Baseline monitoring at a pilot site for sediment reuse

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Introduction: The SURICATES project aims to promote dredged sediment reuse for climate change adaptation, flood protection and coastline defence [1]. Reuse options investigated during an earlier project [2] are now tested in large scale pilot tests, in order to provide port and waterways operators with case studies. At Bowling, a regeneration site lies between the River Clyde and Forth & Clyde Canal, including a housing development, a cycle path, green areas and canal recreational uses. Sediment will be applied on low-lying areas for land uplift and flood mitigation, and used to construct coastline protection.

Methods: A baseline survey was completed using a portable XRF (pXRF) to test feasibility of the method for identifying potential inorganic contaminants in soils, riverbanks and sediments to be dredged. Existing observation wells allowed a shallow groundwater survey (multiparametric probe profiles and adaptive water sampling). This survey does not supersede the regulatory requirements, but is aimed at demonstrating how field measurements can be used at the early design stage and to facilitate effective site monitoring.
Surface soils were analysed by pXRF on raw or 2mm sieved soil and on riverbank sediment at < 50 m intervals. Dredged canal sediments (water 60-80%) were reduced (to water 25-35%) with a hand filter press. Measurements carried out on wet pressed pellets correlate well with laboratory analyses [3].

Results: The resulting data (Fig.1) suggest that canalside soils (and possible areas of sediment deposition) are more homogeneous and have lower contaminant levels than the soils and made ground along the Clyde and former railway sidings.
Multiparametric probe profiles of shallow groundwater, Fig.2) showed rainfall-affected water (EC = 300-400 µS/cm) at the surface but more saline waters at depth (EC of 500, 800 or 1400 µS/cm), and seawater-affected wells (EC about 15 mS/cm). The water table is shallow (0.7 to 6 m) and affected by tide (up to 1 m), with higher EC expected at high tide.
Discussion: Site-specific threshold values for pXRF measurements can be derived from regulatory limits after calibration. They can be used during works to identify potentially off-specification sediments in quasi real time. Such measurements will be developed at pilot works and post-pilot stages, and are expected to facilitate operational management decisions. We will replicate this scheme at other pilot sites (Scotland, Netherlands).

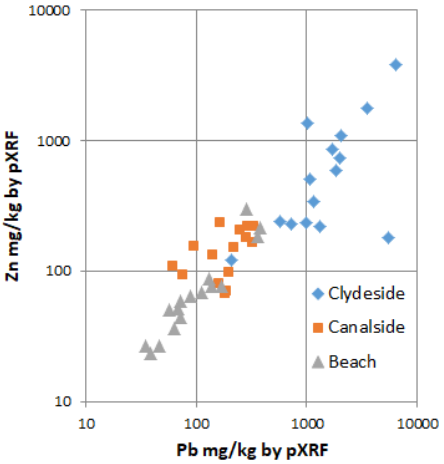

Fig. 1: Pb and Zn concentrations by pXRF (mg/kg) in soil and Clyde beach sediment.

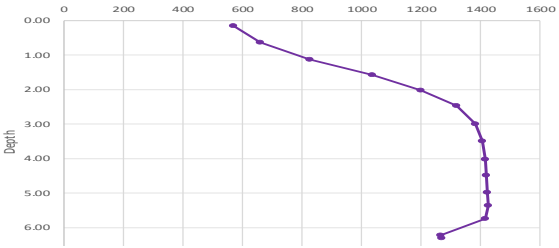

Fig. 2: Conductivity profile by multiparametric probe (µS/cm) in shallow groundwater, BH19.

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References: [1] Wijdeveld, A. et al., (2017) *SedNet conference*; [2] Debuigne, T. et al., (2015) *SedNet conference;* [3] Lemière, B. et al., (2014) *GEEA* **22**:222-233.