Chapter 3
Green Building Approach

3-1. Sustainable Design of Military Facilities

a. USACE criteria for sustainable design of military facilities provide designers with guidance for the construction of all new facilities, and the rehabilitation/renovation of existing facilities. Please note that this guidance is to be followed for all USACE HTRW projects, including DOD funded projects. Sustainable Design means designing, constructing, operating, and reusing/removing the built environment (infrastructure and buildings) in an environmentally and energy efficient manner. Selected sections of the USACE criteria are summarized below.

(1) Green Building goes beyond simply using green products and recycled materials. Green Building is an environmental consciousness or resource awareness about using or not using our valuable natural resources in an energy-conscious or conservative way.

(2) The goals of sustainable design include:

- Use resources efficiently and minimize raw material resource consumption (including energy, water, land and materials), both during the construction process and throughout the life of the facility.
- Maximize resource reuse, while maintaining financial stewardship.
- Move from fossil fuels towards renewable energy sources.

(3) Integrate applicable requirements from the installation Pollution Prevention (P2) Program into the project planning and goal setting process.

(4) Make decisions during the planning and design process to support an installation-wide reduction in the release of ozone-depleting chemicals and greenhouse gases, a reduction in the use of hazardous materials and pesticides, and a reduction in the generation of solid wastes.

(5) Use energy-conserving mechanical and electrical equipment and their accessories, including lighting, that meet or exceed existing USACE criteria.

(6) Investigate the use of cleaner fuels, such as natural gas and cogeneration where remote government owned power plants are available.

(7) Designers must incorporate sustainable design through the following:

- Consider total life-cycle costs and environmental impact of products and materials rather than just initial price.
- Select materials with low embodied energy (see Paragraph 4-25).
- Avoid environmentally harmful materials (e.g., toxic substances, ozone-

depleting substances).
- Avoid excessive packaging or assure recycling of the same.
- Buy locally to minimize transportation.
- Reuse salvaged materials.
- Use products made from recycled materials.
- Select materials that can be recycled at the end of their use.
- Specify a preference for recycled-content building materials in accordance with USEPA/USACE guidance.
- Specify material designated as biobased by the USDA Biobased Products Council.

b. Further information on potential green building aspects associated with a particular technology can be obtained by contacting points of contact from the USACE Center of Expertise for HTRW Specialty List which can be accessed at: http://www.environmental.usace.army.mil/org/special/special.html .

3-2. Green Building Planning Process

a. The following process is a suggested way to evaluate an HTRW project so as to incorporate Green Building opportunities. The process would be most beneficial if it were used iteratively throughout the life of a project, from the planning phases (e.g., during planning of a site investigation, or during the Feasibility Study for a remediation project) through completion of the response action. However, the process can be used at any stage of a project to help identify Green Building opportunities and facilitate their use. In order for the process to work effectively, responsibility for managing the Green Building aspects of a project needs to be clearly defined. In addition, it is important that personnel with expertise to plan and implement all critical Green Building opportunities for a project be actively involved.

b. Figure 3-1 provides a flow chart, and Figure 3-2 provides a more detailed description of the Green Building planning process. The Green Building opportunities and technologies are discussed in Chapter 4.

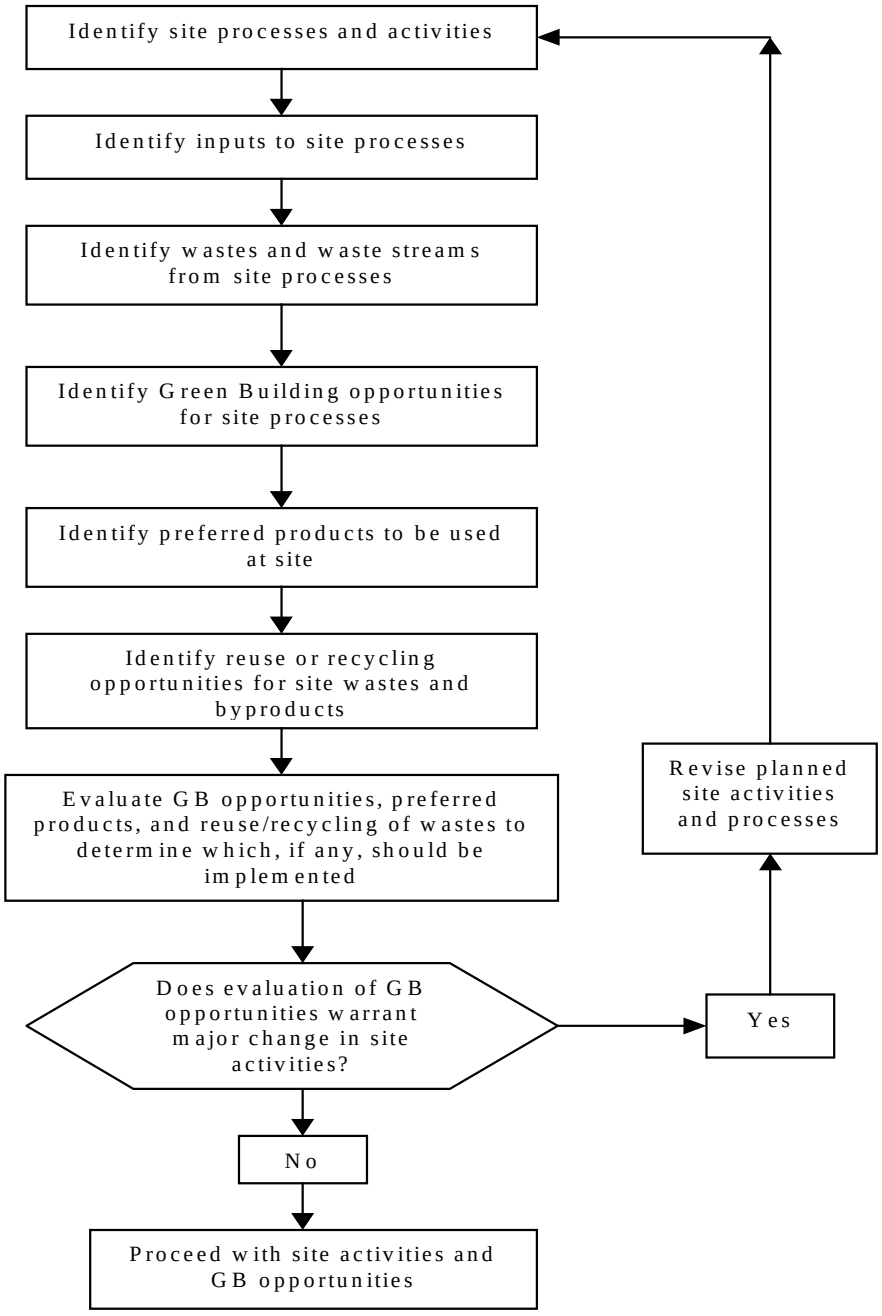

Figure 3-1. Green Building Planning Process Flow Chart

Step One

Identify processes and activities associated with the HTRW site.

Depending on the project and the phase of the project (i.e., planning for site investigations, doing the Feasibility Study, operating remedial action processes), many different processes and activities may be occurring, such as:

- Excavation.
- Product procurement.
- Incineration.
- Operation and maintenance processes (e.g., activated carbon regeneration or replacement).
- Soil or groundwater sampling.
- Clearing, grubbing, and debris removal.
- Chemical or physical remedial treatment processes (e.g., oxidation).

As part of this step, identify the person who will have primary responsibility for evaluating and implementating Green Building technologies. In addition, identify and consult personnel who are familiar with each site process or activity. For example, occupational safety and health personnel can give input on site safety, toxicities of alternative process chemicals, and risks of those processes.

Figure 3-2. Detailed Description of Green Building Planning Process.

Step Two

Identify inputs to the processes at the site.

Examples include:

- Energy to transport soils, or energy for construction.
- Energy to operate incinerators or treatment units.
- Materials and chemicals for treatment units (construction and treatment).
- Buildings materials.
- Operation and maintenance components, such as activated carbon.

Step Three

Identify wastes and waste streams.

Wastes include both materials that have been identified to be remediated and waste materials produced by the remediation process. Examples at HTRW sites might include:

- Treated water.
- Treated soils or sludges.
- Air emissions.
- Waste activated carbon/resins or other treatment residues.
- Investigation-derived waste:
  - Drilling cuttings.
  - Monitoring well purge water.
  - Decontamination wastes.
  - Personal Protection Equipment, sampling equipment, plastics.
- Treatment equipment, vessels, piping.
- Demolition materials.

Figure 3-2 (cont'd). Detailed Description of Green Building Planning Process

Step Four

Identify Green Building opportunities based on evaluation of inputs and wastes.

Green Building opportunities are activities that provide:

- Energy savings through alternative processes or operations that require less energy.
- Materials savings by:
  - Using less virgin material or use of more recycled material.
  - Using more “green” materials (e.g., those that require less energy or pollution to produce).
  - Using material that can be reused or recycled.
- Use of less toxic material.
- Less residue and waste:
  - Using treatment processes that result in less “waste” that requires disposal (see Chapter 5, Success Stories, Paragraph 5-4, Use of Cotton Coveralls instead of Tyvek).
  - Using “wastes” for beneficial purposes (e.g., using treated water for irrigation). (see Chapter 5, Success Stories, Paragraph 5-1, Mead Army Ammunition Plant: Concrete Rubble for Construction).

In this step, potential Green Building opportunities are identified and evaluated. The manager must decide whether they warrant implementation. For example, if the waste streams at a site are very small (e.g., a few feet of plastic tubing), the environmental benefits of recycling may not merit the time, energy, and money required.

Figure 3-2 (cont’d). Detailed Description of Green Building Planning Process

Step Five

Identify preferred products to be used at the site.

Use of preferred products is mandated by current EO 13101 and 40 CFR 247. Preferred products include:

- Recycled materials.
- Materials with at least the required minimum recycled content.
- Biobased materials.
- Energy efficient products.

Step Six

Identify uses or recycling opportunities for site wastes and by-products.

Many “wastes” can be used for beneficial purposes. This reduces both disposal needs and the amount of new materials needed. Examples might include:

- Use of treated water for irrigation or for wetland development.
- Use of treated soil for fill or landfill cover.
- Use of recovered fuels or solvents for energy (see Chapter 5, Success Stories, Paragraph 5-2, Holloman Air Force Base: Waste to Fuel).
- Use of demolition materials:
  - concrete rubble for aggregate (see Chapter 5, Success Stories, Paragraph 5-1, Mead Army Ammunition Plant: Use of Concrete Rubble for Construction).
  - wood for fuel.

Figure 3-2 (cont’d). Detailed Description of Green Building Planning Process

3-3. Regulatory Framework and Issues

a. Several laws and regulations govern activities at HTRW sites. It is beyond the scope of this document to discuss these in detail. However, the reader is reminded that, while working (including doing Green Building activities) at HTRW sites, all pertinent Federal, state, and local laws and regulations must be followed. The following are examples of some of the regulatory issues that may be encountered while planning or conducting Green Building activities.

b. The Resource Conservation and Recovery Act (RCRA) of 1976 and its subsequent amendments (e.g., the Hazardous and Solid Waste Amendments of 1984) set up comprehensive regulations for facilities that generate, transport, store, treat, or dispose of hazardous waste.

c. Several provisions in RCRA may affect attempts to use Green Building approaches (e.g., recycling of site materials) at HTRW sites. Some of the RCRA provisions that may affect Green Building activities at HTRW sites are as follows:

(1) Materials (e.g., soils) that are contaminated with a "listed" hazardous waste may be considered hazardous waste as long as the listed waste is present, even though the waste does not exhibit hazardous characteristics. This may preclude using these materials for beneficial purposes such as construction fill. This problem may be minimized by up-front discussions with the regulatory agencies. In addition, RCRA (40 CFR 266.20) has provisions for recyclable materials that undergo a chemical reaction that might allow recycling of hazardous wastes.

(2) Storing hazardous waste on-site for more than 90 days may trigger permit requirements (40 CFR 262).

(3) Transporting hazardous waste will trigger RCRA and Department of Transportation requirements.

d. The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) enacted in 1980 and amended in 1986 (Superfund Amendments and Reauthorization Act) developed mechanisms to manage the cleanup of abandoned hazardous waste sites.

e. CERCLA provisions that might affect use of this EP include the requirement that remedial actions must satisfy Applicable or Relevant and Appropriate Requirements (ARARs). For example, wastewater used for beneficial purposes such as for irrigation would be required to meet applicable discharge requirements for the receiving stream, and volatile emissions would be required to meet applicable local air standards. Again, up-front discussions with regulatory agencies may be helpful in determining potential ARARs. There may be opportunities to use Green Building technologies for CERCLA actions because consideration of Innovative Technologies is a requirement of 40 CFR 300.430 (e) (5) when a Feasibility Study is done.

f. The Clean Water Act (CWA) regulates discharges to surface water. The act requires National Pollutant Discharge Elimination System (NPDES) permits for point source discharges. It also established a set of pretreatment standards for discharge to sewers. The CWA requires that permits be obtained for discharges from remediation activities to surface waters.

g. The Clean Air Act (CAA) and its amendments established National Ambient Air Quality Standards (NAAQS) for certain air pollutants. The NAAQS are maintained by regulating air emissions sources. In addition to NAAQS, emissions of other hazardous air pollutants (HAPs) are also regulated under the CAA. In some Air Quality Control Regions where the air quality standards are not being met, stringent restrictions on emissions sources may be applied.

3-4. Green Building Opportunity – Site Technology Matrix

a. The following Green Building Opportunity – Site Technology Matrix (Table 3-1) matches Green Building opportunities with selected site activities common to HTRW sites. The selected HTRW site activities are primarily remediation technologies from the Federal Remediation Technologies Roundtable Matrix (http://www.frtr.gov/matrix2/section1/toc.html). Many of the site remediation technologies included in this matrix closely resemble other technologies that are not specifically identified. For example, incineration and thermal desorption have substantially the same Green Building opportunities as other ex situ thermal treatment technologies, such as hot gas decontamination and pyrolysis. Therefore, most of the Roundtable remediation technologies are represented by the selected remediation technologies in the matrix. In addition to remediation technologies, other HTRW site activities, such as building and building material management, paving, and earthwork, are included in the matrix.

b. Note that the following Green Building opportunities are applicable to essentially all of the remediation technologies and are, therefore, not included in Table 3-1: contractual issues, paper reduction, partnering, waste segregation, and mobilization. Potential uses of the Green Building opportunities at HTRW sites are discussed in Chapter 5.

Table 3-1. Green Building Opportunity - Site Technology Matrix

Green Building Opportunities	Site Technologies									
	Solidification/Stabilization	Biopiles	Composting	Slurry Phase Bio Treatment	Chemical Extraction	Oxidation Reduction	Soil Vapor Extraction	Incineration	Thermal Desorption	Excavation/Off-site Disposal
IDW Management: Solids	X	X	X	X	X	X	X	X	X	X
IDW Management: Aqueous	X	X	X	X	X	X	X	X	X	X
Direct Push Sampling							X			
Sampling Equipment Management	X	X	X	X	X	X	X	X	X	X
Plastics Management	X	X	X	X	X	X	X	X	X	X
Occupational Health Safety: PPE Management	X	X	X	X	X	X	X	X	X	X
Electrical Equipment: Sizing and Efficiency		X	X	X	X	X	X	X	X	
Activated Carbon Management		X	X	X	X	X	X	X	X	
Optimize System Operation	X	X	X	X	X	X	X	X	X	X
Piping/Process Equipment Recycling/Reuse				X	X	X	X	X	X	
Use of Package Plants/Skid-Mounted Equip	X		X	X	X	X	X	X	X	
Plant Tissue Residue Management		X	X					X		
Resource Recovery from Treatment Sludges				X	X	X				
Reuse of Treated Soil										
Stormwater Management	X	X	X	X	X	X		X	X	X
Use of Waste Organic Material, Ag Wastes		X	X					X	X	
Use of Excavations for Aquatic Habitat	X	X	X	X	X	X		X	X	X
Use of Incinerators for Waste to Energy								X	X	
Buildings, Building Material Management		X	X	X	X	X	X	X	X	

Table 3-1 (cont'd): Green Building Opportunity - Site Technology Matrix

Green Building Technologies	Site Technologies									
	Air Sparging	Bioslurping	Dual Phase Extraction	In-Well Stripping	Passive/Reactive Wall	Bioreactors	Constructed Wetlands	Adsorption Absorption	Air Stripping	Ion Exchange
IDW Management: Solids	X	X	X	X	X	X	X	X	X	X
IDW Management: Aqueous	X	X	X	X	X	X	X	X	X	X
Direct Push Sampling	X	X	X	X	X				X	
Sampling Equipment Management	X	X	X	X	X	X	X	X	X	X
Wastewater Management						X	X			
Plastics Management							X		X	
Occupational Health and Safety: PPE	X	X	X	X	X	X	X	X	X	X
Electrical Equipment: Sizing and Efficiency	X	X	X	X		X		X	X	X
Activated Carbon Management	X	X	X	X		X	X	X	X	X
Optimize System Operation	X	X	X	X	X	X	X	X	X	X
Piping/Process Equipment Recycling/Reuse	X	X	X	X		X		X	X	X
Use of Packaged Plants/Skid-Mounted Equip	X	X				X		X	X	X
Plant Tissue Residue Management							X			
Resource Recovery from Treatment Sludges						X	X	X		X
Reuse of Treated Soils						X				
Stormwater Management						X	X			
Use of Excavations for Aquatic Habitat						X	X			
Use of Dredged Material, Lake Rehab						X				
Buildings, Building Material Management	X	X	X	X		X		X	X	X

Table 3-1 (cont'd): Green Building Opportunity - Site Technology Matrix

Green Building Technologies	Site Technologies									
	Precipitation Coag.	Sprinkler Irrigation	UV Oxidation	Slurry Walls	Bldgs, Const./Demol.	Paving/Concrete Work	Earth Works	Debris/Brush Removal	Landfill Covers Liners	Site Investigations
IDW Management: Solids	X	X	X	X	X					X
IDW Management: Aqueous	X	X	X	X						X
Direct Push Sampling										X
Sampling Equipment Management	X	X	X	X	X					X
Wastewater Management	X		X			X	X			X
Plastics Management	X				X			X		X
Occupational Health and Safety: PPE	X	X	X	X	X	X	X	X		X
Electrical Equipment: Sizing and Efficiency	X	X	X		X					
Activated Carbon Management	X									
Optimize System Operation	X	X	X	X	X	X	X	X	X	X
Piping/Process Equipment Recycling/Reuse	X	X	X							
Use of Packaged Plants/Skid-Mounted Equip	X	X	X		X	X				
Plant Tissue Residue Management								X		
Resource Recovery from Treatment Sludge	X									
Reuse of Treated Soil, Soil Residue	X					X	X		X	
Stormwater Management	X		X		X	X	X		X	
Use of Excavations for Aquatic Habitat	X		X				X			
Use of Dredged Material, Lake Rehab							X		X	
Building, Building Material Management					X	X		X		