2.0 USING ECOLOGICAL ENHANCEMENTS

Ecological enhancements can be applied in three ways to address impacted properties. One application is to create or restore a safe sustainable wildlife habitat as a final cleanup goal. A second is to use sustainable wildlife habitat as a complement to a traditional remedy. The technologies and controls used to arrive at the habitat may or may not be green technologies. The final application is to use natural or green technologies to remove contaminants or secure sites while providing viable wildlife habitat, though the final use may not be habitat. While these applications are different in their objectives and approach, they all provide ecological benefits.

2.1 Creating or Restoring Wildlife Habitat as a Final Cleanup Goal

Many former and active industrial sites include wetlands and other sensitive habitats within their boundaries. As developmental pressures continue on these sites, these associated habitats have seen significant degradation and loss as a result of the release of hazardous substances. The goal of creating and maintaining habitat in these areas has become increasingly important.

Designing a site restoration project with the goal of creating long-term wildlife habitat offers the advantage of creating and protecting habitat found in previously impacted areas, as well as mitigating the continued encroachment of urban development. Maintaining and improving habitat quality and associated ecological functions as an end use can present challenges as cleanup standards applicable to habitat creation can require complex analyses, and the cleanup goals for ecological protection are often more stringent than those for protection of human health. However, tailoring the cleanup to a specific end use can also avoid unnecessary actions that otherwise increase costs and delay progress.

Habitat creation is like other site cleanups in that there are two ways to achieve the objective. One is to remove all impacted soils to a level where all theoretical risks have been eliminated. This can be cost-prohibitive and can involve significant disturbance of the habitat one is attempting to enhance. The other way is to allow contaminants to remain but ensure that exposure routes are eliminated through engineered or institutional controls. This "complete with control" approach to cleanup is described in EPA's guidance on completing (Resource Conservation and Recovery Act) RCRA corrective action (68 FR 8757). In the guidance, EPA emphasizes that the ultimate goal of corrective action is to satisfy the "protection of human health and the environment" standard. EPA makes clear that the protection standard can be achieved using engineered and institutional controls.

A complete with controls approach would generally need to apply net environmental benefits analysis (NEBA) concepts. A NEBA evaluation allows one to weigh the cost of various remedial options (e.g., contaminant removal, engineered controls, or institutional controls) against the environmental costs and benefits of each alternative. Using NEBA, acceptance for restoring to a nonpristine baseline can be obtained if the benefit from having some habitat value at the site outweighs the potential for adverse effects from contaminants left in place. The NEBA approach is consistent with EPA's guidance on completing RCRA corrective action and fills the gap in EPA's guidance (i.e., the consideration of the ecological consequences of the possible approaches or alternatives).

In the context of habitat restoration, cleanup objectives can be targeted at eliminating exposure routes to wildlife, while ensuring that land is maintained in perpetuity solely as habitat. The actions needed to eliminate relevant exposure routes can be focused and noninvasive while allowing for existing habitat to thrive as future habitat is enhanced.

Guidance is needed that will provide the flexibility required in cleanup standards where it is demonstrated that preserving existing habitat or creating new habitat has an overall benefit to humans and the environment.

2.2 Creating Habitat as a Complement to a Traditional Remedy

Ecological enhancement may have the greatest benefit in supplementing or complementing conventional remedial technologies. Typically, remedial technologies provide environmental relief through source control or removal of residual contaminants to acceptable levels. The ability of the remediated resource, particularly surface soil, surface water and sediments, to return to a prerelease functional level is seldom addressed in the remedial process. The use of ecological enhancement techniques such as improvement of in-stream cover for fish and macroinvertebrates following sediment excavation, the installation of nesting boxes on a landfill cap, or the implementation of a woodlot program will cost-effectively return the resource to a productive capacity that would exceed that developed by the simple remediation of the impacted media. As community acceptance is one of the nine criteria used in selecting a remedy, such measures would receive high marks at sites where local stakeholders are actively involved in the remedial process. Additionally, the implementation of ecological enhancements during remedial construction has the benefit of limiting costs required for mobilization.

Ecological enhancements as part of remedial measures have the additional benefit of limiting potential environmental liabilities related to Natural Resource Damage Claims (NRDC). Under the NRDC process, natural resource trustees have the authority to assess damages for ecological services lost as a result of environmental degradation. The use of ecological enhancements can be used as part of a negotiated settlement to off-set or mitigate potential claims following the remedial process.

2.3 Using Natural Remediation as a Cleanup Technology

The ultimate goal of a treatment technology is to address either past or ongoing releases of chemical substances in a manner that is protective of human health and the environment. Under most state or federal regulatory processes, the cleanup remedy must be cost-effective and must use permanent solutions and/or alternative technologies to the extent practicable. A remedial approach to an environmentally impacted site is decided on during a feasibility study process that is intended to evaluate the potential alternatives to site remediation with respect to nine selection criteria identified by EPA under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (or seven selection criteria under RCRA corrective action).

In certain instances, ecological enhancements may be used as the remedy if applied as an alternative technology. To be accepted under most federal or state hazardous waste programs as an alternative technology, ecological enhancement or a similar green technology would have to first satisfy the goals and requirements of applicable federal or state hazardous waste management regulations; would have to consider the persistence, toxicity, mobility and bioaccumulative potential of site-related constituents; and would have to consider short- and long-term potential threats to human health.

For example, a constructed wetland that offered treatment of relatively immobile and nonbioaccumulative constituents, as well as habitat for aquatic and semiaquatic wildlife, could be a cost-effective, ecologically viable alternative to more costly conventional technologies such as groundwater pump and treat. Likewise, phytoremediation, where the selected plant species are considered with respect to the potential habitat they offer, can be a cost-effective alternative for surface soil source treatment. In both of these instances, an ecological risk assessment or monitoring program may be necessary to demonstrate that constituents of concern are not accumulating to levels that might be toxic to wildlife attracted by the habitat enhancement. There are two questions that would remain, however:

- Are the enhanced habitat and the resulting wildlife population or diversity positive for the remediation system and the surrounding ecology?
- Is this enhancement a fortuitous event or can benefits be designed into the system cost-effectively?

It is important to note that habitat and the condition of a natural resource are not specifically considered as part of the selection criteria. A defensible argument must be made to gain regulatory support and acceptance of the added ecological enhancements in utilizing a green technology or as a component of a remedy. To date, the use of ecological enhancements to serve as the remedial alternative is not well accepted by regulators and often cannot be supported by the strict application of the remedial alternatives selection process.

Green technologies also run into the same regulatory impediments as other technologies when performing remediation on CERCLA and RCRA sites. For example, some sludges to be treated may be "listed" hazardous wastes. If the listed waste is "managed" in the legal definition, then it must be managed in accordance with stringent treatment standards and disposed in a landfill meeting RCRA standards. Plowing or even seeding can be considered management of the waste. Materials that are mixed or derived from these materials are also listed wastes. Therefore, harvesting plant growth may require managing the harvested material as a listed hazardous waste. Few policies have been developed to address these issues, and the regulatory impediments associated with listed wastes have thwarted natural remediation efforts that would have been successful.

Sites with environmental impacts other than RCRA-listed wastes do not suffer the same regulatory impediments. At these sites, seeding and harvesting can be done as needed without triggering costly management standards. The harvested materials will still have to be characterized for relevant hazardous-waste characteristics, but generally, they would not have to be managed as hazardous waste.

As stewards of our natural resources, individuals responsible for addressing environmentally impacted sites have the ability to effect great changes in stressed ecological communities. While a traditional remedial technology may be required to resolve the potential short- and long-term threats to human health and the environment, ecological enhancements can be used as a good faith effort to promote environmental stewardship. They are a cost-effective means that can be used to increase the ability of restored property to support wildlife. In urban settings, where the availability of habitat is limited, islands of habitat on restored lands may prove invaluable in supporting both migratory and permanent resident species.