BROOKHAVEN NATIONAL LABORATORY

TECHNOLOGY FACT SHEET

PECONIC RIVER REMEDIAL ALTERNATIVES

Sediment Removal: High-Capacity Vacuum/Guzzler Recovery

Introduction

High-capacity vacuum/guzzler recovery technology is a viable alternative technology for the removal of contaminated sediments from the wetland areas of the Peconic River basin. Use of the vacuum/guzzler unit (Fig. 1) is an effective method of selectively removing sediments while minimizing the disturbance to the surrounding environment. Once an area has been designated for removal, temporary dams (used to divert freestanding water in the sediment recovery area) are installed, one upstream and one downstream of the work area. A positive displacement pumping system provides dewatering at each of the affected wetland areas, one section at a time.

The vacuum/guzzler unit selectively removes contaminated sediments. This unit provides vacuum dredging capabilities to areas up to a 150-foot distance. Vegetation in areas to be treated may need to be removed and any contaminated sediment attached to the roots removed. Sediments are pumped to a staging area, where they are put in containers and prepared for transport. Freestanding liquids are withdrawn from the container (without disturbing the sediment) for treatment or discharge. The contained sediment is then transported to a licensed off-site facility for final disposition.

Figure 1 Vacuum/guzzler unit in use.

Technology Description

The high-capacity vacuum/guzzler recovery technology (Fig. 2) utilizes high-velocity air suction (5,000 to 7,500 cubic feet per minute) to selectively remove contaminated sediments from sensitive environmental areas. The major components include the vacuum/guzzler (vacuum truck) unit, dewatering structures, roll-off containers, and auxiliary pumping equipment. Sediment control structures are frequently used in conjunction with the system components to control and minimize resuspension of contaminants. The vacuum/guzzler unit may be utilized where direct access to the affected areas is available. To maximize the unit's efficiency, such factors as length of vacuum hose and availability of sediment for removal are taken into consideration.

The maximum distance for effective pumping with the vacuum/guzzler unit is 150 feet. An optional method of increasing pumping distances involves the use of mobile pumping stations (Fig. 3) to pump material to an interim staging area. The vacuum/guzzler unit is then used to pump the material from the interim staging area to a final loading area. This effectively increases the total pumping distance to 600 feet for remote sites with limited access. Since this method involves additional handling of material, pilot testing is recommended for site-specific applications of the pumping stations prior to deployment.

Once the contaminated areas have been delineated and cleanup goals have been established for a particular site, the sediment removal technology can be assembled to maximize efficiency.

Alternative 1: Containerization and Off-site Disposal

Sediments are pumped to a load-out staging area and placed in 20-yard roll-off containers designed for sediments and sludge. The containers are staged in series and systematically filled with sediment pumped directly from the affected areas of contamination. Once a container is loaded, the solids are allowed to settle for a predetermined period of time. The free liquids are removed from each of the filled containers with a 3-inch pump. The removed liquid is then treated or released, depending on the site-specific compliance requirements and residual contamination levels in the liquid. Dedicated trucks transport the roll-off containers directly to a licensed disposal facility.

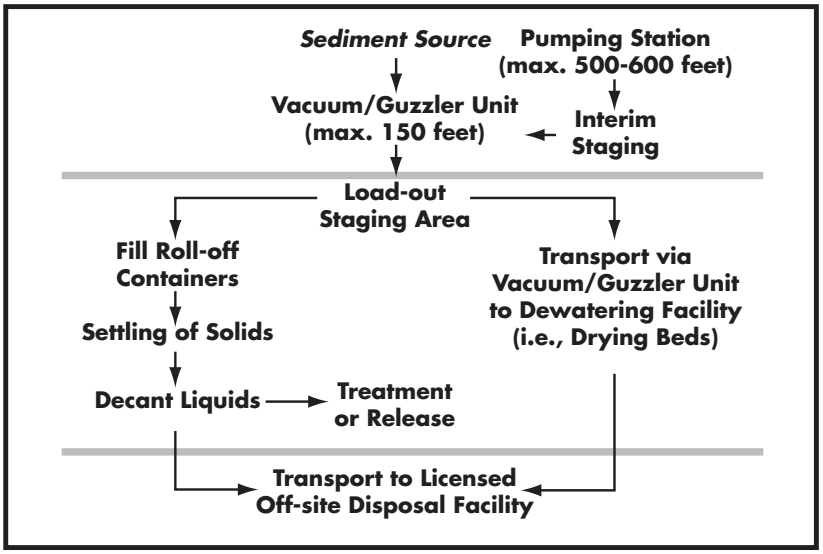

Figure 2 Process flow for high-capacity vacuum/guzzler recovery.

Alternative 2: Transport to Interim Facility for Dewatering

Sediments are pumped directly into the vacuum/guzzler unit at the staging area for transport to an interim dewatering facility. This alternative involves increased material handling, with the transport of sediments first to the interim dewatering facility (i.e., drying beds), followed by containerization and transport of the material to a licensed facility for final disposition.

Selection of the preferred alternative depends on site-specific and regulatory requirements and on the availability of facilities to support the dewatering process.

Figure 3 Mobile pumping stations extend the unit's pumping range.

Advantages

High-capacity vacuum/guzzler recovery technology provides several advantages for the Peconic River application. In particular, it:

- Minimizes environmental damage to the affected wetland areas because it can be used to selectively remove sediments, in contrast to more gross removal techniques,
- Minimizes the likelihood of resuspension or remobilization of contaminants,
- Minimizes the infrastructure requirements for mobilization and operation (i.e., access roads, utilities), and
- Can be deployed effectively during wet, moist, or dry river conditions.

Disadvantages

The primary disadvantage of this sediment removal technology is the need for disposition of freestanding liquids removed from the transport containers prior to off-site shipment. The volume of liquid can be reduced through effective design of the dewatering structures constructed during the removal process. Sampling protocols may be established under regulatory guidance to dictate the final disposition of these liquids (i.e., treatment, recycling).

Relative Cost

This technology offers competitive operational costs ranging from $4,500 to $5,500 per day (plus materials). This daily cost translates into a cost of about $40 per cubic yard for sediment removal under conditions similar to the Peconic River wetland areas.

Maturity of the Technology

This sediment removal technology has recovered heavy metals in shallow and deep-water applications in the United States. These applications have used both the vacuum/guzzler unit and peripheral equipment, such as staged pumping systems, to remove contaminated sediments with minimal disturbance to sensitive environmental areas.

Potential Technology Applicability – Peconic River

High-capacity vacuum/guzzler recovery technology is directly applicable to the remediation challenges posed by contaminated sediments in the wetland areas of the Peconic River basin. This technology is suitable for the selective removal of sediments in sensitive environmental areas with limited access. The ability to selectively remove sediment from up to 150 feet (using optional methods, up to 600 feet) from the staging area provides the flexibility necessary to minimize the impacts to wetlands and adjacent areas. In many cases, the vacuum hoses can be operated so as to control the depth and lateral extent of sediment removal, based on core sampling data obtained before and during the remediation process (Fig. 4). The ability to manually direct the sediment collection process maximizes the selective recovery of contaminated material and minimizes the recovery of excess water. Although this technology can be deployed during moist, wet, or dry river conditions, the presence of makeup water provides the ideal circumstances. The exact ratio of water to product varies with the type of material being recovered.

Figure 4 Selective removal of sediments.

Infrastructure Requirements

Implementation and operation of this sediment removal technology requires minimal infrastructure arrangements. Distances from each of the affected wetland areas to the nearest potential staging area (i.e., paved access areas) exceed 150 feet at various locations. Mobile pumping stations and an interim staging area may be used to access these areas. An all-terrain vehicle (ATV) can be used to tow the pumping station to the location with minimal impact to the environment. The establishment of an interim staging area may require temporary access for movement and placement of the roll-off containers.

The technology is self-sufficient, with electric power and water for cleaning and rinsing root structures containing potentially contaminated sediments. The water is stored in a portable tank, which is truck-mounted for increased mobility between staging areas.

Long-Term Remedy

The long-term remedy is to completely remove contaminated sediments from the affected areas of the Peconic River basin. There would be no need for additional treatment or removal of sediments. Comprehensive sampling protocols will be established at the excavation sites and the sediment control structures during and after the removal process.

Impact to Wetlands/Adjacent Areas

Application of this sediment removal process results in minimal impact to the wetlands and adjacent areas. The ability to perform selective removal of sediments from relatively small areas with the oversight of trained field technicians reduces the environmental impact to the wetland areas. In addition, the ability to access remote wetland areas without the destruction caused by heavy equipment maintains the integrity of the adjacent areas and eliminates the need for construction of access roads.

Site Restoration Requirements

Due to the minimally intrusive nature of this sediment removal technology, the integrity of the wetland and adjacent areas is largely maintained. The requirements for site restoration of the affected areas are minimal. Restoration may involve removal of temporary access roads for placement of staging areas. It may also involve reconstruction of vegetation that required removal to recover contaminated sediments.

Process Residuals Management

The water removed from the roll-off containers, as identified in Alternative 1, is sampled and/or treated for heavy metals or organics. This water may be treated with an in-line process or containerized for off-site treatment. Sampling protocols will be established for the process residuals and approved by the state and federal agencies responsible for compliance.

If on-site drying beds are utilized for dewatering, as identified in Alternative 2, the process residuals will be managed per the site regulatory and compliance requirements. If off-site dewatering is selected, the process residuals will be managed per the facility and applicable state and federal requirements. Final disposition of all sediments will be conducted through a licensed facility.

Need for Site-Specific Testing

To account for site-specific conditions, a pilot test, where the test environment has been thoroughly characterized and removal goals established, is recommended. A pilot test will be performed during a one-month period, with a week required for mobilization (equipment placement and startup). The pilot study will be designed to cycle the entire process sufficiently to assure a smooth operation for accessible locations at distances up to 150 feet to simulate the wetland areas requiring remediation. The cost for such a pilot study will be approximately $90,000-$110,000 (based on 20 working days), consistent with the daily rates identified in the Relative Cost section.

This pilot study may be expanded to evaluate the use of pumping stations for increasing pumping distances at remote locations. The additional pilot costs associated with this expanded scope will depend on site-specific requirements.

Need for Long-Term Monitoring

Application of this technology will remove the contaminated sediment from the affected wetland areas. Provided the initial source of the contamination has been eliminated, there is no need for long-term monitoring.

Synergy with Other Technologies

High-capacity vacuum/guzzler recovery technology is a stand-alone alternative for the removal of contaminated sediment from the Peconic River basin. Selective reconstruction of wetlands may be necessary where vegetation was disturbed in order to access and remove contaminated sediment.

Resources

Miller Environmental Web Site
http://www.millerenv.com

Contact

For information regarding this fact sheet, please contact **Ken White (631/344-4423, kwwhite@bnl.gov)**.

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