlease that 'creating a sense of belonging' within the development and its surrounding communities is important for adaptation. A range of social and economic factors are known to influence community resilience, and so the development sought to foster some of these within the Barangaroo community. These included:

- providing high levels of accessibility and social inclusion by "designing for dignity"
- increasing awareness of climate change and fostering commitment to a carbon neutral district
- making use of communication tools such as websites, newspapers and phone apps to build community cohesion
- working with businesses and emergency response teams on disaster preparedness and recovery plans.

References

Lendlease, 2015: Climate change adaptation and community resilience – Barangaroo South. Accessed 18 May 2017. [Available online at http://www.llwebstore.com/flippingbook/Development/BarangarooSouth/ClimateChangeAdaptation_MAR2015/files/assets/common/downloads/Climate%20Change%20Adaptation%20&%20Community%20Resilience%20-%20March%202015.pdf].

Further reading

Barangaroo South website: www.barangaroosouth.com.au/about/sustainability (accessed 18 May 2017).

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