

Ocean Reef Outfall - WA

Long Launches can be hard work



Ocean Reef Outfall

Client Water Authority of
Western Australia
(Water Corporation)

Project Ocean Reef
Outfall
Duplication

Pipeline 2,500m of
1,420mm OD x
10mm WT
SINTAKOTE

Construction WAWA Major
Projects Branch

Construction November 1991–
Period June 1992



Solving a Community Problem

The Perth suburb of Ocean Reef lies some 23km north west of the city and links with the sea. Spread before the waters of the Indian Ocean, it offers a refuge for leisure craft and is a favoured fishing spot for the Wanneroo area which borders Marmion Marine Park. Ocean Reef also serves this hinterland by carrying treated effluent from the Authority's Beenyup Waste Water Treatment Plant through an ocean outfall some 1.8 km out to sea. When the existing ocean outfall tunnel serving the treatment plant began to surcharge late 1990 under peak wet weather flows, the Authority acted quickly on existing approval. Bolstered by the success of a similar project at Cape Peron, south of the city, the Authority adopted a design in weight coated SINTAKOTE mild steel cement lined pipe with welded joints. The construction method; site assembly and 'bottom pull' launch.

A SINTAKOTE Solution

Detailed design called for a 1420mm OD SINTAKOTE cement lined, steel pipe with 10mm wall thickness and welded joints. A 110mm thick weight coat of concrete would provide the necessary ballast and protection against damage during installation and service. Welded joints provided the structural integrity for a towed launch out to sea while offering greatest flexibility in on-site construction. The construction involved weight coating pipe and welding these together into 'strings' some 150m long. Some 13 strings were constructed in this way and grouped together on a rack adjacent to the launching rail. Strings were lifted from the rack by hydraulic jacks mounted on transverse rail bogies. Once in position over the launching rail the strings were lowered onto launching rail bogies and welded to the main string. These launching rail bogies conveyed the growing pipeline to the water's edge where they were recovered, and the pipe transferred to the ocean floor for the 'bottom pull' launch.

Engineering Demands

Joint reinstatement within strings used conventional concrete, however during the launch, epoxy compounds were used to meet the cycle time. The pipeline passed through a reverse curvature during the launch and the uniformity of beam stiffness was essential to avoid local overload. The minimum radius of curvature was 2,500m leading to extreme compressive stresses on the concrete of around 40 MPa. The towing force was provided by a winch mounted on a sea-going tug with a 1500kN winch pull. The tug itself was secured by 3 ocean floor anchors located 2.5km offshore. The winch force was transferred to the pipe head via two barge mounted, counter woven 64mm diameter steel cables.

The Launch

Peter Mapstone, the Construction Manager and his team faced a variety of testing challenges imposed not only by the engineering nature of the project but by mother nature herself, particularly during the launch. Weather forecasts at launch time were received at 12 hourly intervals while the Department of Harbours and Marine provided ocean current data three times a day during the launch. Emergency procedures against possible cyclone activity also had to be considered and made effective if necessary. During the launch, radio communication was maintained with the tug, barge and survey control. The tug controlled the pulling force which peaked at around 1400kN against static friction. The barge controlled axial alignment of the line by winching north or south as required by survey. Peter Mapstone's team worked around the clock during the launch and were only forced to batten down' once, to accommodate currents associated with a 3 to 4m swell and 2m seas. "Our exposure to the weather, particularly sea currents and the cost of the launch itself reduced our window of launch opportunity to an absolute minimum. The pipes were supplied to meet critical jointing requirements to facilitate welding during the launch phase. Their performance was everything I expected", said Peter. The strings were welded and successfully dragged into position after a four-day period in April and linked to the tunnel for a June commissioning, ahead of time and below budget.

The Future

The Perth northern suburbs community can look forward to continued reliability in this essential service, so often taken for granted. Recent improvements in water treatment processes and water quality control will ensure that the Beenyup Waste Water Treatment Plant meets the latest performance criteria and that the improved outfall facility remains environmentally compatible.