

Coastal resilience, planning with communities for sea level rise

by: Hans Oerlemans¹, Claudia Baldwin²

¹ Founding partner wOnder city+landscape, Queensland; PIA affiliate member

² Regional and Urban Planning Program, member 'Sustainability Research Centre' and 'Engaged Cluster', School of Social Sciences, University of the Sunshine Coast, Queensland; PIA corporate member

This paper was presented at the PIA 2013 State Conference in Mackay, Australia.

ABSTRACT

The undeniable consequences of climate change and sea level rise for coastal communities in Australia require pro-active planning in conjunction with communities to develop innovative solutions. Queensland policies and approaches to coastal planning recommend engagement with the community, but provide limited guidance about how to do this in a contested environment, involving potential trade-offs of amenity and security, through use of hard infrastructure solutions. We refer to an example from the Netherlands, which has had to develop new approaches to deal with sea level rise, both technically and institutionally. For the beach town of Katwijk, the new approach meant that the community was interactively involved in the design of coastal reinforcement. Combining local experience with technical know-how resulted in a novel outcome that strengthened both coast and town and is promoted internationally as an example of innovation. Lessons from this Dutch experience should encourage Australian coastal protection agencies to engage communities in a more interactive way to find their own solutions.

INTRODUCTION

The growing urbanised population (UNFPA 2007) combined with climate change and sea level rise present major challenges for Australia's coastal cities and towns (IPCC 2007). Past land use decisions have resulted in thirteen percent of the urban population in Australia now living in low elevation coastal zones - 1.6 times more than in the USA or Europe (UNFPA 2007). Increased risk of flooding is expected from the cumulative factors of sea level rise and increased storm events with more intense rainfalls, storm tides and exposure to erosion (IPCC 2007, DCCEE 2009). In 2011, between 50,000 and 70,000 buildings in Queensland were reckoned to be exposed to the risk of sea level rise of 1.1 metres. Combined with infrastructure, the total replacement value in 2011 was estimated at between \$37.7 and \$52.2 billion (DCCEE 2011). One year earlier, the Gold Coast Council assessed that the damage bill for the Nerang River catchment alone could exceed \$200 million (GCCC 2010a).

This paper examines the tensions around Australia's urbanised coastal areas, where Councils will have to weigh up 'soft' options and 'hard' coastal protection interventions to protect economic assets. Issues will arise about sharing costs and the potential for maladaptive actions that unintentionally lead to increased vulnerability or additional impact (Singh-Peterson et al 2013). Using the Gold Coast as an example, there appears to be limited direct guidance in how to deal with this tension. We argue that a key component of any strategy is to engage the community in framing the issues and finding solutions that they will have to live with. Highly technical information about risk and options needs to be transparent, salient, credible and legitimate (Leith et al 2012) and understood in the context of local knowledge. We showcase a methodology to engage the community in the design of these protection

measures, where an interactive planning method turned an intrusive protection measure into a supported improvement of the urban environment in Katwijk at Sea, the Netherlands. We conclude with lessons for Queensland and the Gold Coast based on the case study.

APPROACHES TO COMMUNITY ENGAGEMENT IN COASTAL URBANISATION AND CLIMATE CHANGE

Mitigating these risks requires vision and long-term commitment (UNFPA 2007). Therefore the Queensland State has adopted policies like the Queensland Coastal Plan (DEHP 2012a, DEHP 2013) and the State Policy for Coastal Management (DEHP 2012b). The policies aim first of all to protect the natural coastal processes and prevent degradation. This might not be sufficient when confronted with the existing and growing urbanisation (Lazarow et al. 2008, DCCEE 2009). In existing developments which have social and economic value, the policies state that erosion control works may be acceptable, but they should be seen as a last resort, with retreat also being given consideration.

While the Queensland State government provides overall policy direction and data, implementation is primarily through local government planning schemes and erosion management plans. Local governments execute erosion control works like beach nourishment and undertake the community engagement around these projects (DEHP 2012a, Lazarow et al. 2008). In this context, the Gold Coast City Council has developed a Shoreline Management Plan, with actions for a 10-year capital works program (Lazarow et al 2008, GCCC 2010b). The 'Three Point Plan for Coastal Protection' presents the execution of 3 coastal protection projects between 2013 and 2015 (GCCC 2013). The 5-year Sustainable Flood Management Strategy (GCCC 2010a) sets out to prepare flood risk management plans for the entire city. Strategic planning for flood risks due to climate change and sea level rise thus seem to be well on the agenda.

In this area the challenge is particularly great. The Gold Coast population has grown from 110,900 in 1976 (ABS 1986) to 497,848 in 2008 (ABS 2008) and is projected to be 900,000 by 2030 (DCCEE 2009). The urban footprint, on the other hand, firmly delineates the area beyond which no urban expansion is allowed (DIP 2009). In other words, the current urban footprint is expected to accommodate almost double the amount of people. Already, the highest density is within ar-

reas that are the most vulnerable to the impacts of climate change (Lazarow et al 2008). At the same time, sources for beach nourishment sand will diminish in the long-term. This makes it likely that the city will need to decide at a certain moment for planned retreat or protection with hard coastal structures (Lazarow et al 2008). The Gold Coast already utilises both soft and hard protection works, like the A-line seawall. Furthermore, Cooper and Lemckert (2012, p. 6) point out that the community and corporate attitude of the Gold Coast in some ways "mirror the Dutch attitude of human dominance over nature".

Seen in this light, the projects of the three-point-plan may be just the start of ongoing strategies to address the tension of an urban environment impacted by climate change. With potential concern within the community about amenity and disproportionate cost sharing, as Singh-Peterson et al (2013) point out, engagement and support of the community is necessary (DCCEE 2011). The Queensland Coastal Plan and following policies (DEHP 2012a, DEHP 2012b, DEHP 2013a, DEHP 2013b) all emphasise the need for active community participation. In practice however, both European and American research has found that the majority of community participation in planning and environmental management takes place at the 'lowest' level: information provision and minimal consultation (APaNGO 2007; Bielele and Cayford 2002). Yet participation with higher levels of interaction and deliberation has been found to enhance problem solving ability, improve quality of, and support for the decision (de Graaf 2007).

We draw attention to involving stakeholders in the development of scenarios and via scenario games as a method of higher level of engagement that stimulates imagination, capacity building and social learning. Previous studies have shown that involving the range of stakeholders in a scenario development process is an effective way to allow them to explore complex combinations of choices and outcomes (Evans et al 2013; Shaw et al 2009). Integrating local expertise in scenario development can expand the information included and embed scientific perspectives within local meaning contexts (Shaw et al 2009). Furthermore, Tompkins et al (2008) argue that public understanding of the trade-offs that have to be made, is critical in gaining some degree of public support for long term coastal decision-making.

The following case study of Katwijk gives an example of a scenario development game that was used to resolve a complex problem in coastal protection in the Netherlands.

A DUTCH APPROACH

The Gold Coast City Council refers regularly to “the Delft Report” (GCCC 2005, GCCC 2010b, GCCC 2013). The research for this report on coastal erosion, was commissioned after the 1967 floods and executed by the Hydraulic Laboratory in Delft, the Netherlands (Delft Hydraulics Laboratory 1970). Since then, the Dutch approach toward coastal protection has changed dramatically.

The Netherlands has a long tradition of dealing with flood issues. Much of the country is reclaimed from the sea, rivers and lakes and 26% of the country lies below sea level (Slomp 2012). This is possible due to a system of dykes and water boards, which started in the late Middle Ages (Tol & Langen 2000). Major flood disasters in 1916 and 1953 led to the Zuiderzee land reclamations and the so called ‘delta works’ to confine the flood threats from the sea (Olsthoorn et al. 2009). These works strengthened the technical ability and the mentality of ‘fight against water’ (Bendeler et al. 1998). Meanwhile, the western coast, a sandy dune system, was managed to prevent erosion, mostly through retaining sand with sandblow-screens, planting beach grass and occasional beach nourishment. But despite all the technical efforts, the coast was deteriorating. Up to 1990, every year 20 hectares of dune area was lost due to structural erosion (V&W 2000).

‘Fight against water’ becomes ‘Building with nature’

In the late 1980’s a new, system-based approach towards nature, and coastal protection, developed in the country: ‘building with nature’, using natural processes to design the environment (Metz 1998, Metz & Heuvel 2012, Didde 2013). The Netherlands started to experiment with intensifying supplementary sand depositing on the coast. By putting more sand into the system, the annual loss of dunes was turned into structural accretion. The coastal zone became more natural, with stronger native vegetation and less need for vegetation management. Planting beach grass to capture sand has stopped, while the existing beach grass has become stronger (V&W 2000). The pro-active ‘building with nature’ approach has since produced other innovations, like the ‘sand engine’ (Prov. Z-Holland, 2013) and artificial oyster reefs that grow faster than the sea level rises (Didde 2013).

Review safety standards

At the end of the 1990’s, the safety standards for the primary flood protection were still from the 1950’s. But the economical importance of the

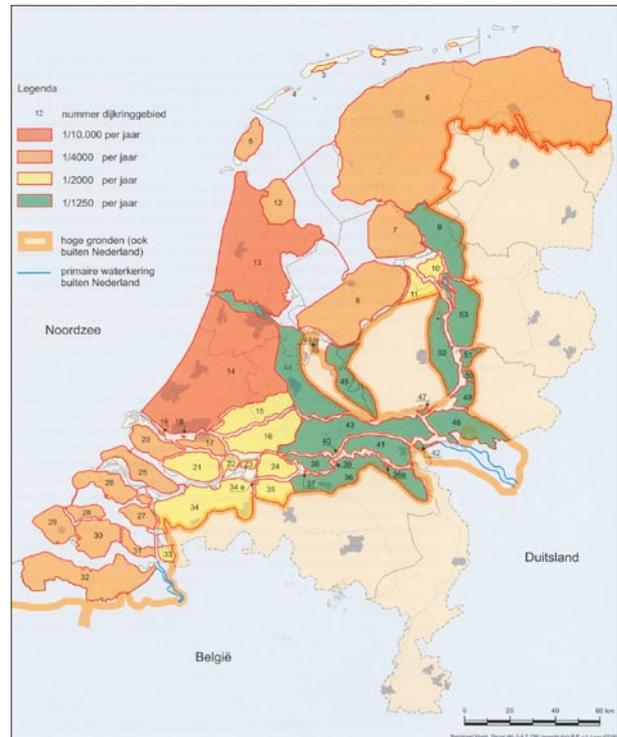


Figure 1. The dyke-rings with updated flood protection levels. The safety levels express the chance that a maximum water level occurs, which the flood protection needs to be able to withstand. (Source: MI&N 2011)

hinterland had grown tremendously. The GNP increased 6-fold between the 1950s and 2000 (corrected for inflation). During the same period the number of residents had increased by 50% (V&W 2000). It also became clear that the government would be made accountable by its citizens after a natural disaster, even though the individuals have their own responsibilities too.

After 2000 the safety standards were updated in accordance with the improved understanding of damage-risks of the various hinterland areas. The new statutory safety levels currently vary from 1:250 to 1:10,000 per year (figure 1) (MI&M 2011). Flood protection in the whole country, along rivers and coast, were assessed and where necessary works are carried out to bring them up to standard. Segments that were safe at the time, but would not be safe in 2100 due to expected climate change, were incorporated too (V&W 2000). Katwijk, the case study, is one of the ‘weak links’ on the coast.

Community demands more influence

Protests in the 1960’ and 1970’s against top-down planning in the Netherlands, led to community consultation being a statutory part of the planning process. But for many, the minimal require-

ments were not satisfactory. In the 1990's experiments with interactive participation became more common (Goorbergh & Scheffers 2012, de Graaf 2007). The idea was that involving the community in an early stage would create a broader support and simultaneously less resistance, leading to less objections in the statutory consultation process and prevent follow-up court cases. De Graaf (2007) and Boedeltje (2009) show that in most cases a higher level of participation does indeed lead to higher levels of support in the community.

Water management was the last 'technical fortress' in the Netherlands to incorporate a higher level of participation into their work. During the 1980's dyke-reinforcements had become a battlefield between the water management authorities and local communities together with landscape conservationists. The almost flood disasters of 1993 and 1995, led to the conclusion the water management authorities had to involve the community to be able to solve the safety issue quicker (Keijts 2007). Over the years the level of participation increased. Katwijk was the first project on the coast where the community was actively involved in researching the design solutions.

CASE STUDY: KATWIJK AT SEA

One of the 'weak links' in the primary flood protection on the coast was the town of Katwijk at Sea (Prov. Z-Holland 2007). While in 2007, the coast met the safety standard of 1:10,000, assessments revealed that it would not within 50 years, and would need to be reinforced before 2015.

The dune strip was not wide enough for a natural 'growing with the sea' strategy. Retreat was economically not viable and above all culturally and socially not acceptable. That would be sacrificing a centuries old town to coastal protection. Landward the urban area continued far inland, past the dune zone. Raising the existing protection line was not cost-effective. Innovative localised or offshore solutions did not meet the requirements (Arcadis et al 2008). Thus protection involved going seaward (figure 2). This meant raising and widening the dunes, up to 4 metres in height and 150 metres in width (figure 3) (Arcadis et al 2009b). This would have a big impact on the connections between the town and the sea and beach (figure 4), with major cultural, social and economic implications. Katwijk, originally a fisherman's village, was (and is) a flourishing family beach town. Tourism and visitors from the region were important for its economy. The beach and sea were an integral aspect of the town's ambience, with direct sea-views from the boulevard

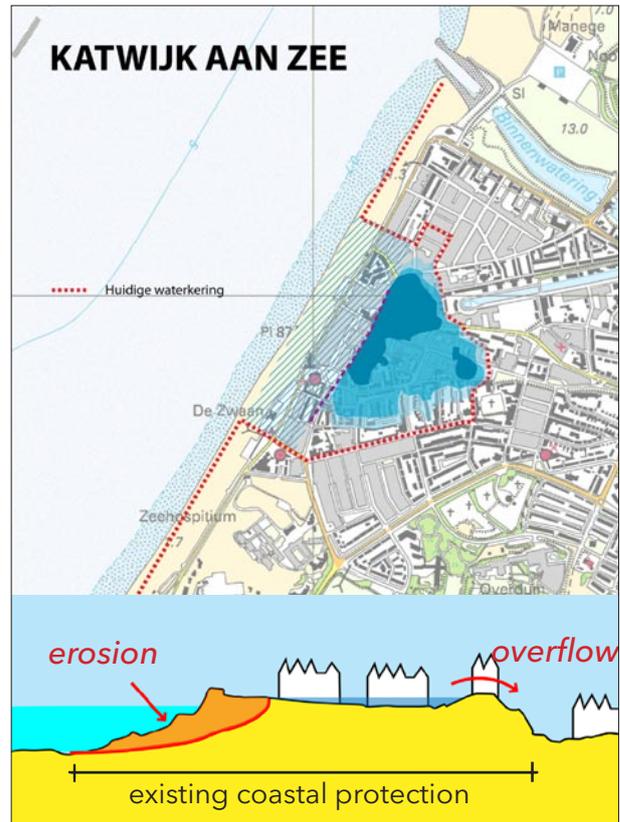


Figure 2. Katwijk with the current primary protection line (red dotted) going through the town. In blue, the dune erosion and inundation levels during a 1:10,000 storm. (Source: Arcadis et al 2008)

and the main shopping street. The beach pavilions provided the cafes, pubs and restaurants for the centre, making shopping and beach an integrated experience. In such a context, reinforcing the flood protection could not be handled as just another coastal-engineering project. The prime objective, to strengthen the primary flood protection, needed to be carried out with special care for the local spatial quality and in close interaction with the community (Rijnland 2008).

The project was carried out under authority of the local water board, in collaboration with the national, provincial and local government. The water board is accountable for the primary flood protection. The National Government is responsible for controlling structural erosion. It also sets the statutory safety levels and therefore funds the technically required improvements of the primary flood protection and necessary measures to compensate spatial qualities that will be lost or diminished in the process. The province is the supervising authority over assessing the protection's safety levels every 5 years. It also guards the spatial quality of the solution and the integration with regional policies. Yet it all happens within the territory of the local government, so they are

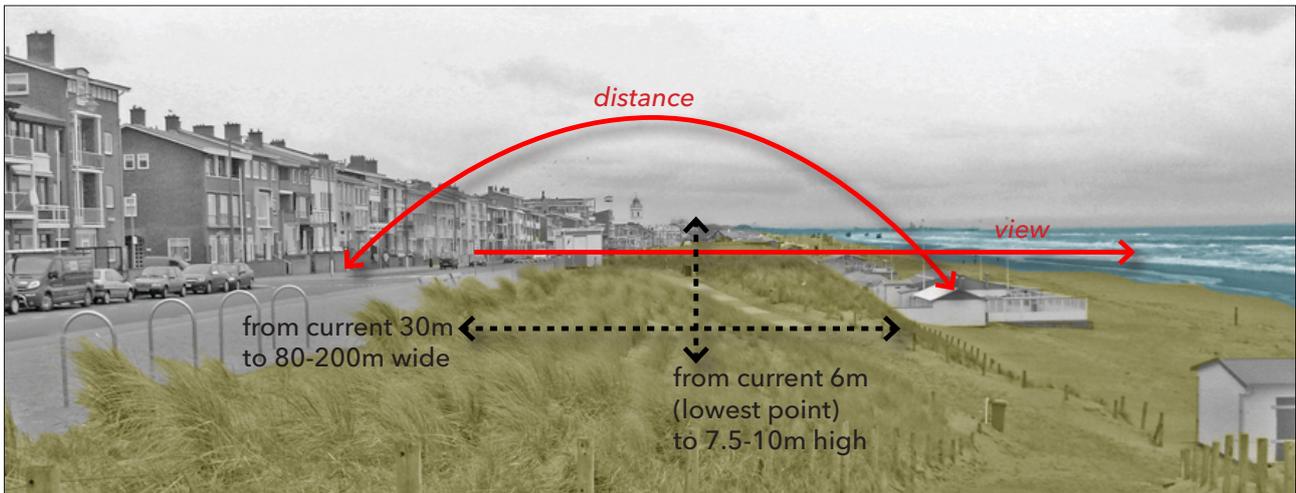


Figure 3. In the existing situation the dunes are 6m. high at the lowest point and 30m. wide. They need to be raised up to 10m. and widened up to

170m., depending on the combination and the technical solution; higher means smaller, lower means wider. (Source: OKRA landscape architects)



Figure 4. A few of the visualisations that were made to show the spatial effects of different protection models on the town. Left: the view from

a main shopping street in the centre. Right: a view on the boulevard. (Source: OKRA landscape architects)

a primary partner too. Province and council would need to fund any extra spatial quality. A multi-disciplinary team of consultants carried out the work: the project management, water engineering, design and interactive participation.

Interactive planning

The interactive planning process was done in four steps and formed an integrated part of the design process.

First the issue and process were communicated at a public meeting, followed by a news letter,

featuring: Why is it necessary to strengthen the coast at Katwijk and how will we involve you? The national government and the province had already extensively communicated on the weak-links program in general. So the people of Katwijk were not surprised, but rather anxious to learn what it would mean for their town (Arcadis 2008).

Prior to this meeting, the possible solutions were researched and modelled by the water experts. Given the conditions, the options for Katwijk were: (1) dune, (2) dyke-in-dune (comparable with a seawall) - both with various combinations of widths and heights - or (3) a plain dyke (figure



Figure 5. Reference images for the three options. From left to right: 'dune', a pure sand solution,

'dyke', a hard construction, and 'dyke in dune', an enhanced kind of seawall. (Source: Arcadis)

5) (Arcadis et al 2008). These models were also presented during the public meeting. Showing there were solutions for the problem did reduce the anxiety in the community over the threat of climate change. Knowing that it can be solved made it easier to accept the problem (Arcadis 2008).

The second step was a range of interviews (or focus groups) with stakeholder groups (retail traders, residents, nature organisations, council, etc.), to detect the spatial issues and tensions in town, both existing and related to the coastal project. The interviews were held with small groups of 2 to 3 people and in confidence. This gave stakeholders the chance to talk freely and vent emotions, which helped to further reduce anxiety. The result was a clear picture of the core spatial dilemmas:

1. View versus Distance - the sea-view from the town, boulevard and apartments, which sought a low and wide solution, versus the distance between the town and the beach, arguing for a high and small design.
2. Ecology and peacefulness versus Facilities and connection - the highly valued space for nature and experiencing quietness, versus the active use of the coastal zone to keep the town and beach connected and solve the existing shortage of parking and recreational facilities.

The urban footprint of Katwijk was confined by the surrounding dunes already for years. Gradual densification of the town had consumed space for parking, sport and play. The council was planning to build a subterranean parking structure under one of the last squares. Several stakeholders hoped to use the coastal strip for playgrounds and small sports fields, although landscape and nature organisations were not enthusiastic about that idea.

The dilemmas were transformed into a 'scenario game' (OKRA 2008). The game was composed of two parts (figure 6):

1. Make your own coastal protection solution
2. Add elements to compensate for lost spatial qualities.

The players had six types of coastal elements at their disposal: dune and dyke-in-dune, both in three different widths and heights. (It had already become clear that a dyke was unwelcome.) The elements were on scale and needed to be placed on a board, showing the existing situation. Points on the elements represented the differences in construction costs. For the compensation elements, the players had the choice of a range of paths, pavilions, parking and recreational facilities. These elements were derived from the interviews.

The scenario game was played in three different ambition levels: 'austerely & efficient' (corresponding to the funding provided by the national government), 'moderate', and 'luxurious', with increasing amount of points to use. The bigger the budget, the more compensation elements they had to include. Furthermore, the game was played with mixed groups. Residents, retailers and hospitality businesses, public servants, pressure groups, water-engineers, and politicians all had a part in the decision process, so they were mixed in the groups. It was important that the various parties heard each other's considerations and arguments. Each mixed group developed their own solution. The outcome was presented to the other groups and further discussed. In total the game was played with 9 groups with 6 to 8 people each (figure 7).

The general consensus was that the town did not need the most expensive solution. They preferred a moderate, but specially tailored one, with various widths and heights, to match the height differences of the local settings. The dyke-in-dune option was only used along the town centre, to minimise the disconnection with the beach. The number of paths and recreational uses had a bit more variation. The introduction of a dune

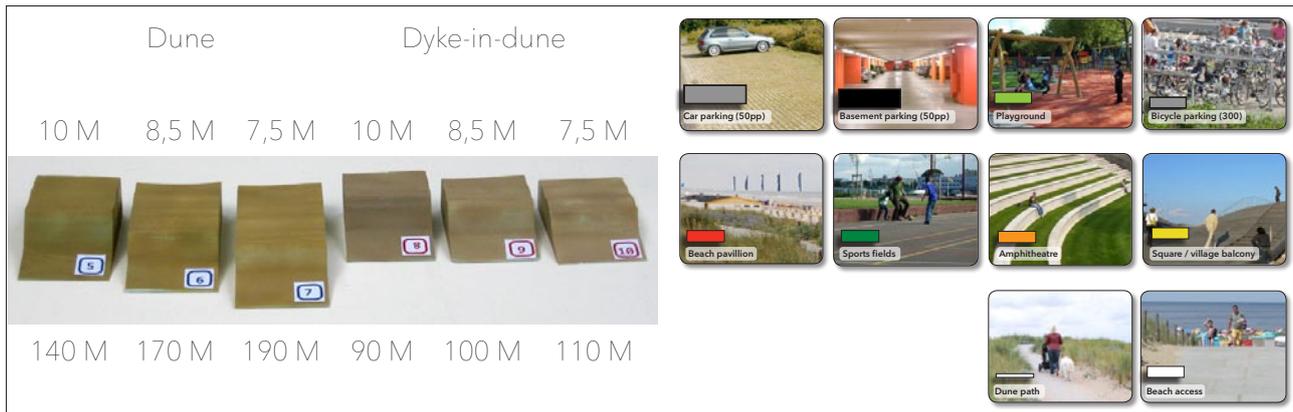


Figure 6. The six game pieces for coastal protection and the elements of the compensation measures. All coast pieces were on scale. The

vertical scale of the coastal elements was ten-fold the surface scale, to make the height differences more clearly visible. (Source: OKRA 2008)

pavilion was generally agreed upon, as stepping-stone between the centre and the beach. Most surprising was a solution of one group; they integrated parking into a dyke-in-dune solution, to solve the shortage of parking in the centre. When this solution was presented to the other groups, it gained massive support (Arcadis et al 2009a).

The outcomes of the scenario game were used to develop the design for the coastal protection. Regular meetings with all governmental levels kept these parties attuned in the process. Several workshops were held with stakeholder groups to work out the details (OKRA 2009). Feedback to the wider community was organised through regular newsletters.

The most difficult part in the design process was the integration of the parking solution. The technicians of the water board and national water

department were not enthusiastic about this idea. It was technically very difficult, to almost impossible, to combine underground parking with a dyke-in-dune and still meet the required 1:10,000 safety level. But the council took the option seriously (figure 8) and had it further developed (Gemeente Katwijk 2009). It would be a beautiful solution for the serious parking problem in the town's centre and it had a vast support of the community. It took quite some massaging, negotiating and modifying, but in the end, the combination of parking and dyke-in-dune is going to be realised (figure 9). The process further went relatively smooth. The design was supported by most of the community. There were no serious objections in the statutory consultation process and no court cases. The construction started in the second half of 2013 (Kustwerk Katwijk, 2013).



Figure 7. Impressions of the scenario game event. (Source: OKRA landscape architect)



Figure 8. Artist impression of the parking combined in the dyke-in-dune solution, made for the Council of Katwijk to promote further research

and implementation of the idea. (Source: OKRA landscape architects)

RECOMMENDATIONS FOR QUEENSLAND

Before elaborating on community participation, we comment on two aspects that arise from comparing the context of the Dutch case with the situation in Queensland and the Gold Coast. We acknowledge that these two are not within our area of expertise, however suggest that it would be worthwhile to look into the possible benefits of these approaches for Queensland and the Gold Coast.

Building with nature

The Queensland approach towards coastal management prioritises preventing disturbance of the natural processes. The Dutch context displays that it is possible to work more actively with the forces of nature. There is a wide range of options between trying to control nature and preventing disturbance. A pro-active approach towards the natural coastal system can have big advantages. Larger buffers can be created, to better withstand storm-tides and periods of intensified erosion. Approaching the coast as a larger system than just a council can be cost-effective and lessen the need for local interventions. 'Building with nature' has proven to be very useful for many other countries (Didde 2013). The USA is using this Dutch expertise to improve their coastal protection after the Katrina and Sandy hurricanes. The DCCEE wrote in 2009 (p140): "maintain natural coastal defences ... and encourage mechanisms for their enhancement". This can be seen as advocacy to apply 'building with nature' also in Australia.

Flood risk levels

Queensland uses a general 1:100 year event as measurement for flood-risk. In recent years a discussion has started within the governmental authorities to differentiate the flood-risks. The DCCEE (2009) as well as the Queensland Reconstruction Authority after the 2011 floods (QRA 2012) both identify the need to consider flood events rarer than the nominal 100 year return period. The Queensland Coastal Plan (2012a) does diversify risks for development assessments. The coastal hazard adaptation guidelines work with variable safety levels, based on use and life span (DEHP 2012a).

The Dutch system takes a different approach. It uses protecting areas and various safety standards, based on economical value, potential damage costs and gravity of the flood event (V&W 2000). This provides a different scale for the cost-benefit analysis of interventions, both in time and in area; not protecting every single building or collection of plots on their own, but protecting large urban areas.

Interactive community participation

The *Guideline for Preparing a Coastal Hazard Adaptation Strategy* (DEHP 2013a) presents a well-defined 9-step framework for developing a strategy. It includes two stages of community consultation: step 4 (*consult the community about the potential adaptation options*) and step 8 (*engage in community consultation on the draft adaptation strategy*). This does not imply a high level of engagement. According to both De Graaf's (2007)

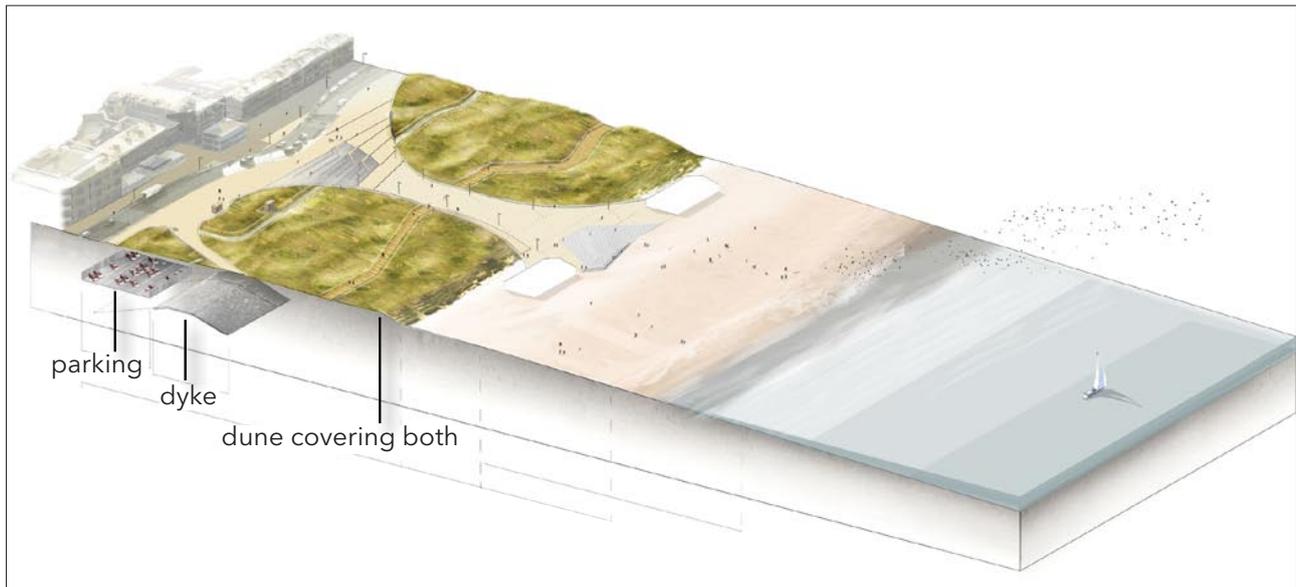


Figure 9. The final design of the coastal protection, with the parking solution incorporated in such a way that the 1:10,000 safety requirement is met. Construction starts 2nd half of 2013. For

more information on the design and process, visit: www.kustwerkkatwijk.nl. (Source: OKRA landscape architects)

and Boedeltje's (2009) conclusions, it will not likely to gain a higher level of support; certainly not more than the statutory consultation process would. However the DEHP also states: "community and stakeholders should be engaged early in the process, by providing opportunities for integrating their contribution in the identification of risks, adaptation options and criteria for appraisal" (DEHP 2013a, p16). The Katwijk project demonstrates what that could look like and the potential benefits.

Use of a traditional approach in Katwijk might have resulted in similarly modelled dunes, with different heights and widths, and the same paths, pavilions and recreational elements. But according to De Graaf's (2007) and Boedeltje's (2009) findings, it would not have had the same level of understanding, general support and ownership by the community and stakeholders. The holistic approach was essential to achieve this. The project focussed not only on strengthening coastal protection, but also on the integrated spatial quality, cultural identity and economic functioning of the town. Discussing these issues with the stakeholders and incorporating the outcomes into the plan, created goodwill and support for a difficult and intrusive operation.

Important to achieve that support was obtaining trust and creating an open and transparent process. The interviews were an effective start to create a base of trust. The scenario games strengthened that. Proving that there were no

preset designs and the discussion was truly open was very important. Giving feedback to the community and demonstrating how the results were incorporated into the subsequent process were also essential. The fact that the council adopted the parking proposal, communicated that to the public and fought for it in the project meetings, undoubtedly contributed to the credibility and legitimacy of the decision. This is consistent with the findings of APaNGO (2007), Boedeltje (2009) and Leith (2012), emphasizing the importance of trust, openness, transparency and a clear link to decision-making. Absence of these ingredients can seriously undermine the participation process (APaNGO 2007).

A crucial aspect was that community consultation about the potential adaptation options was not simply about giving information and asking for feedback. Through the scenario game the community stakeholders were actively involved in modelling, researching and discussing the different options. The visual tools and interaction between all parties, including the engineers, public servants and politicians, improved the quality of the discussion, level of mutual understanding of trade-offs and acceptance of the result, consistent with Evans et al (2013), Shaw et al (2009) and Tompkins et al (2008). The understanding worked both ways. For instance, the fact that the engineers were involved in the discussion when the 'parking in dyke-in-dune' option was proposed, and they experienced the community's overwhelming support, made them more receptive

to the idea. It thus achieved the goals of public participation as stated by Slomp (2012, p70): *"to improve the quality of and agreement on the end result, by involving local knowledge, validating democratic and transparent government, in which citizens are able to influence decision-making"*.

Finally, a traditional approach would certainly have missed out on the unique innovation that is now going to be realised in Katwijk. We surmise that the social learning derived from engaging and communicating with others assisted in the ability to explore novel possibilities (Wenger 2000). Incorporating the spatial issues of a wider area into the project and mobilising the creativity of the wider audience achieved this. The parking structure made the project more expensive than a pure coastal protection solution, but less expensive than the total of what two separated solutions would have cost. Even more important, by solving a spatial issue that was originally outside the scope of the project but important to the community, the coastal protection project achieved a positive association, which made the negative impacts more acceptable. That the Minister of Infrastructure and Environment now uses Katwijk as a proud example to promote Dutch innovation and water management abroad (NOS 2013) is a pleasant and unintended side effect.

CONCLUSION

We suggest that the combination of coastal urbanisation and climate change in Australia will lead to greater contestation about natural and soft versus active flood protection measures in the future. The paper explored how can this be resolved on a local scale and in harmony with the community. For this we turned to the case of Katwijk in the Netherlands. From the Dutch coastal protection context, we ask for further consideration of two aspects: to investigate the usefulness of the 'building with nature' approach and to review the way of determining flood-risk levels. Our analysis of the benefits of the interactive planning process of Katwijk demonstrated ways to explore complex and highly technical coastal protection options with the community that could be applied in Queensland and on the Gold Coast.

References

- ABS, 1986. Year book: Australia 1986, catalogue no. 1301.0.
- ABS, 2008. Regional population growth, Australia, 2006-07, catalogue no. 3218.0.
- ABS, 2012. Regional Population Growth, Australia, 2012, catalogue no. 3218.0
- APaNGO, 2007. Community engagement in planning - exploring the way forward. Amos G., Warburton D., APaNGO Project Partners. TCPA and APaNGO Project Partners, Oldham.
- Arcadis, 2008. Verslag Informatiebijeenkomst Kustversterking Katwijk, gehouden in 't Zeepaviljoen - Katwijk aan Zee. 4 September 2008.
- Arcadis, Alkyon, OKRA landscape architects, 2008. Startnotitie kustversterking Katwijk.
- Arcadis, Alkyon and OKRA landscape architects, 2009a. Presentation 'Workshop Ruimtelijke Kwaliteit'. landscape architects. Presented on 25 June 2009, Katwijk aan Zee.
- Arcadis, Alkyon and OKRA landscape architects, 2009b. Nota varianten en alternatieven kustversterking Katwijk.
- Beierle, T. and Cayford, J., 2002. Democracy in Practice: Public Participation in Environmental Decisions, Resources for the Future, Washington D.C.
- Bendeler, G., Boom, L. van den, Hulspas, M., Smith, R., 1998. Nat & droog, Nederland met andere ogen bekeken. Rijkswaterstaat, Architectura & Natura, Amsterdam.
- Boedeltje, M.M., 2009. Draagvlak door interactief bestuur: fictie of feit? Thesis (PhD). Universiteit Twente, Enschede.
- Cooper, J. and Lemckert, C., 2012. Extreme sea-level rise and adaptation options for coastal resort cities: A qualitative assessment from the Gold Coast, Australia. Ocean & Coastal Management, 64, 1-14.
- DCCEE, 2009. Climate Change Risks to Australia's Coasts. Commonwealth of Australia, Department of Climate Change and Energy Efficiency.
- DCCEE, 2011. Climate Change Risks to Coastal Buildings and Infrastructure. Commonwealth of Australia, Department of Climate Change and

Energy Efficiency.

DEHP, 2011. State of the Environment Queensland 2011. State of Queensland, Department of Environment and Heritage Protection.

DEHP, 2012a. Queensland Coastal Plan. State of Queensland, Department of Environment and Heritage Protection, (version February 2012).

DEHP, 2012b. Queensland Coastal Plan, State Planning Policy 3/11 Guideline: Coastal Protection. State of Queensland, Department of Environment and Heritage Protection, (version May 2013).

DEHP, 2013b. Draft Coastal Management Plan. State of Queensland, Department of Environment and Heritage Protection.

DEHP, 2013a. Guidelines for Preparing a Coastal Hazard Adaptation Strategy. State of Queensland, Department of Environment and Heritage Protection.

Delft Hydraulics Laboratory, 1970. Gold Coast, Queensland, Australia; Coastal erosion and related problems. Report 257. Delft Hydraulics Laboratory, Delft, The Netherlands.

Didde, R., 2013. De natuur bouwt mee, kustverdediging en ecologie. Wageningen World, nr.2, 18-21.

DIP, 2009. South East Queensland Regional Plan 2009-2031. Queensland Government, Department of Infrastructure and Planning. Brisbane.

Evans, L., Hicks, C., Fidelman, P., Tobin, R. and Perry, A., 2013. Future Scenarios as a Research Tool: Investigating Climate Change Impacts, Adaptation Options and Outcomes for the Great Barrier Reef, Australia. Human Ecology, DOI 10.1007/s10745-013-9601-0.

GCCC, 2005. Gold Coast Shoreline Management Review, Information Sheet. Gold Coast City Council, Gold Coast.

GCCC, 2009. Climate Change Strategy 2009 - 2014: setting direction, enabling action. Gold Coast City Council, Gold Coast.

GCCC, 2010a. Sustainable Flood Management Strategy, Protecting our future. Gold Coast City Council, Gold Coast.

GCCC, 2010b. Gold Coast Shoreline Management Plan, Summary Report. Gold Coast City

Council, Gold Coast.

GCCC, 2013. Three Point Plan for Coastal Protection: a long term solution for Gold Coast beaches. Gold Coast City Council and Queensland Government. Gold Coast.

Gemeente Katwijk, 2009. Brochure 'Kracht in de kust, kustversterking versterkt'. Gemeente Katwijk, Katwijk aan Zee.

Goorbergh, F. van den and Scheffers, J., 2012. Participatie @ groene ruimte. Landwerk, Wageningen.

de Graaf, L., 2007. Gedragen beleid, een bestuurskundig onderzoek naar interactief beleid en draagvlak in de stad Utrecht. Thesis (PhD). Eburon, Delft.

IPCC, 2007. Climate Change 2007, Synthesis Report of the Fourth Assessment Report. Core Writing Team: Pachauri R.K., Reisinger A. (Eds.). Intergovernmental Panel on Climate Change (IPCC), Geneva - Switzerland.

Keijts, B. (ed.), 2007. Ruimte voor hoogwater; Nederland rivierenland. Land+Water, Koninklijke BDU Uitgevers, Barneveld.

Kustwerk Katwijk, 2013. Kustwerk Katwijk, uitvoering [online]. Provincie Zuid-Holland, Gemeente Katwijk, Hoogheemraadschap Rijnland and Rijkswaterstaat. Available from: <http://www.kustwerk-katwijk.nl/public/index.php?id=18> [Accessed 26 July 2013]

Lazarow, N., Tomlinson, R., Pointeau, R., Strauss, D., Noriega, R., Kirkpatrick, S., Stuart, G., Hunt, S., 2008. Gold Coast Shoreline Management Plan, Volume 1 - 4. Gold Coast City Council in partnership with Griffith University.

Leith, P., Coffey, B., Haward, M., O'Toole, K. and Allen, S., 2012. Improving science uptake in coastal zone management: principles for science engagement and their application in south-eastern Tasmania. In Kenchington, R., Stocker, L. and Wood, D. (ed). Sustainable Coastal Management and Climate Adaptation: Global Lessons from Regional Approaches in Australia. CSIRO Publishing, Collingwood Vic.

Metz, T., 1998. Nieuwe natuur, reportages over veranderend landschap. Ambo, Amsterdam.

Metz, T., Heuvel, M. van den, 2012. Salt & Sweet, water and the Dutch. NAI Publishers, Rotterdam.

- MI&M, 2011. Veiligheid Nederland in Kaart (VNK2), overschrijdingskans, overstromingskans, overstromingsrisico. Ministerie van Infra & Milieu, Interprovinciaal Overleg, Unie van Waterschappen.
- NOS, 2013. Nederland gaat VS helpen met voorkomen van rampen [online]. NOS news, 6 march 2013. Available online: <http://nos.nl/video/lq/481705-nederland-gaat-vs-helpen-met-voorkomen-van-rampen.html> [Accessed 25 July 2013]
- OKRA landscape architects, 2008. Presentation 'Scenario Spel Kustversterking Katwijk'. Presented on 22, 23 and 26 September 2008, Katwijk aan Zee.
- OKRA landscape architects, 2009. Katwijk - Kust, visualisatie m.e.r. alternatieven en ruimtelijke pakketten. (Version September 2009).
- Olsthoorn, X., Werff, P. van der, Bouwer, L.M., Huitema, D., 2009. Neo-Atlantis: The Netherlands under a 5-m sea level rise. *Climatic Change*, 91, 103-122.
- Prov. Z-Holland, 2007. Ruimtelijke Verkenning Kustveiligheid en Ruimtelijke Kwaliteit Katwijk aan Zee. Provincie Zuid-Holland, Gemeente Katwijk, Hoogheemraadschap Rijnland.
- Prov. Z-Holland, 2013. De Zandmotor [online]. Provincie Zuid-Holland and Rijkswaterstaat. Available from: <http://www.dezandmotor.nl/> [Accessed 24 July 2013].
- QRA, 2012. Planning for stronger, more resilient floodplains, Part 2 - measuring to support floodplain management in future planning schemes, draft version. Queensland Reconstruction Authority.
- Rijnland, 2008. Selectieleidraad kustversterking Katwijk. Hoogheemraadschap van Rijnland, Projectgroep zwakke schakel Katwijk. (Version 5.0, 6 February 2008).
- Shaw, A., Sheppard, S., Burch, S., Flanders, D., Wiek, A., Carmichael, J., Robinson, J., Cohen, S., 2009. Making local futures tangible - Synthesizing, downscaling and visualizing climate change scenarios for participatory capacity building. *Global Environmental Change*, 19, 447-463.
- Singh-Peterson, L., Serrao-Neumann, S., Crick, F. and Sporne, I., 2013. Planning for climate change across borders: insights from the Gold Coast (QLD) - Tweed (NSW) region, *Australian Planner*, 50:2, 148-156.
- Slomp, R., 2012. Flood Risk and Water Management in the Netherlands, a 2012 update. Report for Ministry of infrastructure and the Environment.
- Tol, R., and Langen, A., 2000. A concise history of Dutch river floods. *Climate Change* 46, 357-369.
- Tompkins, E., Few, R., and Brown, K., 2008. Scenario-based stakeholder engagement: Incorporating stakeholders preferences into coastal planning for climate change, *Journal of Environmental Management*, 88, 1580-1592.
- UNFPA, 2007. State of world population 2007: Unleashing the Potential of Urban Growth; United Nations Population Fund, New York - USA.
- V&W, 2000. 3e kustnota; traditie, trends en toekomst. National Government The Netherlands, Ministerie van Verkeer en Waterstaat (Ministry of Transport and Water).
- Wenger, E., 2000, Communities of practice and social learning systems. *Organization*, 7, 225-246.