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Consideration of Unintended Impacts in Sustainable Remediation Options

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Sustainable Remediation (SR) and Environmental Social Governance (ESG)

What is SR?

- Sustainable remediation is defined as site assessment and remediation that protects human health and the environment while maximizing the **environmental**, **social**, and **economic** benefits throughout the project life cycle. (Sustainable Remediation Forum, 2013)

What is ESG?

- ESG is a means to evaluate how a company performs in environmental, social and governance criteria to determine the level of sustainability that it has achieved. The compiled data from these nonfinancial metrics provide insights on overall sustainability and leads to an ESG score or report.

Remediation – An Unintended Consequence

- Thoughts around SR and ESG topics are constantly evolving

- Remediation intended to be protective of human and environmental health, it is addressing a liability

- Impacted sites are often caused due to the fulfillment of a societal need

- Society demands goods and service, industry supplies needs to benefit society
  - ➢But there is a cost (financial, environmental, societal)
  - ➢Need for remediation itself is essentially an unintended consequence

- Conducting a remediation project has both positive and negative impacts, there are unintended consequences

- We can use sustainable remediation concepts to help achieve corporate ESG goals and minimize unintended negative impacts

Examples of Unintended Impacts of Remediation Projects

Displacement of contaminants: During the remediation process, contaminants may be displaced and transported to other areas of the site or surrounding environment.

Generation of hazardous waste: Remediation activities such as excavation and soil removal can generate large amounts of hazardous waste that need to be disposed of properly.

Disturbance of ecosystems: The remediation process can disturb ecosystems and disrupt natural habitats, which may result in the loss of biodiversity and ecosystem services.

Air and water pollution: The use of heavy equipment and machinery during the remediation process can generate dust, other air pollutants, or runoff issues.

Financial burden: Remediation projects can be expensive, and the costs can outweigh the benefits, particularly if the project is not well-planned or if the remediation technology chosen is not effective.

Community disruption: Remediation projects can disrupt the lives of nearby residents, particularly if they involve the relocation of people or businesses.

Key Topic: Materials and Waste

Conventional Approach:
Install remediation systems & monitoring networks with short term objectives
- Consider wind turbine example

Unintended Consequences:
Energy required to remove and dispose of infrastructure
- Wind turbine blades ending up in landfills

Planning Considerations:
How can we design systems with end of life in mind?
What assumptions on predicting market changes are you making?

SR Approach:
- Reduce – materials substitution, maximize lifespan
- Reuse – identify beneficial reuse opportunities
- Recycle – segregate materials, purchase recyclable materials

Benefits:
- Enable ease of remedy transition to less intensive remedy
- Make parts that typically fail first easily interchangeable
- Prioritize reuse of materials at other sites (cost savings)

Key Topic: Air Emissions

Conventional Approach:
Air emissions considered for system controls only (i.e. SVE effluent treatment)

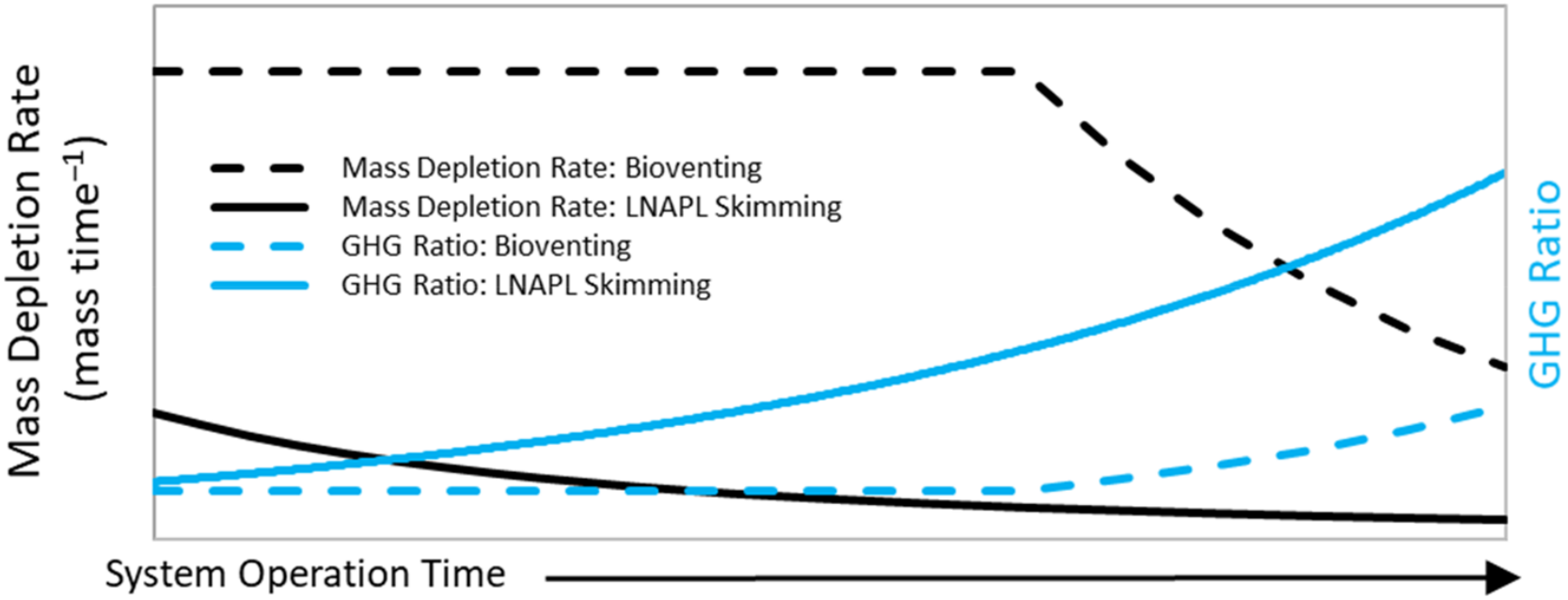
Unintended Consequences:
Emission footprint "cost" can be high for many activities and materials

Planning Considerations:
- Can I achieve the same goals while minimizing the environmental footprint?
- What is the impact vs benefit… emission per mass removal?

SR Approach:
- Conduct environmental footprint assessment and prioritize lower footprint remedies, apply GSR BMPs to selected remedy
- Consider renewable energy sources (wind, solar)

Benefits:
Decrease environmental impacts, often leads to cost savings and social benefits

Consider Metrics Evaluating: Emissions per contaminant mass removed



From: Bioventing revisited: efficacy of enhanced biodegradation for sites with mobile LNAPL
Quarterly Journal of Engineering Geology and Hydrogeology. 2023;56(2). doi:10.1144/qjegh2022-085

Key Topic: Biodiversity

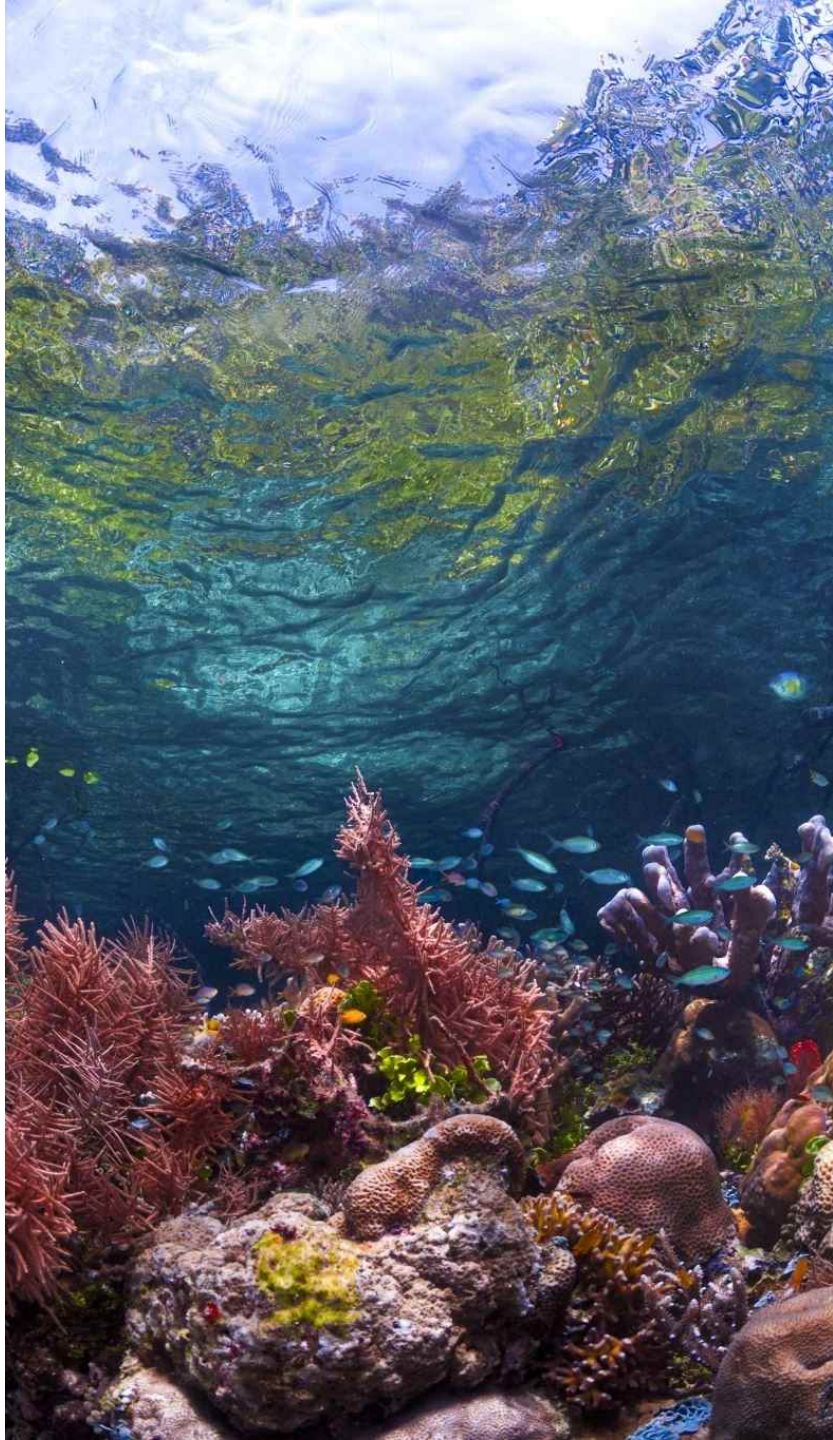
Conventional Approach:
- Hardscape restoration (pavement, riprap)
- Destruction for access to impacts (logistical access to historic site or surface impact to remediation subsurface)

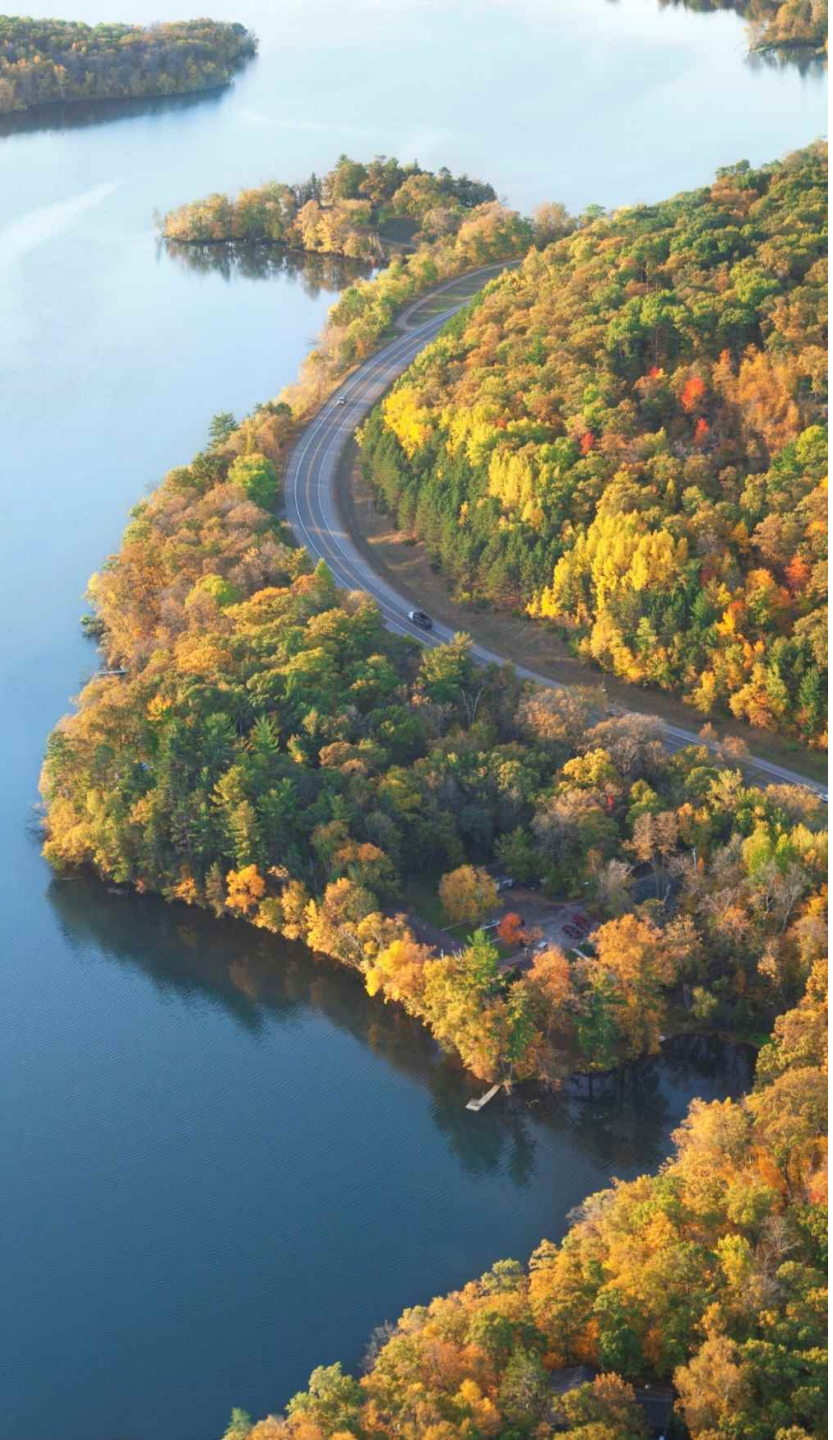
Unintended Consequences:
- Disruption of natural ecosystems
- Decrease of habitat space
- Enable invasive species

Planning Considerations:
- Are there any endangered/sensitive/indicator species in the surrounding area?
- Is there ability to prevent loss or increase biodiversity?

SR Approach:
- Consider nature-based solutions
- Vegetative cover, site redevelopment with native landscaping, phytoremediation, engineered wetlands

Benefits:
Promote biodiversity, increase habitat & greenspace, hydraulic control, lower GHG footprint and heating potential, promote climate resiliency





Key Topic: Water Scarcity

Conventional Approach:
Pump, treat, discharge to storm sewer

Unintended Consequences:
- Lower water table
- Reduce water resources

Planning Considerations:
- Does my remedy impact long term water availability in a resource sensitive area?
- Are there monitoring approaches to ensure efficient use of water resources?

SR Approach:
- Recycle treated water (reinject or reuse)
- Consider optimized monitoring activities (use of down-well sensors, passive sampling approaches, etc.)

Benefits:
Efficiently use water resources to minimize impacts on ecosystems and potable water supplies

Key Topic: Community and Social Considerations

Conventional Approach:
Site is redeveloped into a beneficial greenspace

Unintended Consequences:
Increase property values leads to green gentrification

Planning Considerations:
How will this site end use impact the community in the long term?

SR Approach:
Involve local stakeholders in end use planning, focus on equity

- Park vs. Rec Center vs. Community Garden
- Keep zoning consistent with historic use
- Designate low-income housing requirements

Benefits:
Project outcomes provide benefits and protections to local community

Use Stakeholder Input to Weight Metrics

Is it better to leave contamination in ground or remove it?

- Phase changes (i.e. aqueous to vapor)
- Excavate and relocate to landfill
- Manage in place

Are GHG emissions an environmental or social metric? Economic?

- If both does one priority outweigh the other?
- Who decides (responsible party, regulator[s], local community, global community)?

Prioritize stakeholder objectives with input:

- Remedial criteria typically key for oversight agency
- Technologies may vary based on community or other stakeholder participation (i.e. short term cleanup and high impact vs long term cleanup with low impact)

How Do We Get Started?

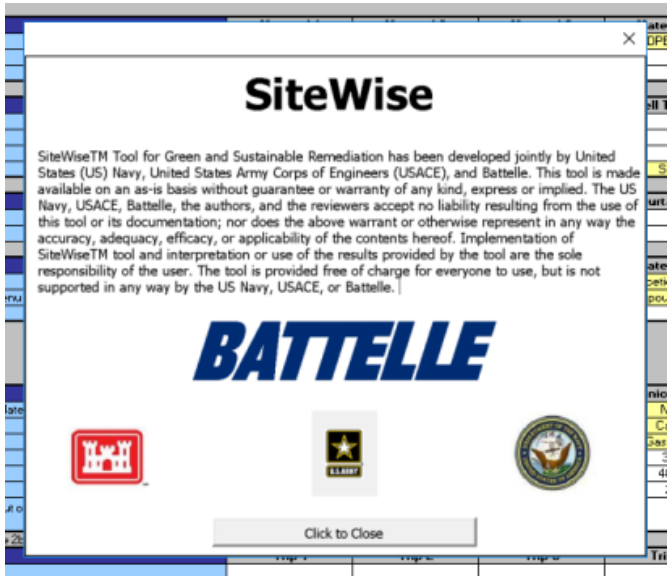
Sustainability should be considered early in the remediation process

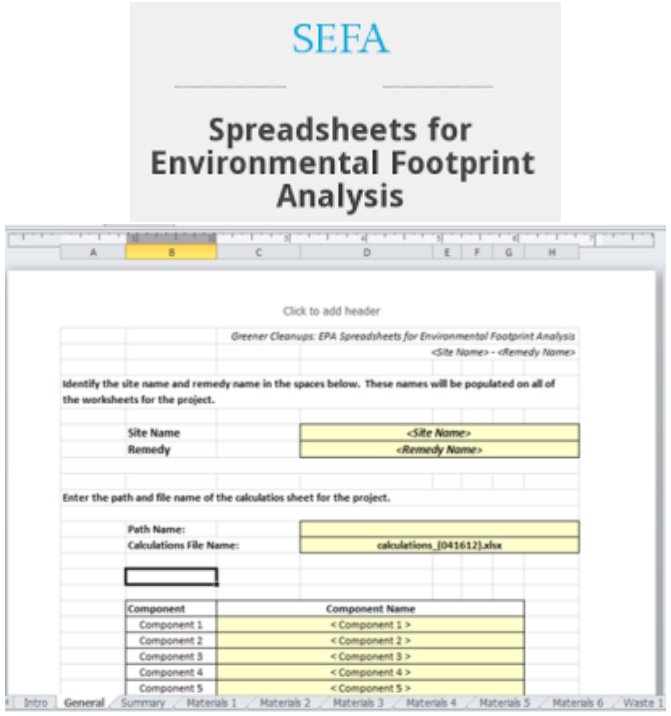
Challenge conventional thinking in order to produce a better overall remedy

State and local governments provide guidance and requirements for incorporation of sustainability while meeting remedial criteria and project goals

Many different tools and frameworks exist, all have underlying commonalities

Available Resources For Sustainable Remediation





- **EPA Greener Cleanups**
- **ITRC Sustainable Resilient Remediation Guidance**
- **ASTM E2893-16/E2876-16**
- **SURF/SURF UK Guidance**

SURE by RAMBØLL

- ✓ Designed for landowners, consultants, contractors, and regulators
- ✓ Reduces the complexity of reviewing and communicating environmental, social, economic impacts of projects
- ✓ Records the project decision-making and supports communication of key decisions
- ✓ Advances efficient, acceptable, and sustainable solutions
- ✓ ISO 18504:2017, ASTM E2893-16 and SuRF compliant
- ✓ Supports identification of related UN SDG's
- ✓ Available online free of charge

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On-line platform developed by Ramboll for sustainable remediation assessment, engagement, and reporting

Closing Thoughts

Using SR Framework to Minimize Unintended Impacts

How do potential remedy impacts align with corporate ESG and sustainability goals?

What is the environmental footprint of remedial actions (existing remedy or comparing alternatives for future remedies)?

What impact do the remedial actions have on current and future site/locality use?

Are key stakeholders identified and consulted to ensure remedy is meeting intended objectives?

Does the project team have multiple disciplines including economists, social scientists, communications experts?

Sustainable Remediation Forum (SURF)

SURF is a nonprofit organization dedicated to maximizing the overall environmental, societal, and economic benefits from remediating degraded environmental conditions by:

- Advancing the science and application of sustainable remediation
- Developing best practices
- Exchanging professional knowledge
- Providing education and outreach

WEBSITE

www.sustainableremediation.org

SOCIAL NETWORKS

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