Fixing Failures or Re-thinking Futures? From Resilient Remedies to Resilient Land- and Water-Scapes

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Introduction and approach: Climate change is an existential threat, but global change is broader – human population growth, land (and water body) use change, resource depletion and waste accumulation, and their resultant habitat, biodiversity and service impacts are multi-dimensional and complex challenges facing mankind**.** As essential habitats, resources, carriers of contaminants and retainers of records, sediments play complex roles in hydrodynamic, ecological and human socio-economic systems, in which sediment quality, quantity, location and transport all control its function. Human management can change these dimensions of sediment status, impacting its roles and behavior; we manage and remediate systems to address changes and their effects.

Remediation and site re-use, including restoration and redevelopment activities, are intrinsically linked, although a disconnect between these two remains. A sustainable conceptual site, system, or basin model for remediation or restoration projects considers traditional CSM elements, as well as resource inputs and outputs, land re-use and restoration goals, stakeholder well-being, and resilience; it should include desirable and undesirable pathways of environmental, economic and social impact of management alternatives, both during and after the project completion.

Resilience and ecosystem service [1] considerations can include potential effects of re-contamination or recovery from point and non-point sources; erosional, depositional or disturbance events from ongoing, changing or extreme natural or anthropogenic processes; and potential impacts from changing socio-economic, political and infrastructure changes. Management alternatives are dictated by site conditions. They are also affected by the use envisioned for a site. Choices may limit site re-use, and how we re-use a site may affect the resilience of the alternative.

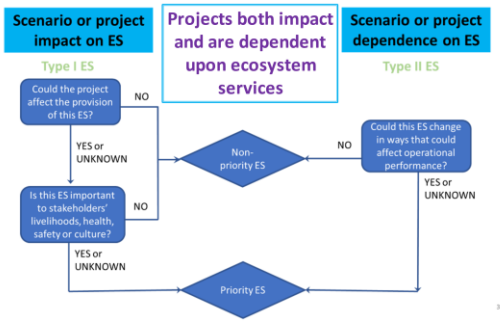

Fig. 1: Projects both impact and are dependent upon ecosystem services. Sustainable projects avoid vulnerabilities, optimise opportunities, seek to avoid impacting regional resilience, and, ideally, also seek to enhance regional resilience.

Results and discussion: While, in general, management technologies for soils and sediments may look more similar to each other than those for groundwater, many of the site characteristics that drive alternative selections may be more similar for sediments and groundwater/NAPL – both have greater accessibility and feasibility challenges than do most soil sites, and both are more strongly affected by source control issues that may drive long-term resilience. A holistic approach brings together remediation and reuse to achieve whole-system sustainability benefits, exploit synergies and minimize the costs and environmental impacts associated with bringing land back into beneficial use. Strategies for expanding the scope of management sustainability assessment, to better effect more resilient futures, will be explored.

References: [1] Boerema, Moulaert, Apitz, Hack, Boon (2021) *Terra et Aqua* **164** (Autumn 2021): 41-53; [2] Dimas et al. (2004) *Wasserwirtschaft* **22**:222-233.