

CASE STUDY

Carss Bush Park environmentally friendly seawall – Stage 1

Author: Tom Heath, Georges River Council

Georges River Council is moving towards new foreshore development projects which enhance habitat complexity, supplement existing natural foreshore areas and improve biodiversity. Carss Bush Park seawall is the largest example of the Georges River Council's foreshore habitat improvement approach.



Figure 1. Section of the completed Carss Bush Park seawall including rockpools and saltmarsh.

Project need

Carss Bush Park is located in Carss Park, along the western foreshore of Kogarah Bay (Georges River estuarine bay), Sydney. The site's vertical concrete seawall was historically constructed to reclaim land from Kogarah Bay, developing the existing foreshore shape.

Over time and with the influence of tide and wave action, systematic structural failures in the seawall grout and concrete occurred. These structural failures resulted in erosion behind the wall and consequent subsidence following king-tides or storm surges. Large holes became apparent behind the seawall, creating a health and safety concern due to their location along a popular walking route and adjacent playing fields.

The ongoing erosion also had an environmental impact on the local ecosystem. Increased sedimentation impacted the Kogarah Bay seagrass community and other benthic habitats, while reducing water quality. The seawall was also a vertical solid concrete seawall, providing minimal intertidal habitat, reducing the biodiversity of the area. Previous short-term engineering responses to such erosion issues involved utilising geotextile-fabric and aggregate to backfill the holes to reduce the ongoing movement of fine sediment material. This remediation technique had merit along small stretches of foreshore as a temporary fix while more appropriate designs are planned and budgeted for.

An environmentally friendly seawall construction project at Carss Bush Park was necessary to meet the long-term remediation requirements of the foreshore, enhance biodiversity at the site and restore a degree of tidal processes. Stage one of the project focused on a 0.6ha area of foreshore and parkland adjacent to the local sporting fields. The foreshore infrastructure included a 230m long vertical concrete seawall covering the majority of the lower intertidal area, with turf behind the wall.

Figure 2. Historical aerial photographs of Carss Bush Park demonstrating the changing foreshore structure and shape from early on during the reclamation process in 1937, to reclamation completion in 1982, to the 2015 shape and structure prior to new foreshore construction.



a) 1937 – reclamation commenced.



b) 1982 – reclamation complete.



c) 2015 – seawall prior to work (stage one identified).



2015 – concrete seawall section.

Project steps

The objective of this project was to design and construct an environmentally friendly seawall to increase the intertidal habitat range of the foreshore, while remediating current erosional processes.

Understanding the problem

The emphasis of many foreshore projects is to construct seawalls which protect infrastructure, negatively transforming the intertidal environment by replacing biologically diverse natural foreshore habitats with artificial, featureless structures with low biodiversity.

Utilising concepts from the Environmentally Friendly Seawall Guidelines (DECC and SMCMA, 2009) and lessons learnt from Council's previous seawall projects, Council in conjunction with NSW Office of Environment and Heritage designed a seawall to unlock the biodiversity potential of the Carss Bush Park foreshore. This was achieved by allowing natural coastal processes, such as tidal ingress, to influence the foreshore, in conjunction with the incorporation of a number of different habitat types. The Carss Bush Park Foreshore Improvement Project has developed innovative estuarine ecosystems including rockpools at varying intertidal levels, longer foreshore slopes and crevices, mudflats for mangrove and benthic organisms, endangered saltmarsh communities and riparian vegetation.

The Carss Bush Park seawall was examined from both a scientific and engineering approach to not only develop an original seawall design, but to ensure the successful construction and long-term structural integrity of the project. The foreshore has also been designed with future adaptability to climate change incorporated; ensuring the aesthetics and success of the project are not impacted by sea level rise.



Figure 3. Aerial of completed seawall identifying key features. (PP - Photo points).

Quick facts

Project overview	Design and construct an environmentally friendly seawall to control erosion, provide marine and terrestrial habitat and improve foreshore access.
Cost and time	Total project cost \$700,000 - \$800,000. Includes: environmental management, excavation and soil disposal works, seawall material supply and construction, 240m of concrete walking path construction, and vegetation supply and planting. Construction completed over a three months in late 2015.
Funding and technical support	A \$276,000 Estuary Management Program grant was provided by NSW Office of Environment and Heritage and supplemented with Council funds. Technical support was provided from within Georges River Council and from NSW Office of Environment and Heritage. Total Earth Care was contracted by Council to undertake the construction works.
Key project facts and outcomes	<ul style="list-style-type: none"> - 240m of foreshore remediated - 1375m² saltmarsh constructed and planted - 112m² rockpool habitat created - 10,000 native plants planted - To date 15 site tours and 1 conference - 1 interpretive sign installed

Project design specifics

Each of Council's environmentally friendly seawall designs has been based on historic records of the natural foreshore and an assessment of natural features in close proximity to the site.

Tidal flushing, predominant wave direction and freshwater influences were also assessed when designing seawall features such as various habitat types.

Following analysis of the design parameters, rockpools, saltmarsh benches, rocky intertidal areas, and tidal mudflats were all included in the Carss Bush Park foreshore design.

Rockpools

The constructed rockpools are innovative seawall features (Council's previous Dover Park East project also includes rockpools), emulating natural features to retain water during low tide and provide habitat and refuge areas for estuarine species. Four large rockpools were constructed along the foreshore, within the mid-shore tidal level (0.5 – 0.7 AHD). These pools were incorporated into the sloped sandstone log seawall, with greater horizontal grade than the previous vertical concrete seawall. The pools were engineered using large rectangular sandstone blocks which also provide horizontal surfaces within the seawall, and an industrial pond liner which enables the retention of water at low tide.

Due to the size of each pool (>2m²) and the concern of deoxygenation and increased water temperatures during low tide emersion, each rockpool is 30-60cm deep. As these pools are deeper than most natural rockpools examined, further habitat enhancement was included to provide shallower areas. The bottom of each pool is crushed sandstone with larger blocks and boulders installed with cut outs, grooves and recesses to provide habitat, refuge and shallower areas.

Changing the level of the rockpool changes the time period of high tide emersion and the frequency of exposure. Previous seawall projects (Dover Park East and Sans Souci Park) include different rockpool heights to encourage the development of different intertidal habitat communities.

Saltmarsh

Sections of the existing concrete seawall were kept in place and utilised as tidal barriers to create large saltmarsh benches. By keeping sections of the existing seawall infrastructure, the volume of material leaving the site was reduced, and the work was completed without building new structures. Saltmarsh bench construction was specified based on the levels of existing, natural pockets of saltmarsh within Kogarah Bay, and information gained from previously successful saltmarsh revegetation projects in the area. For the site, a level of 1.0 AHD was constructed, allowing different saltmarsh species including *Suaeda australis*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Juncus kraussii*, *Triglochin striata* to be planted in different areas.

Rocky intertidal habitat

Large sandstone foreshore habitat areas were created using sandstone logs and rip-rap to create variable slope and surface finish. Geofabric and 20mm aggregate was used as a base from which the required levels were developed. Rip-rap has sufficient natural features and creates voids without further work required, while the sandstone logs were enhanced by including cut outs, grooves and recesses to provide habitat. These logs create large horizontal habitat areas on which algae and diatoms can establish, increasing the abundance of grazing gastropod species within the intertidal zone.

Mudflat

A large section of the terrestrial Carss Bush Park work site was excavated to the level of the adjacent Kogarah Bay to create a benthic mudflat area. As the site was previously reclaimed land, the remnant estuarine soil type was present under the reclamation material. By removing the seawall structure and associated fill, tidal processes recommenced.

Acid Sulfate Soil testing was performed before and during the project to monitor any associated risk with excavation works. Sediment controls remained in place at the mouth of the new mudflat for a period of time following excavation to allow the settling of sediment.

Since its construction, the topography of the mudflat area has changed with the migration of fine benthic sediment, and sand, into the area. Whelk species and self-sown mangroves have also migrated into this area.

Figure 4. Before and after photo points illustrating the development of habitat features along the Carss Bush Park foreshore.



a) Photo Point 1 (PP1 Fig 3) 'before' construction illustrating minimal foreshore amenity or habitat.



b) Photo Point 1 (PP1 Fig 3) 'after' construction illustrating excavation works to develop tidal bay and vegetation planting.



c) Photo Point 2 (PP2 Fig 3) 'before' construction illustrating erosion areas.



d) Photo Point 2 (PP2 Fig 3) 'after' construction illustrating tidal migration into saltmarsh benches during king tide events.

Success and lessons learnt

The design and construction of this significant environmentally friendly seawall project has led to improvements in the natural ecology of the Kogarah Bay environment, while also increasing the aesthetic, social, educational and cultural values of the Georges River foreshore. Combined with other successful environmentally friendly seawall projects in Kogarah, a cumulative improvement in habitat availability and variability along the Kogarah Bay foreshore has been achieved.

Further ecological analysis is required prior to final conclusions being developed, however observable improvements in biodiversity have been identified on the intertidal foreshore of Carss Bush Park. The retention of water during low tide has provided suitable habitat for ascidians, Porifera, fish, algal and invertebrate species previously not present on the Carss Bush Park foreshore. Sediment migration into the mudflat area also allowed the natural establishment of mangroves in these areas where mangroves have not been present since reclamation.

While restoration of the Kogarah Bay intertidal foreshore to natural conditions is not a realistic option due to its highly urbanised state, Council's environmentally friendly seawall projects showcase how cost effective ecological enhancements along a highly urbanised shoreline can be achieved.

Critical to ensuring the local community were supportive of the project, certain design elements were compromised to reflect the heavy recreational use and highly urbanised nature of the location. Only a limited area of riparian revegetation was included to maximise the size of other habitat features and to ensure the project footprint didn't encroach substantially on the adjacent playing fields. As views from neighbouring private properties needed to be maintained, only low lying riparian vegetation was planted. Landscaping features were also added to the design to ensure the works were aesthetically pleasing to a broad sector of the community, and to promote useability for the public of the foreshore.

Planning and approvals

- No development consent is required for foreshore stabilisation works under the *State Environmental Planning Policy (Infrastructure) 2007* by public authorities, therefore works were considered under Part 5 of the *Environmental Planning and Assessment Act 1979* through a review of environmental factors and managed internally by Georges River Council.
- Permits were required under the *Fisheries Management Act 1994* from NSW Department of Primary Industries (Fisheries) for:
 - reclamation, as the seawall was built seaward in the intertidal zone, and
 - dredging, as removal of fill was conducted in the intertidal zone.
- Land Owners Consent under the *Crown Lands Act 1989* was required by NSW Department of Industry, Lands and Forestry division as part of the land on which the works occurred is Crown land.

NOTE: Always consult with your local Council prior to undertaking any foreshore works or adjustments. They will be able to provide information on what approvals may be required and which government agencies provide these.

References

DECC and SMCMA (2009). *Environmentally friendly seawalls: A guide to improving the environmental value of seawalls and seawall-lined foreshores in estuaries*, Department of Environment and Climate Change, Sydney. Available from: <http://www.environment.nsw.gov.au/publications/coasts/090328-env-friendly-seawalls-guide.htm>



Figure 5. Section of the completed Carss Bush Park seawall including rockpools with integral habitat features and saltmarsh.

Find out more

Fish Friendly Marine Infrastructure is a NSW Department of Primary Industries (Fisheries) developed program. This project has been assisted by the NSW government through its Environmental Trust. More information on Fish Friendly Marine Infrastructure can be found at: www.fishhabitatnetwork.com.au, or by calling the NSW Department of Primary Industries (Fisheries) Aquatic Habitat Rehabilitation team on 02 6626 1396.

To find out more about the Carss Bush Park seawall project contact Tom Heath, Georges River Council, on 02 9330 6038.

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