The Interstate Technology and Regulatory Council (ITRC) Green and Sustainable Remediation Framework

Nick M. Petruzzi, PE
Cox-Colvin & Associates, Inc.

Cox-Colvin & ASSOCIATES, INC. ENVIRONMENTAL SERVICES

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Why Green and Sustainable Remediation (GSR)?

- Improved stakeholder engagement
  - Education, benefits, collaboration
- Simplified, reproducible results
  - Quantify desired metrics
- Reduced impacts
  - Emissions/greenhouse gases (GHGs)
  - Energy/Water/Waste
  - Ecosystems

Outline

1. Brief background of GSR
2. ITRC GSR Framework components
   - Planning process
   - Implementation process
   - Cleanup phases
3. Tools to support use of the ITRC GSR Framework
4. Brownfield case study

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1 ITRC's GSR Definition

The site-specific employment of products, processes, technologies, and procedures that mitigate contaminant risk to receptors while making decisions that are cognizant of balancing community goals, economic impacts, and net environmental effects.

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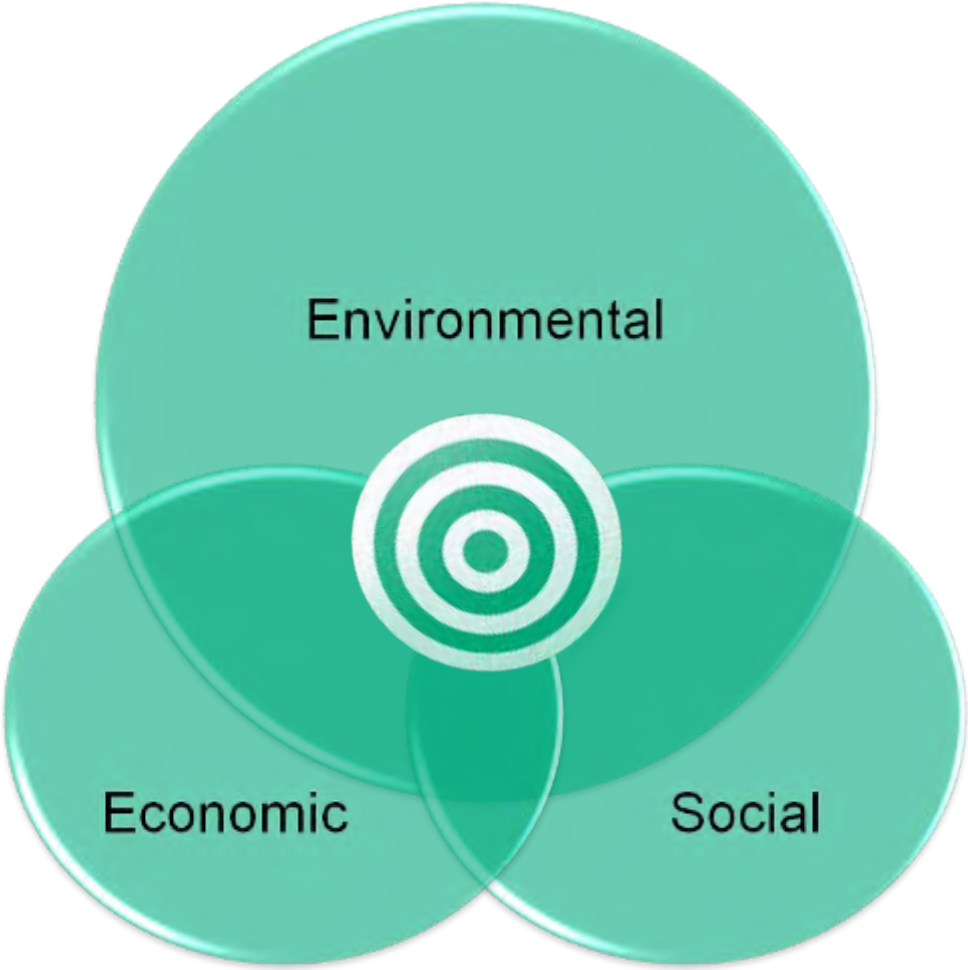
1 GSR Reality – Targeted Balance



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1 ITRC GSR Products

- Overview Document
  - Green and Sustainable Remediation: State of the Science and Practice
  - (GSR-1, 2011)
- Technical & Regulatory Guidance Document
  - Green and Sustainable Remediation: A Practical Framework
  - (GSR-2, 2011)

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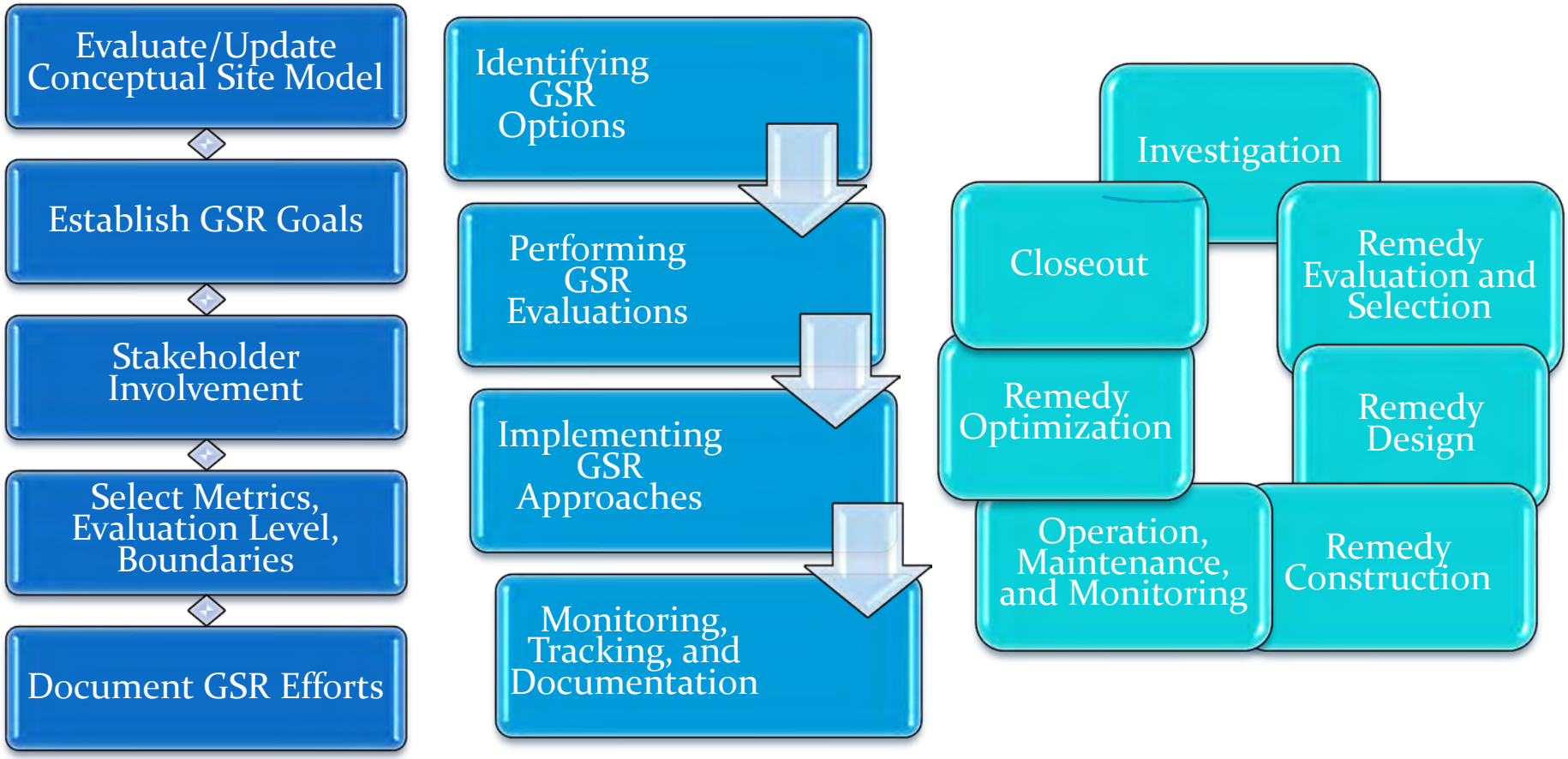
2 GSR Planning + GSR Implementation



= GSR Framework

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2 GSR Planning Process

(Tech Reg Section 2)

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2 GSR Planning Process

(Tech Reg Section 2)

- Evaluate/Update Conceptual Site Model
- Establish GSR Goals
- Stakeholder Involvement
- Select Metrics, Evaluation Level, Boundaries
- Document GSR Efforts

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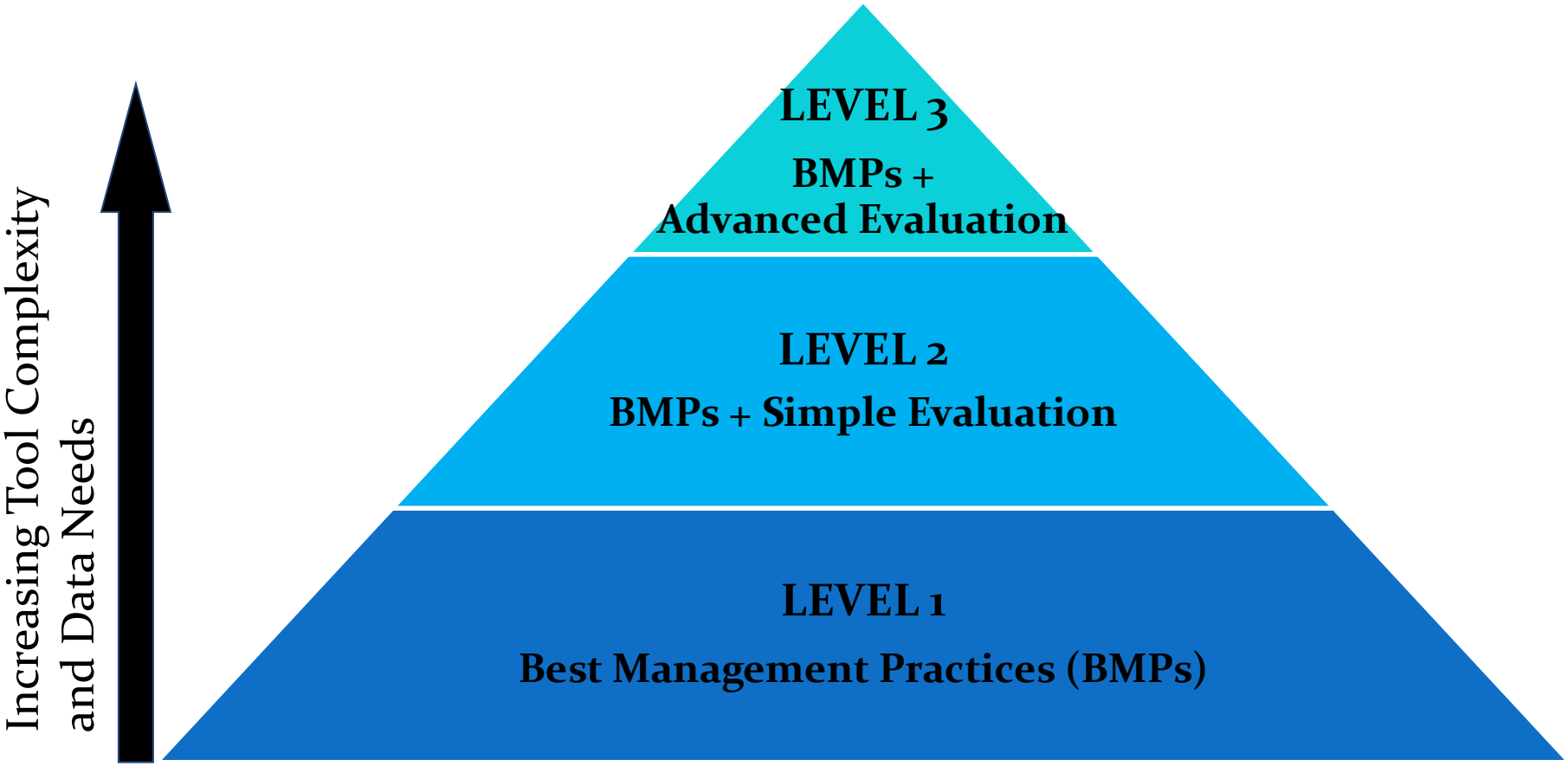
2 GSR Evaluation Levels



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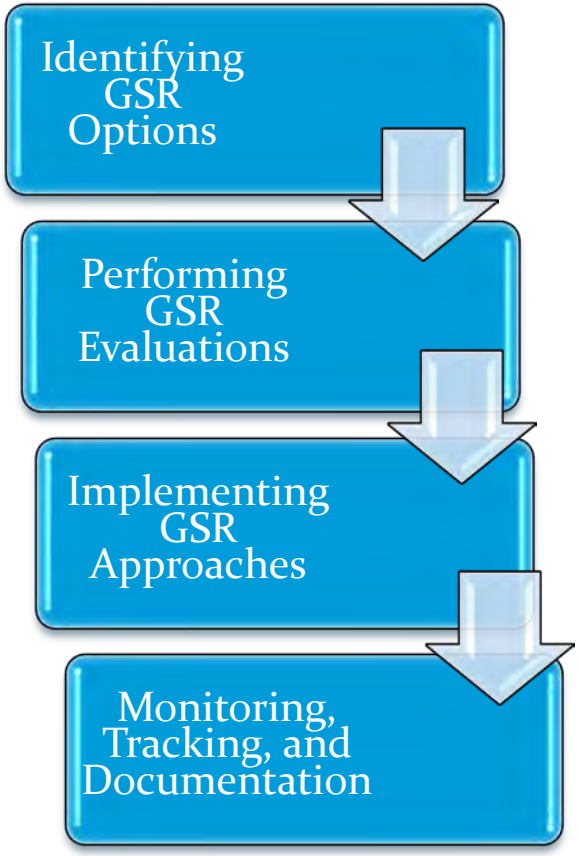
2 GSR Implementation Process

(Tech Reg Section 3)



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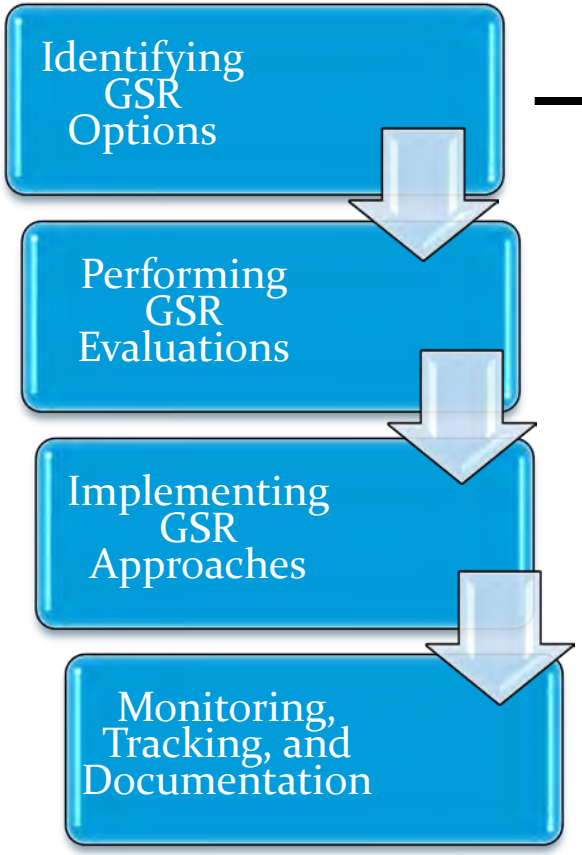

Approaches and best management practices (BMPs)

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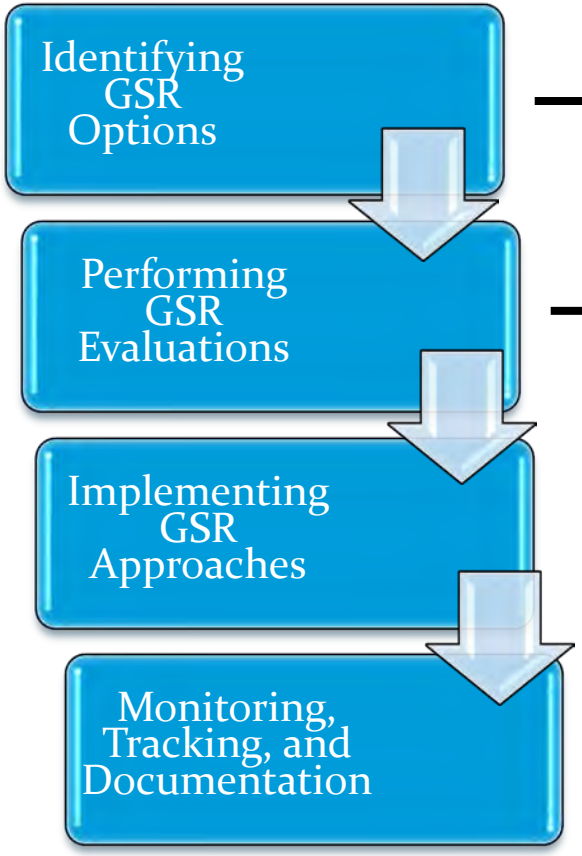

Approaches and best management practices (BMPs)

GSR evaluation level identified during planning (Level 1, 2, or 3)

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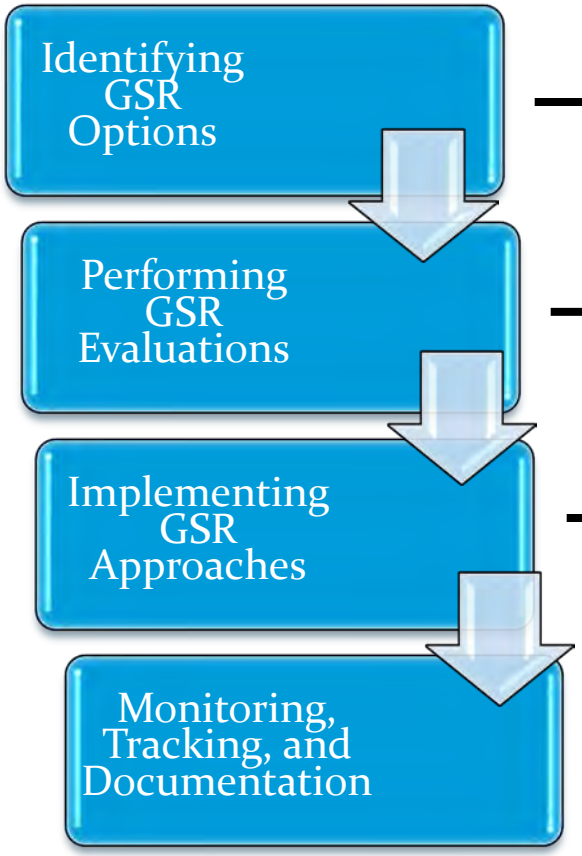

Approaches and best management practices (BMPs)

GSR evaluation level identified during planning (Level 1, 2, or 3)

Incorporate options and evaluation results; ensure team understands GSR elements; involve stakeholders

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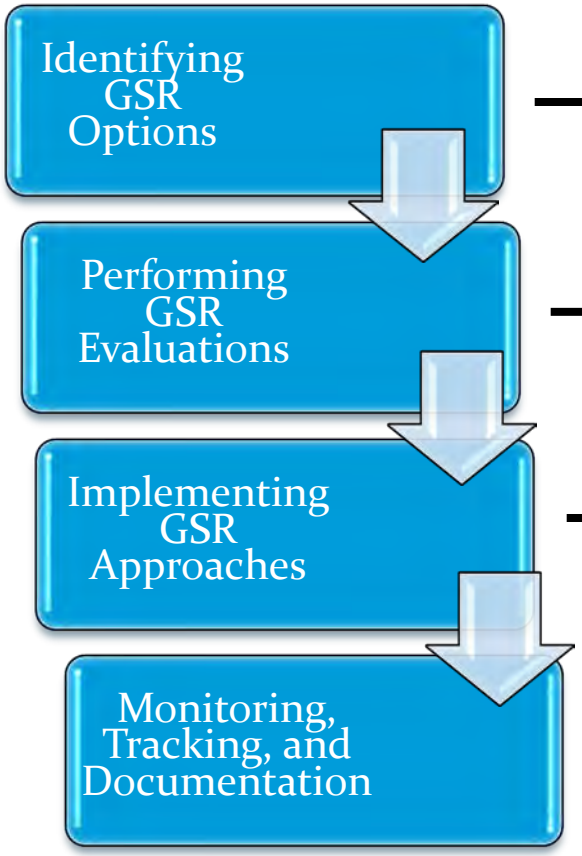

Approaches and best management practices (BMPs)

GSR evaluation level identified during planning (Level 1, 2, or 3)

Incorporate options and evaluation results; ensure team understands GSR elements; involve stakeholders

Provides transparency; identifies benefits, successes, and lessons learned; incorporated into regulatory reports

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2 How Does GSR Fit?

Investigation	• GSR application during planning
Remedy Evaluation and Selection	• Ideal point for incorporating GSR
Remedy Design	• Integration of GSR into selected remedy
Remedy Construction	• GSR integral part of remedy
Operation, Maintenance and Monitoring	• Cumulative benefits resulting from GSR
Remedy Optimization	• Sustainability performance improvement for existing remedies
Closeout	• Support for site reuse

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❸ Tool Selection

- Consider
  - Site-specific GSR goals, metrics, and boundary conditions
  - Project scope, budget, selected evaluation level, and purpose of GSR evaluation
  - Available site data
  - Type of remediation technologies
  - Regulatory cleanup program
- No certification or standard evaluation method
- ITRC does not endorse any specific GSR tool

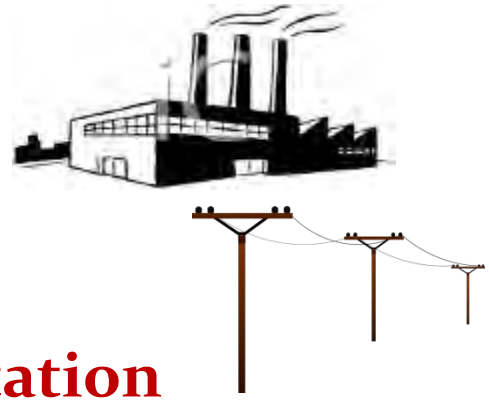
❸ Before Selecting GSR Tools

Goals → Metrics → Tools

Example Goals	Example Metrics
Reduce emissions	Greenhouse gases Air quality emissions
Conserve natural resources	Energy and water use Resource consumption
Create habitat	Ecological service value
Improve community	Traffic volume Jobs for local workers

❸ Boundaries for GSR Evaluation

Off-Site Impacts



On-Site Impacts

Transportation

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❸ Project Scope

Stakeholders	Values	GSR Metrics
Project leader	Project efficiency	Energy & cost savings
Property owner	Property value	Land use
Community group	Safety and quality of life	Traffic volume
Site regulator	Health and environment	Air pollutant emissions Ecological habitat

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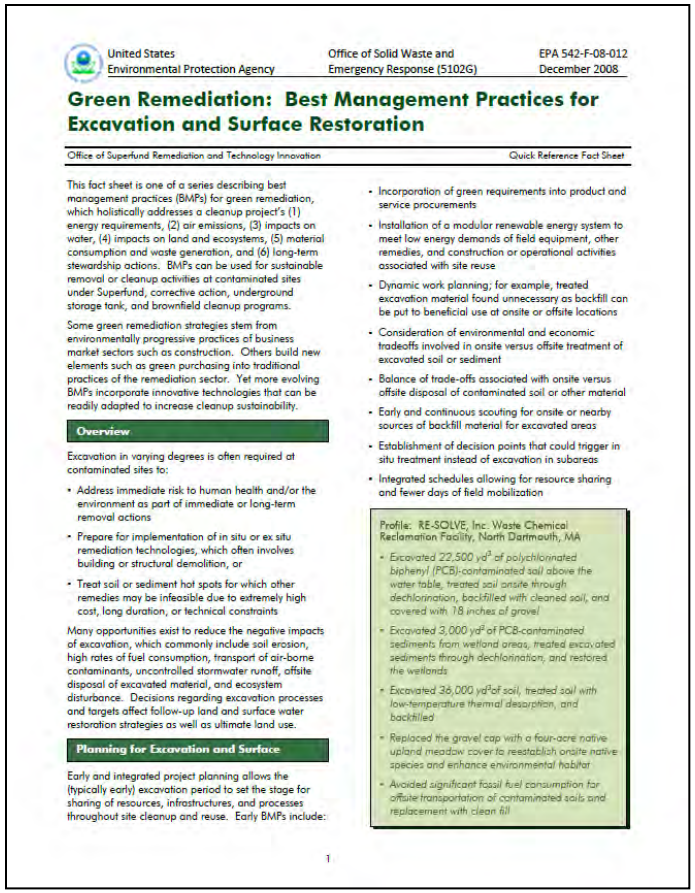
❸ GSR Tools: Level 1 (BMPs)

- ASTM, EPA, SURF, USACE
- EPA fact sheets
  - Introduction to BMPs
  - Site investigation
  - Excavation
  - Pump-and-treat
  - Bioremediation
  - SVE/air sparging
  - Clean fuel and emission technologies
  - Renewable energy
  - Landfill covers and energy



United States Environmental Protection Agency | Office of Solid Waste and Emergency Response (5102G) | EPA 542-F-08-012 December 2008

Green Remediation: Best Management Practices for Excavation and Surface Restoration

Office of Superfund Remediation and Technology Innovation | Quick Reference Fact Sheet

This fact sheet is one of a series describing best management practices (BMPs) for green remediation, which holistically addresses a cleanup project's (1) energy requirements, (2) air emissions, (3) impacts on water, (4) impacts on land and ecosystems, (5) material consumption and waste generation, and (6) long-term stewardship actions. BMPs can be used for sustainable removal or cleanup activities at contaminated sites under Superfund, corrective action, underground storage tank, and brownfield cleanup programs.

Some green remediation strategies stem from environmentally progressive practices of business market sectors such as construction. Others build new elements such as green purchasing into traditional practices of the remediation sector. Yet more evolving BMPs incorporate innovative technologies that can be readily adapted to increase cleanup sustainability.

Overview

Excavation in varying degrees is often required at contaminated sites to:

- Address immediate risk to human health and/or the environment as part of immediate or long-term removal actions
- Prepare for implementation of in situ or ex situ remediation technologies, which often involves building or structural demolition, or
- Treat soil or sediment hot spots for which other remedies may be infeasible due to extremely high cost, long duration, or technical constraints

Many opportunities exist to reduce the negative impacts of excavation, which commonly include soil erosion, high rates of fuel consumption, transport of air-borne contaminants, uncontrolled stormwater runoff, offsite disposal of excavated material, and ecosystem disturbance. Decisions regarding excavation processes and targets affect follow-up land and surface water restoration strategies as well as ultimate land use.

Planning for Excavation and Surface

Early and integrated project planning allows the (typically early) excavation period to set the stage for sharing of resources, infrastructures, and processes throughout site cleanup and reuse. Early BMPs include:

- Incorporation of green requirements into product and service procurements
- Installation of a modular renewable energy system to meet low energy demands of field equipment, other remedies, and construction or operational activities associated with site reuse
- Dynamic work planning; for example, treated excavation material found unnecessary as backfill can be put to beneficial use at onsite or offsite locations
- Consideration of environmental and economic tradeoffs involved in onsite versus offsite treatment of excavated soil or sediment
- Balance of trade-offs associated with onsite versus offsite disposal of contaminated soil or other material
- Early and continuous scouting for onsite or nearby sources of backfill material for excavated areas
- Establishment of decision points that could trigger in situ treatment instead of excavation in subareas
- Integrated schedules allowing for resource sharing and fewer days of field mobilization

Profile: RE-SOLVE, Inc. Waste Chemical Reclamation Facility, North Dartmouth, MA

- *Excavated 22,500 yd³ of polychlorinated biphenyl (PCB)-contaminated soil above the water table, treated soil onsite through dechlorination, backfilled with cleaned soil, and covered with 18 inches of gravel*
- *Excavated 3,000 yd³ of PCB-contaminated sediments from wetland areas, treated excavated sediments through dechlorination, and restored the wetlands*
- *Excavated 36,000 yd³ of soil, treated soil with low-temperature thermal desorption, and backfilled*
- *Replaced the gravel cap with a four-acre native upland meadow cover to reestablish onsite native species and enhance environmental habitat*
- *Avoided significant fossil fuel consumption for offsite transportation of contaminated soils and replacement with clean fill*

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http://www.clu-in.org/greenremediation/

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❸ GSR Tools: Level 2 (Simple)

- CO_2 emissions on-line calculator
- Matrix, checklist, or decision tree

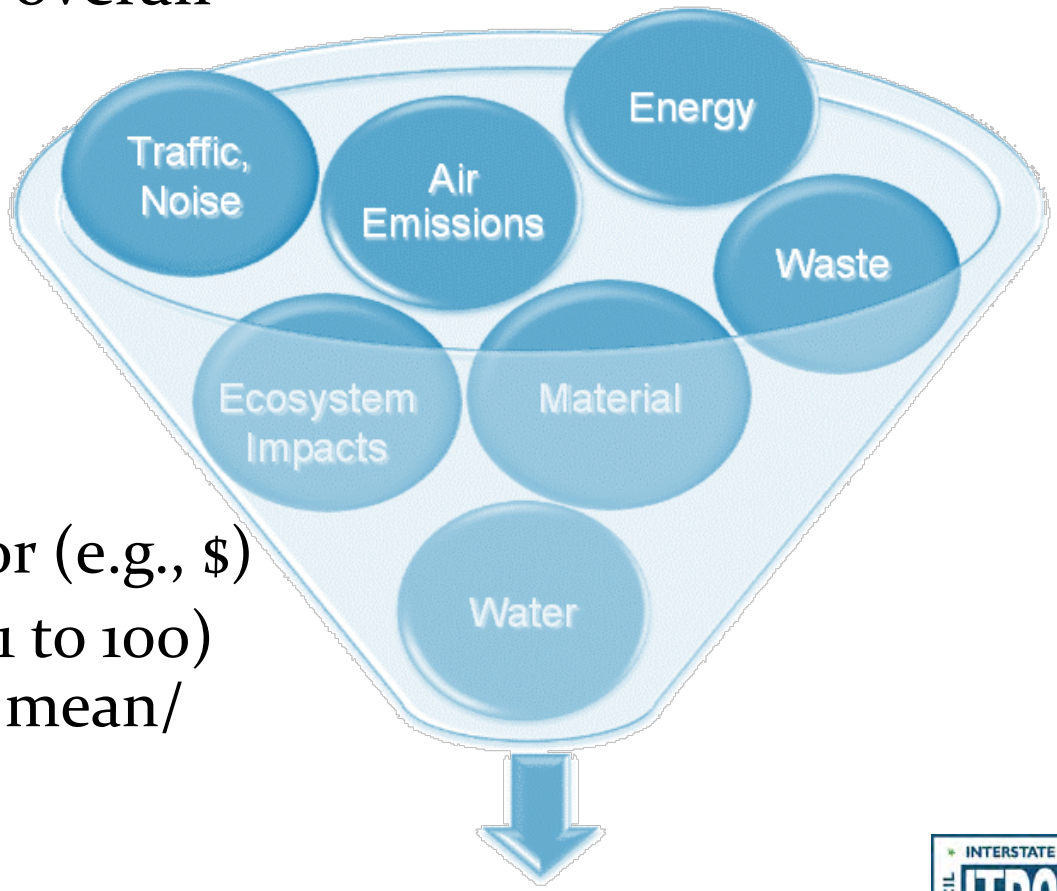
Metric	In Situ Thermal	Bioremediation	In Situ Chemical Oxidation
Greenhouse gases	☹	☺	😐
Solid waste	☺	☺	☺
Sensitive species	😐	☺	😐
Community disturbance	☺	☺	☺
Community acceptance	☺	😐	😐
Cost	☹	☺	😐

❸ GSR Tools: Level 3 (Advanced)

- Carbon footprint calculators
- Remedy footprint tools
  - Air Force Sustainable Remediation Tool (SRT™)
  - Navy and Army Corps of Engineers SiteWise™
  - EPA's environmental footprint methodology
  - Other tools
- Net environmental benefits analysis tools
- Life-cycle assessment (LCA) tools

❸ GSR Tools: Weighting/Scoring

- Some tools give you an overall GSR score
- Decide relative importance of each GSR metric
- Normalize to common units and range
  - Common denominator (e.g., $)
  - Common range (e.g., 1 to 100) based on min/max or mean/ standard deviation
- No "perfect" approach



Tool Output

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❹ Brownfield Case Study (Level 3)

Setting

- NJDEP Brownfield Site
- Former Landfill - chlorinated benzenes impacting soil and groundwater
- Remediation Driver: Redevelopment
- Interim Remedy Selected: Hotspot Excavation
- Other Remedies Considered: in-situ chemical oxidation (ISCO), in-situ thermal

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❹ Brownfield Case Study (Level 3)

GSR Evaluation Overview

- Evaluation method: SiteWise™ and Sustainable Remediation Tool™ (SRT™)
- GSR scope: applied during site assessment, remedy selection, and construction
- GSR metrics: energy consumption, air emissions (including GHG), water consumption, accident risk, cost savings
- GSR boundaries: both tools account for material manufacturing and site impacts

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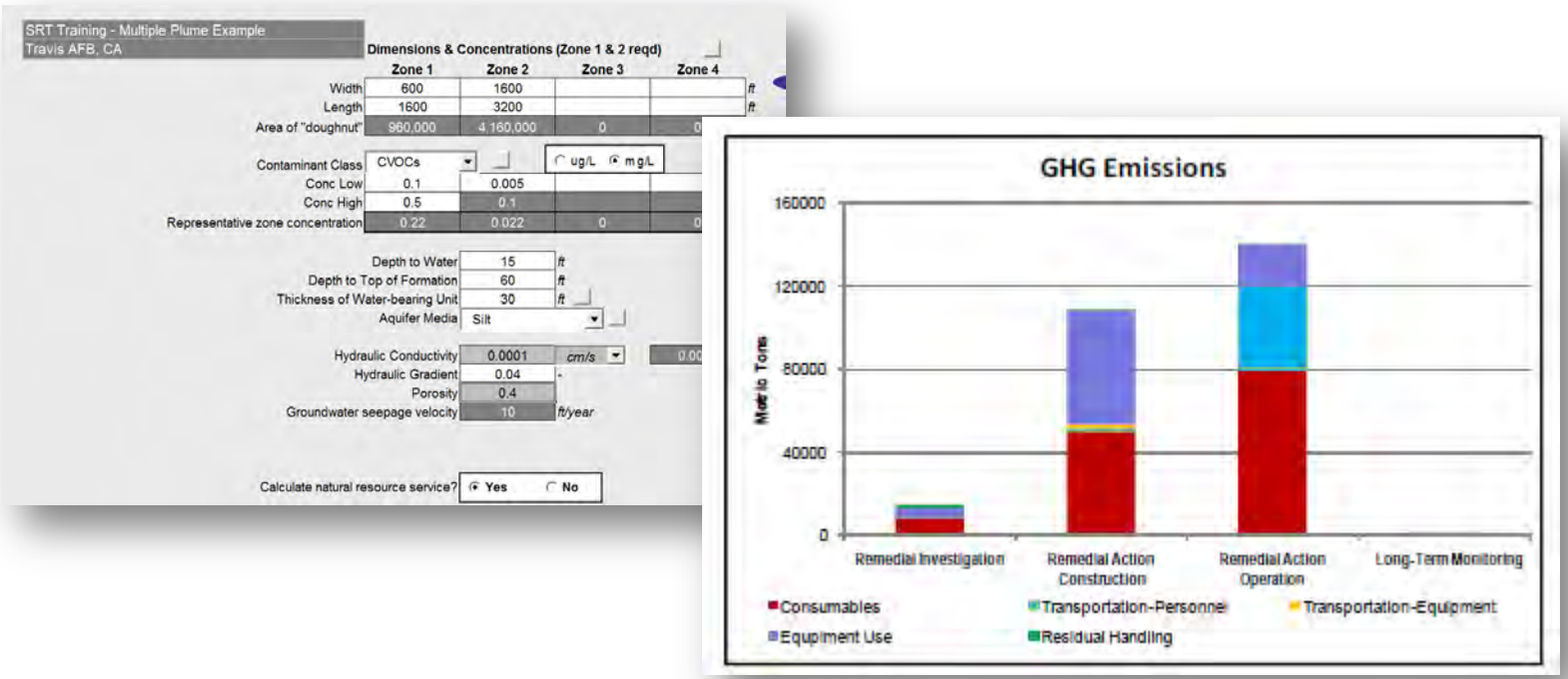
4 Brownfield Case Study (Level 3)

SiteWise™ and SRT™



- Tool selection depends on amount of information available and technologies being evaluated

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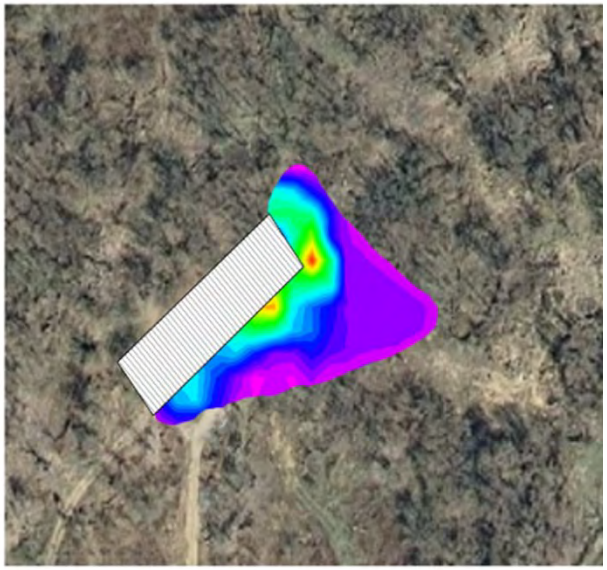
❹ Brownfield Case Study (Level 3)

Significant GSR Elements of Project

- Environmental
  - Triad, biofuels, waste reduction
  - 50% carbon footprint reduction
  - 30% schedule reduction
- Social
  - Revitalize blighted neighborhood
  - Community input
- Economic
  - Leverage public/private investment for future redevelopment



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Questions?

nick_petruzzi@coxcolvin.com

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