Albany Seawater Desalination Plant
Intake Bores Study Summary

Technical Partner

The Albany South Coast Intake Bores Study is a desktop study commissioned by Water Corporation and undertaken by TDW Consultants, an independent drilling consultant.

This document is prepared by Water Corporation and is a summarised version to support community and stakeholder engagement, providing a clear overview of the study's key findings.

Purpose of the Study

Due to climate change and population growth, there is a projected increase in demand for drinking water. Water Corporation is investigating potential areas for a future seawater desalination plant near Albany. This initiative aims to ensure a secure and sustainable water supply for the Lower Great Southern Towns Water Supply Scheme (LGSTWSS) beyond 2030.

This study is a desktop assessment that looks at the concept design and risks involved in using intake bores—underground wells that draw seawater—as a possible way to supply raw water to a future desalination plant. It focuses on the Sandpatch area, located on the Torndirrup Peninsula in Albany.

What are intake bores

Because the South Coast at Sandpatch has rough ocean conditions, building a traditional offshore intake pipeline would be very difficult. This study looked at an alternative approach—using intake bores, which are special wells drilled from land to draw seawater from beneath the seabed. These bores would eliminate the need for permanent structures on the seabed that would be hard to build and maintain in the powerful Southern Ocean waves.

Unlike open ocean pipelines, intake bores draw water through the seabed or from underground aquifers, depending on the local geology.

The bores may be vertical or angled (slant well) with horizontal extensions to extend the screens out and beneath the seabed.

The difference between a traditional vertical well and the slant well with horizontal extension is shown below. The screened intake sits below the seabed.

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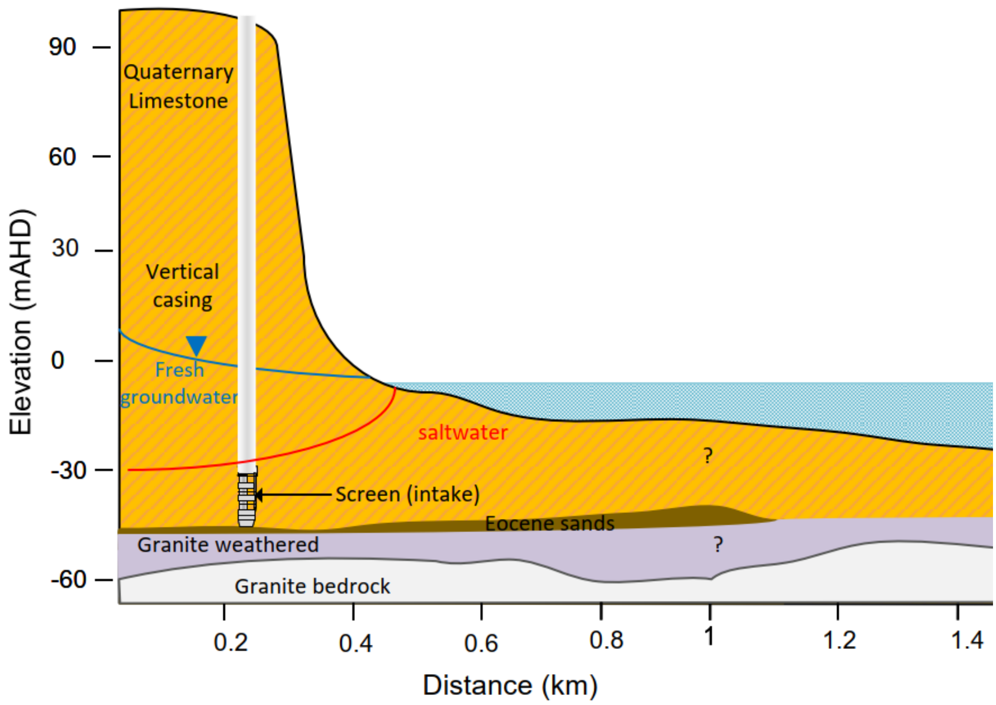
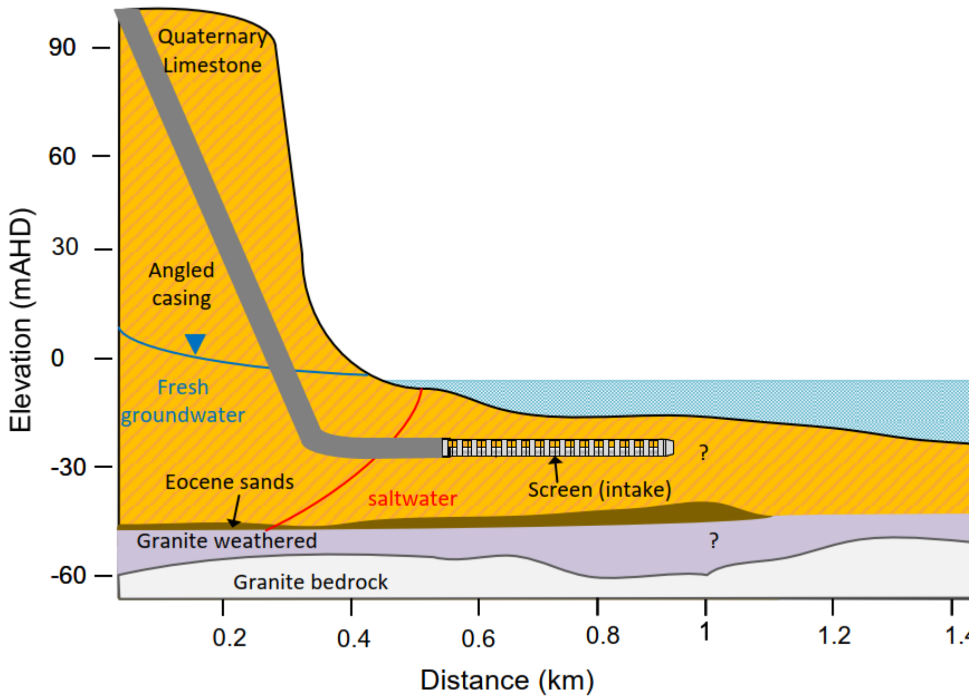
Traditional Vertical Well



Slant Well with horizontal Extension



Note: Cross sections depicted are a stylised interpretation of geology, particularly where data is limited, and are not to scale.

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Key Findings

Geology and Water Quality

- The geology in the Sandpatch area is complex, with layers of sand, limestone, and granite beneath the surface. These layers vary in depth and stability, which affects how and where bores can be drilled.
- Offshore geological conditions within the first 500 metres from the shoreline are not well understood. This lack of data means target areas for the intake bores cannot be determined and makes it difficult to predict drilling challenges and water quality outcomes.
- Water drawn from the bores may vary in quality and quantity depending on depth and location. Shallow bores are more likely to produce seawater, while deeper bores could yield brackish or mineral-rich water due to mixing with groundwater or long underground residence times.
- There is a risk of elevated levels of iron and manganese in the water, which could clog bore screens and filters, increasing maintenance needs and affecting water treatment processes.
- The target lithology (physical characteristics of rocks) could not be confirmed due to the lack of geological information.

Feasibility and Design

- Intake bores are technically feasible and have been used in other projects, but they require careful planning due to geological uncertainties and potential risks.
- The concept design involves drilling at an angle from land, with the bores running horizontally under the seabed. This avoids the need for infrastructure out in the ocean.
- It was assumed each bore could produce up to 83 litres per second. To meet the plant's intake needs of 303 litres per second, at least four bores would be needed, plus two extra bores as backup.
- To avoid interference between bores, the concept suggested the bores would need to be spaced at least 500 metres apart to maintain stable water flow and to reduce the risk of overlapping drawdown zones.
- Bore locations should be selected based on lower cliff elevations and accessibility, ideally near existing roads, like those used for the wind farm.
- Offshore bore screens should be placed at least 180 metres beyond the saltwater interface to avoid mixing with freshwater and ensure consistent seawater intake.
- Drilling will need large work areas, including two drill pads (each 100m x 100m), plus space for equipment and materials.
- Final well design and methodology couldn't be completed because of limited geological information, which was considered a flaw.

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Investigations and Risks

Onshore and Offshore Investigations

To better understand the underground conditions and reduce uncertainty, both onshore and offshore investigations are needed:

- Onshore drilling will help confirm the strength and type of rock layers, especially granite and limestone, and assess whether drilling is feasible from land.
- Offshore investigations are essential to understand the geology beneath the seabed, but they are difficult due to rough ocean conditions and limited access.
- The report noted that the required marine geotechnical investigation could not be completed in the critical area extending 500m from the shore.
- An alternative method was proposed that involves drilling angled “mother” holes from the shore, with smaller “daughter” holes branching out beneath the seabed. This approach helps explore a wider area without needing to drill directly from the ocean but will not give a full picture of the geological conditions.
- These investigations are critical to determine whether the intake bores can be safely and effectively constructed.

Estimated Costs

- The cost of exploration and installing a test bore is estimated between $3 million and $5 million at each of the bore locations.
- If a suitable formation was found during exploration, the report recommends a trial pumping period of at least one year. This would allow time to monitor water quality and bore performance and confirm whether the bore can reliably produce the right volume and quality of water for a desalination plant.

Fatal Flaw Risks

While the study confirms that intake bores are technically possible, it also highlights several serious risks—referred to as “fatal flaws”—that could prevent the project from succeeding without further investigation:

- **Uncertainty in Offshore Geology**: The geology beneath the ocean floor, especially within the first 500 metres from the shoreline, is poorly understood. This area is critical for bore placement, but it may contain unexpected rock formations like shallow granite that could block drilling.
- **Difficult Access for Investigation**: Traditional vertical drilling to explore this zone is not feasible due to dangerous ocean conditions. The only viable method is angled drilling from land, which is expensive and complex. A significant area of land is required to be cleared for each bore constructed, including a minimum 100m x 100m drill pad and an additional 100m x 100m laydown area for equipment and materials. Where these works intersect with areas containing federally listed environmental values, delays in obtaining clearing approvals are likely.

- **High Cost and No Guarantee**: Installing a test bore to explore the geology and water quality could cost up to $5 million. Even after this investment, there's no certainty that a suitable aquifer will be found to supply the desalination plant.
- **Challenging Drilling Conditions**: Even with detailed geotechnical studies, drilling could encounter unstable sandy layers, karstic limestone (which can collapse), and zones where drilling fluid is lost. These conditions could delay or halt construction. In addition, bore decommissioning and rehabilitation will be complex due to the significant length and angled construction of the bores.
- **Construction Water Supply Demands**: The drilling process may require up to 4,000 litres per minute of water to manage operations, especially if water is lost into porous rock formations. This would require additional infrastructure just to support drilling.
- **Unpredictable Water Quality**: The quality of water drawn from the bores is unknown. It could range from clean seawater to brackish or mineral-rich groundwater, which may contain high levels of iron and manganese. These variations could affect treatment processes and long-term bore performance.
- **Hydraulic Complexity**: The limestone aquifer may allow freshwater to flow far offshore, complicating the ability to draw consistent seawater. Without a test bore and extended pumping trial, it's impossible to predict what kind of water will be produced.

Conclusions

The study shows that it's technically possible to drill and construct bores to draw seawater for the proposed desalination plant. However, there are no guarantees that a suitable aquifer will be found due to the significant uncertainties about the underground conditions near the shoreline, which pose serious risks. These risks could be reduced by drilling test bores at an angle from the shore, but doing so could cost up to $5 million per location. Even if a suitable bore can be constructed, there's no guarantee that the underground water source will be suitable.

It is almost certain that a critical flaw will emerge during the investigation, delivery, or operation of angle seawater intake bores at the South Coast site, potentially rendering the option infeasible.