

# Review of Thin-Cover Placement in *Spartina* Marsh and Potential Bioturbation Effects

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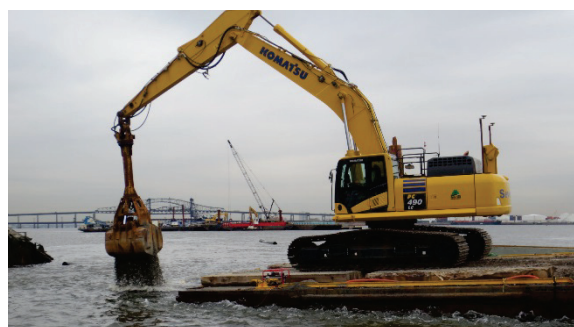
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**Introduction:** Remediation success is determined by the ability of a remedy to achieve remedial action goals within an acceptable time, and by the long-term permanence of the remedy. Thin-cover placement is still often viewed as a relatively new, emerging technology. Yet, thin covers have been demonstrated as effective remediation techniques at a number of sediment sites. Thin cover placement can be used to enhance natural recovery processes and minimize impacts to the aquatic environment by effectively and rapidly reducing the mobility, toxicity, and potential exposure of benthic organisms and higher trophic animals to sediment chemicals of concern (COCs).

**Methods:** We reviewed case studies where thin-cover placement of clean material over impacted sediment was used either as a remediation alternative or as an ecological restoration approach. This technique is sometimes referred to as enhanced monitored natural recovery (EMNR) when the goal is to accelerate monitored natural recovery processes, such as the acceleration of natural deposition. Our review also focused on the feasibility of a smooth cordgrass (*Spartina alterniflora* or *Spartina*) salt marsh to naturally recover once the marsh has been remediated through the placement of a thin-cover as a remediation or restoration layer.

**Results:** There are several case studies where thin-cover placement has been used effectively as a remediation technique to reduce the mobility, toxicity, and exposure to COCs, including estuarine, river, tidal flats and marsh settings. The earliest use of thin-cover placement occurred in Washington State, USA, ca. the early 1990s. The effectiveness of placing a thin layer of sediment to restore natural marshes and the subsequent marsh recovery patterns has been closely monitored by the U. S. Army Corps of Engineers Research and Development Center (USACE RDC) since the 1990s. Case studies found in peer-reviewed literature are summarized for the following topics: methods for the placement of a thin-cover of clean sediment material on a salt marsh, effectiveness of use as a remediation technique, natural habitat recovery time of smooth cordgrass through varying depths of sediment, *Spartina*

tolerance characteristics, and potential issues related to bioturbation from sediment dwelling organisms.



**Fig. 1.** Thin cover placement strategies.

**Discussion:** The results of this work indicated that several methods can be used effectively to apply clean sediment material to a salt marsh and thereby enhance stability and growth of new vegetation. Thin covers are a protective remedy alternative when properly applied. They can be used to achieve site-specific remedial goals and minimize disturbances to the aquatic environment. Bioturbation does not diminish the effectiveness of the thin cover, as the thin cover is not intended as an uninterrupted chemical barrier, but as a layer to reduce surface sediment chemical concentrations. Recovery times vary depending on thicknesses, quality of the capping layer, and other factors including hydrology and vegetation.