Natural physical factors in the Whitsand Bay area

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1. The Sedimentary Setting

Existing seabed sediments in the region are dominated by sand, indicating a highly energetic regime. Mud-dominated sediments tend to occur only in small sheltered environments.

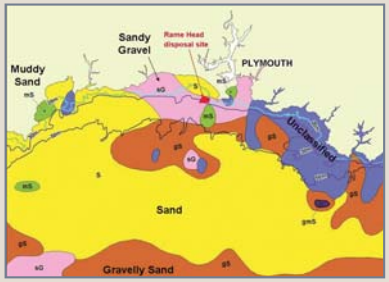


Figure 1. Distribution of seabed sediments on the continental shelf immediately south of Plymouth (redrawn from British Geological Survey, 1987).

Figure 2. Sites of the past (dashed) and current dredge material disposal sites, and the locations of stations for which CEFAS holds interpreted data from grab samples.

The sediments of inner Whitsand Bay are dominated by clean sand.

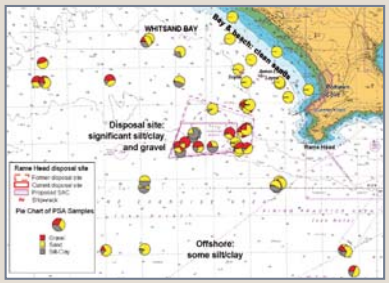


Figure 3. Simplified grain size distributions of sea-bed sediments. Note that silt/clay occurs in significant proportions in places at the disposal site, in lesser proportions further offshore, but is absent in Whitsand Bay.

Existing seabed sediments in the region are dominated by sand and gravel. Rock outcrops occur in the disposal site, which has a very variable sea bed.

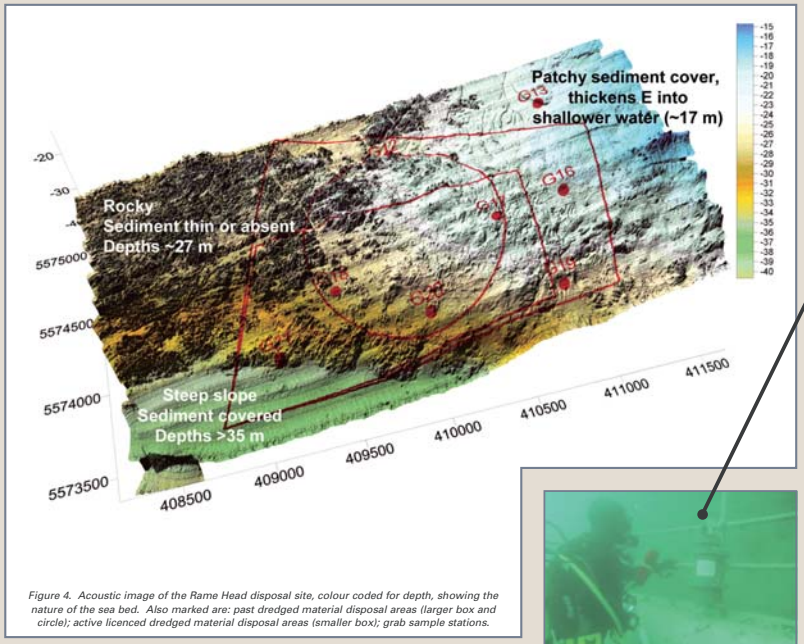


Figure 4. Acoustic image of the Rame Head disposal site, colour coded for depth, showing the nature of the sea bed. Also marked are: past dredged material disposal areas (larger box and circle); active licenced dredged material disposal areas (smaller box); grab sample stations.

Diver and water quality logger at Scylla (courtesy Rob Wick, National Marine Aquarium).

2. The Hydrodynamic Setting

The main currents are fast at spring tides and flow along-shore. These currents act to disperse fine material from the bay.

Figure 5. Spring tide depth-averaged flow: at HW +1.1 hours (blue arrows) and HW +4 hours (green). Data taken on the spring tide of 23rd Feb 2005.

Acting alone, tides will move disposed fine sediment along-shore, not across it.

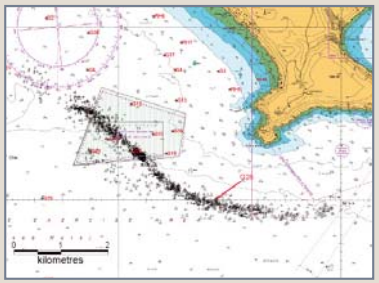
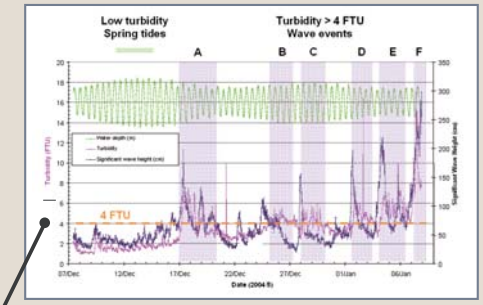


Figure 8. Predicted location of very fine sand after 24 hours of modelled tidal dispersion from the disposal site.



Measured turbidity is low, and responds mostly to waves.

Figure 7. Oceanographic data measured at 5 m above the seabed at Scylla, for winter 2004/5 (7th Dec – 10th Jan).

Most turbidity data are below 10 FTU, and even during a winter storm remains below 18 FTU. For context, these water clarities are as clear as at most tropical coral reefs (Larcombe et al, 2001).

Table 1. The range of techniques used in the environmental assessment of the physical regime and the nature of information obtained.

Technique used	Information obtained
Assessment of the geomorphologic and hydrodynamic setting	Understanding of the major processes controlling the physical system.
Swath bathymetry	High-resolution depth information for the disposal area. Individual mounds resulting from recent disposal events were identified.
Side-scan sonar	Images of the sea bed roughness and sedimentary bedforms.
Particle size analysis	Distribution of gravel, sand, silt and clay in sea-bed sediments.
Underwater video camera tows	Nature of the sea-bed sediments and bedforms, the presence of litter, plus information on encrusting and mobile fauna.
Recording loggers deployed on Scylla	Water turbidity, wave height, salinity and temperature obtained at the Scylla dive site.
ADCP current meters deployed in transect lines	Tidal flow data obtained landward of the disposal site, also used to validate flow models.
Sediment dispersal modelling of disposal plumes	Predictions of the likely transport of disposed sediments.

3. Conclusions

1. The geomorphology of Whitsand Bay and the regional hydrodynamics indicate that the bay is expected to export any fine sediment it receives. Similarly, it is highly unlikely that there will be long-term retention of fine sediment in Polhawn Cove.

2. There is no evidence of excessive silt levels in sediments between the disposal site and Whitsand Bay or in Polhawn Cove. Samples show that there is less than 1% silt in these sediments.

3. Tidal modelling indicates that disposed sediments will tend to be transported in a south-easterly direction away from Whitsand Bay and the Marine SAC.

4. At the Scylla dive site, water turbidity is generally low (i.e. high clarity). There are no indications of any abnormal patterns of turbidity that might be anthropogenic in origin.

References

British Geological Survey (1987). Sea bed sediments around the UK. South Sheet, scale 1:1,000,000.

Larcombe, P., Costen, A. & Woolfe, K. (2001) The hydrodynamic and sedimentary setting of nearshore coral reefs, central Great Barrier Reef shelf, Australia: Paluma Shoals, a case study. Sedimentology, 48, 811-836.

Acknowledgements

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