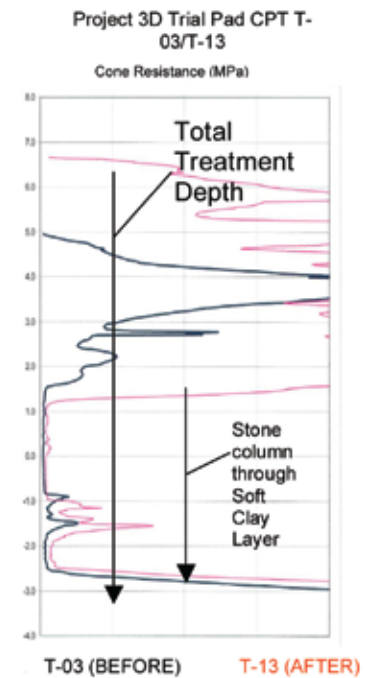


## Vibro-Stone Columns for Port Waratah Coal Services, Coal Delivery Expansion Project - Newcastle, Australia.



**The use of Vibro-Stone Columns permitted the construction of an additional coal Stacker and coal stockyard on soft mangrove clays.**

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### Project

An additional coal stacker and stockpile pad were planned as part of the PWCS project 3D expansion in Newcastle. The stacker was constructed on a berm built over the reclaimed sand and mangrove beds of Kooragang Island.

### Soil Conditions

The subsoil consisted of recent dredged sands upto 3 metres thick overlying a soft clay layer upto 4.5 metres thick. Medium dense sands were encountered below these layers.

### Solution

Vibro-stone columns, 1.1 metres in diameter were installed into the medium dense sand layer using the conventional wet method of installation. Keller 'M' and 'S' depth vibrators were used for the process. All installation rigs were equipped with automatic recording devices which provided real time records of each column installed.

### Design Criteria

Site	Criteria	Load
Pad Settlement	<250 mm	180 kPa
Berm Settlement	<150 mm	115 kPa
Berm Tilt	<0.3%	
Stacker Differential	<0.075%	
Ground Acceleration	$g = 0.16$	

The design was performed using the Priebe Method for stone columns

### Monitoring & Verification

A large scale area load test was performed on working columns in the area of the deepest soft clay layer using a 5 metre high sand embankment. The trial was intensely monitored by settlement plates, Hydrostatic Profile Gauges, load cells, inclinometers, and pre and post CPT's. Back analysis of the trial results confirmed the accuracy of the initial design.

**Client:**  
**PWCS**

**Main Contractor:**  
**Bechtel Australia**

**Consultant:**  
**Bechtel (Services)**  
**Douglas Partners**