

Appendix 13.5

Coastal Expert Review of Arup Coastal Erosion Study

Menno Eelkema

AquaVision BV

Remaining issues to be addressed by the applicant's coastal erosion expert:

In general, the study on the coastal recession near Gobby Beach performed by Arup seems to be thorough. However, there are still some issues which might need clarification or elaboration: (paraphrased answers by the applicant are given in red)

- The proposed measure intended to decrease the rate of cliff erosion is placing a layer of shingles on the beach above the high water line. The report by Arup mentions a volume of approximately 1100 m³ of sacrificial material (rounded shingle). It is not entirely clear from the report how this number of 1100 m³ is determined. The surface area for this nourishment is more or less well defined, so the variable determining the volume is the thickness of this layer. Arup should elaborate more on how this thickness and volume is established.

Applicant: The top level of the nourishment is designed to be at 3.28 m above datum, which corresponds to the 1/200 years storm surge level. This level has sea level rise and land subsidence taken into account. This top level, combined with the surface area and cross-sectional shape of the nourishment, results in the 1100 m³ mentioned in the report.

- Coupled to the previous question: In what way is the effectiveness of the proposed beach nourishment calculated? Is it regarded as purely sacrificial material (i.e. the waves have to erode the material first before they can erode the cliff), or is it specifically designed to reduce wave run-up? Would the nourishment lose effectiveness if the water level would ever rise above the top of the nourishment?

Applicant: The nourishment is designed primarily as sacrificial material, although the nourishment will also reduce the wave run-up. Also, if the water level would ever rise above the top of the nourishment, the nourishment would still be effective due to this wave reducing effect.

- According to Arup, the cliff erosion is an effect of both wave attack as well as groundwater seepage. In the EIS Appendix 13.3 the relative importance of these processes is assumed as 50% each. This is an important assumption, as it determines the effectiveness of the proposed measures for protecting the cliff (for example, a nourishment would have had little effect on the slumping after storm Frank). What is the basis of this 50/50 ratio?

Applicant: This ratio is based on the observation that the coastal retreat is a result of both processes: the slumping due to groundwater makes the cliff's profile more gentle, while the erosion due to waves makes it more steep. In this way, the groundwater slumping puts the cliff's material on the beach, and the waves wash it away over time.

- Arup has stated in their witness statement that the erosion caused by groundwater seepage will be reduced by the drainage systems installed at the facility. The question here is whether

this statement is an assumption, or validated through expert knowledge or a study on the effects of the drainage system on groundwater flow in the area.

Applicant: the beneficial effects of the drainage system have been covered in the applicant's study on the hydrogeology of the site and the proposed drainage system.

- When do we say that the erosion has 'reached' the facility? Arup states: *"Due to the episodic nature of the events, any erosion estimate needs to take into account retreat along the whole length of the study area as opposed to a localised location where the highest rate of erosion is recorded."* Arup computes average retreat rates for the entire stretch of coast under consideration, but also shows that some parts might be eroding faster than this average, depending on the time period considered. Also, apparently the effect of storm Frank is not uniform along Gobby Beach. However, the walkway or the pipeline only need to be breached in one location to lose their function. It would be prudent to elaborate more on why a spatial average erosion rate is allowed to be used in this case.

Applicant: As soon as a specific section of the site has slumped, it will take a while before the same section will be in a state in which it can slump again. Also, these sections are not behaving independently. As soon as one section slumps, the adjacent section will probably become more likely to slump in the future. This makes that a retreat rate averaged along Gobby Beach is acceptable.

- Additional question raised during the hearing: What will happen actually when a nourishment is in place, and the cliff face slumps due to groundwater seepage? Will the cliff material land on top of the nourishment, or will the slump push the nourishment towards the bay?

Applicant: It is not entirely clear at this point what will happen, but in both cases, the nourishment would still offer protection as a sacrificial layer.

Conclusion: The coastal consultants commissioned by the board are of the opinion that the applicant has addressed these issues sufficiently.