

Note / Memo

**HaskoningDHV UK Ltd.
Maritime & Aviation**

To: Tim Bownes - MHPA
From: Mike Chambers
Date: 18 November 2020
Copy: Adrian Rowlands - MHPA
Our reference: PB8556-RHD-ZZ-XX-NT-Z-00011
Classification: Project related
Checked by: [Click or tap here to enter text.](#)

Subject: Pembroke Dock Marine Infrastructure - Marine Rock Dredging

Dear Tim,

The proposed level of the new slipway will involve excavation below the existing seabed level. Before the ground investigation (GI) it was thought that the rock was deeper and the excavation in rock would be minimal. However, following the GI it has proved the rock is much higher than was originally thought and the majority of the excavation below water will be in the bed rock.

The Ground Investigation results have now been processed and the results of the rock testing are complete. The underlying bedrock is generally a competent limestone with general areas of fracturing. The rock strength is generally 20 MPA with a fracture spacing of 0.5m.

The top of the rock is on average around 2 to 3m below MLWS and the depth of rock to be excavated in the marine environment is at its deepest is approximately 4.5m. Therefore, the depth of excavation is well within the range of a large excavator. These large excavators can exert their maximum pressure when they are not at the full range of their extension. Therefore, if the contractor works with the tide, they will be able to put maximum pressure on the deepest parts of the rock excavation.

The expected methodology to excavate the rock is for a large barge mounted back actor to excavate the rock. It is expected with a powerful 30/40-ton machine the majority of the fractured rock should be able to be excavated directly with a bucket with ripper teeth fitted (fig 1).



Fig 1 Rock Bucket

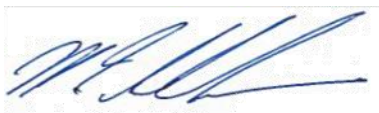
For areas where the fractures are not as numerous something that will exert a more concentrated pressure may be used to break the rock up before being excavated. This is likely to be a single ripper tooth as shown in (Fig 2) Again if this is completed at low water the machine will be able to exert maximum pressure to fracture the rock.



Fig 1 Ripper Tooth

Based on information from the Rock manual rock strengths of up to 70 MPA are likely to be able to be broken up using a ripper tooth. As the rock strengths indicated from the GI are much less than this it is thought the combination of a rock bucket and ripper tooth should enable the rock to be removed without the intervention of any other equipment.

Yours sincerely

A handwritten signature in blue ink, likely belonging to Mike Chambers.

Mike Chambers
Principal Project Manager
Maritime & Aviation