



# ▶ CASE STUDY: WATER APPLICATION

## Gulf Harbour Marine Village

The Kiwi's of New Zealand will be defending the **America's Cup** in the year 2000 in one of the most beautiful settings at Gulf Harbour on the outskirts of Auckland "the city of sails". The million plus residents of Auckland will have a firsthand view of this most famous of all sailing races which will be held in the Hauraki Gulf and hosted by the **Gulf Harbour Marine Village**.

The Gulf Harbour development, located on the Whangaparaoa Peninsula north of Auckland is the first of it's type in New Zealand. The Marine Village has been developed around a canal concept with pontoon berths and access to the existing marina and ocean via a short entrance channel.

On completion the development will provide a mix of shops, professional chambers, restaurants and cafes, a supermarket and various sporting facilities catering to approximately 7,000 people.

The project is unique in that it is the largest canal development in the world to use the Keystone Retaining Wall System. The 17.5 hectare (44 acre) site comprises an area of land approximately 500 meters (1650 ft.) by 350 meters (1150 ft.). The Developers objective was to maximize the available land while providing sufficient water frontage and access to boat berths while maintaining the canal theme. The design team decided this could only be achieved by using vertical walls around the perimeter of the canal.

Several design layouts were considered for the canal system. The preferred option followed a curved alignment parallel to the higher ground to the east of the site. This alignment allowed the canal to be founded on sand stone thus providing the necessary bearing capacity required to support the retaining walls. The upscale nature of the development required the overall aesthetics of the canal system to be of the highest standard.

The canal is joined to the existing marina by a short entrance channel which allowed the project to be constructed in dry conditions and flooded on completion.

American architect **Robin Riley, of Robin Riley Associates**, responsible for the urban design and architectural concepts for Gulf Harbour's Marine Village, Town Centre and Canal commented ... *"The use of Keystone for the canal walls was an important urban design and architectural decision for Marine Village designers. Because of the extreme tidal change at Gulf Harbour, as much*



- ▶ **PROJECT:** Gulf Harbour Marine Village
- LOCATION:** Auckland, New Zealand
- PRODUCT:** Keystone Compac Units 
- SQUARE FOOTAGE:** 66,000 units (6100 m<sup>2</sup>)
- DEVELOPER:** Anthony Wood & Assoc.
- ENGINEERING CONSULTANT:** Becker, Carter, Holling & Fernwell.
- KEYSTONE REPRESENTATIVE:** W. Stevenson & Sons  
Auckland, New Zealand



Gulf Harbour Marine Village project with Keystone canal walls.

as 3 meters (10 ft.) of wall can be exposed to view for long periods of time. Consequently, it is very important to the visual aesthetics of the design that the materials being used complement the architecture being employed. At Gulf Harbour, Keystone fits the bill. The robust pattern and appearance of the material make it ideal for a marine setting. The pigment color chosen for the Keystone units, allows for a comfortable inclusion in the overall scheme of the village, where it plays a supportive role rather than dominating the selection of architectural colors."

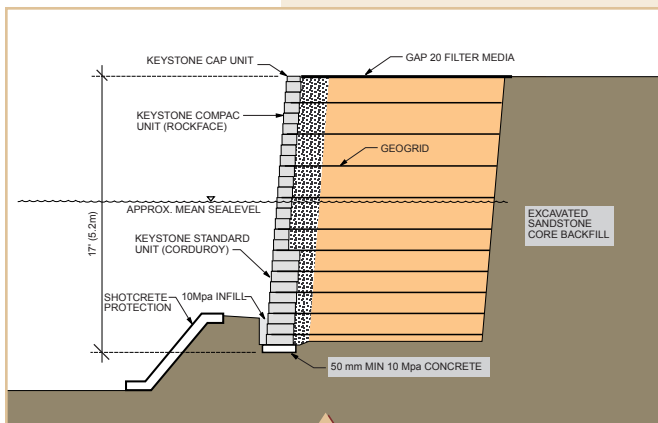
Several alternative wall systems were considered but these did not offer the aesthetic or geometric flexibility of the Keystone Retaining Wall System, manufactured and represented by **W. Stevenson & Sons**, Auckland, New Zealand.

The Keystone system, comprising high-strength segmental concrete units interlocked by high-strength fiberglass pins and geogrid soil reinforcement, provided the project designers with a number of distinct advantages.

- 1 **Design flexibility** - Accommodation for any geometric form including curves, internal and external right angle corners.
- 2 **Attractive in appearance** - Keystone offered a number of color and face textures, including the 3-plane "rockface" and "corduroy" finishes selected for the project.
- 3 **Proven history** - All materials incorporated in the Keystone system have been used successfully in a number of similar marine projects worldwide.
- 4 **Non weather dependent** - Keystone units are dry cast concrete, manufactured in a block plant. This enabled unit production and installation of the canal walls to proceed regardless of weather conditions.
- 5 **Use of on site soils** - The Keystone/geogrid system enabled the use of excavated soil to be reused as backfill material, a considerable cost saving on a project of this size.
- 6 **Use of local labor** - The Keystone System enabled the wall to be constructed using local labor and without the use of special equipment, thus substantially reducing construction costs.
- 7 **Reduced Hydrostatic Pressure** - The ability to dry stack Keystone units, allows the passage of water through the wall thus reducing hydrostatic pressure; a major consideration given the 3 meter (10 ft.) tidal movement in the canal



Gulf Harbour site during construction.



Typical canal wall section.

- 8 **The versatility of the system** - The modular interlocked nature of the Keystone System allows for future additions or alteration work at minimal cost and without changing the overall appearance of the canal.

The Gulf Harbour Project required a canal incorporating vertical walls to maximize land and water use. The Keystone Retaining Wall System provided a cost effective solution. All materials in the system are resistant to the harsh marine environment. Construction of Keystone walls requires no specialist labor or equipment allowing for easy installation at competitive rates.

The result is an aesthetically appealing high density marine development which enhances and promotes the region beautifully.

