Green and Sustainable Remediation Program

August 2017

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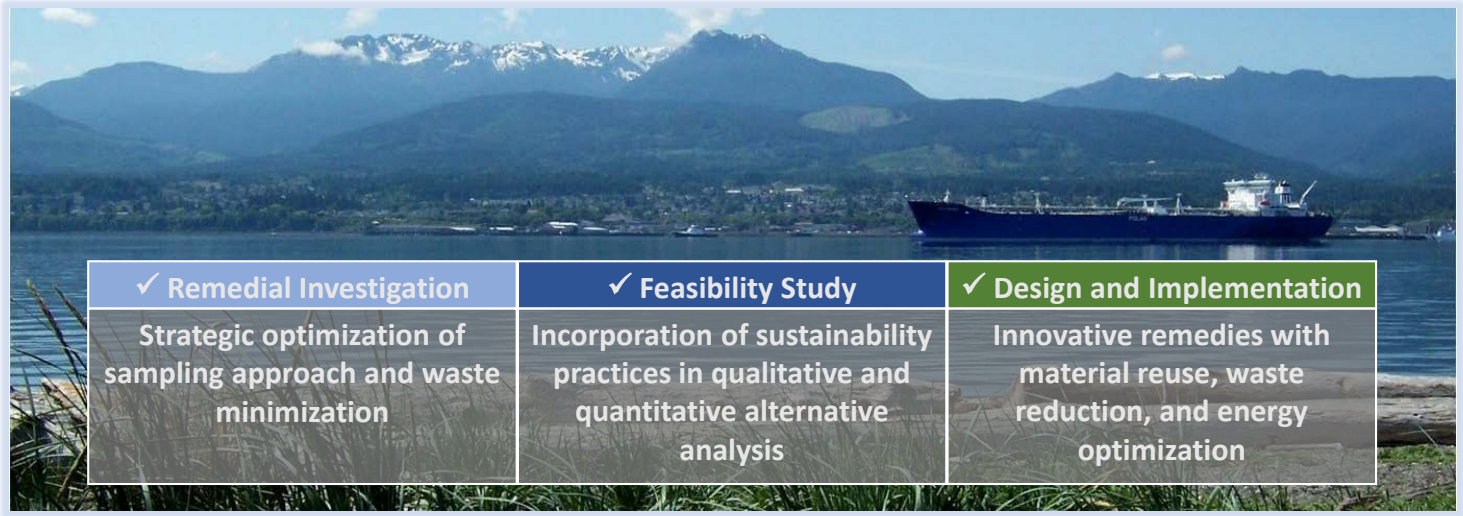
PROGRAM OVERVIEW

Floyd|Snider incorporates Green and Sustainable Remediation (GSR) throughout our remedial services including investigation, design, construction, operation, and monitoring to minimize the environmental impact and footprint associated with the remedy itself. There are many environmental benefits to restoring impacted sites using GSR, including reducing waste, minimizing impacts to water resources and ecosystems, and lessening the carbon footprint. We also recognize that GSR frequently provides our clients with a cost benefit over other less sustainable remedial techniques due to lower operations and maintenance requirements, reduced or eliminated waste streams, and fewer excavations and disposals. Our experience draws on the established framework for GSR, rooted in policy and guidance documents published by the U.S. Environmental Protection Agency (USEPA), and incorporates methods recommended as Best Management Practices (BMPs) for greener remediation.

We incorporate principles and practices encouraged by state and federal agencies with industry trends in green redevelopment practice to produce solutions to our client's environmental and business challenges while minimizing environmental impact, enhancing public benefit and approval, and providing cost savings in both the short- and long-term.

PROGRAM MISSION

Floyd|Snider's GSR program works to reduce the impact of remedial actions on the environment through strategic remedial investigation, remedy development, and design and implementation for cost effective, long-lasting, and low-impact alternatives that enhance the selected remedial action and future use of the site. The elements of our GSR program are presented in this document in three primary categories, or project phases, as shown in the graphic below and on corresponding pages.



We give back to our community by supporting local and small businesses, reducing or recycling waste, and implementing remedies that are protective of human health and the environment. The GSR program provides enhanced environmental strategy and remediation services that are mutually beneficial to our clients, the environment, and the community.

GREEN AND SUSTAINABLE REMEDIATION AND REDEVELOPMENT SERVICES

Integrating Green and Sustainable Remediation with Client Objectives

The current framework for the practice of GSR owes much to the policy goals, principles, and methods established by the USEPA and further developed by industries and groups involved in cleanup, including ASTM International. Our GSR program utilizes this ever-growing body of guidance, which is often incorporated into remedial evaluations and act ions under state and federal law. According to these principles, the **energy, air, water, land and ecosystems, materials,** and other resources used in environmental remediation should be considered in order to reduce the project's net environmental footprint in ways that are consistent with applicable statutes and regulations.

> **Communicating the economic and social benefits of GSR can support agency and community acceptance and positively impact the outcome of a remedial alternative analysis.**

5 Core Elements to Consider in GSR

Energy:
Minimize total energy use and maximize renewable energy use

Air:
Minimize air pollutants and greenhouse gas emissions

Water:
Minimize water use and impacts on water resources

Land and Ecosystems:
Protect use for habitat and other functions

Materials:
Reduce consumption and waste generation

The five core elements (see insert), and the over-arching principle of long-term stewardship, have been assessed relative to environmental remediation and compliance, spawning additional strategies, evaluation tools, and best practices that apply to nearly every aspect of the cleanup process. Green and sustainable remedial considerations are often integrated into all phases of a cleanup process under the Comprehensive Environmental Response, Compensation, and Liability Act, Resource Conservation and Recovery Act, Toxics Substance Control Act, and other USEPA-administered cleanup programs and are typically appropriate for cleanups administered by states, including under the Model Toxics Control Act (MTCA) in Washington State.

We are driven by each client's individual sustainability goals and their need for cleanup strategies that produce long-term benefits consistent with future use and redevelopment goals. Our GSR program is grounded in practical approaches that strive to integrate sustainability with cost-saving measures, which are often naturally parallel objectives. Working backward from desired long-term outcomes, we develop remediation strategies that are both sustainable and efficient because they are based on future client goals. For example, at the **Everett Landfill Site,** our team designed the remedial action with specific plans to accommodate future redevelopment activities (see inset on next page).

Design and Implementation Project Example

Integrating Landfill Cover Systems with Reuse at the Everett Landfill/Tire Fire Site

Client: City of Everett
Location: Everett, WA

Floyd|Snider supports design and implementation for mixed-use redevelopment of a landfill consistent with USEPA's green remediation best practices, including:

- **Reuse of Material:** Integration of multi-media landfill cap with productive and beneficial reuse of asphalt, concrete, and landscaping materials
- **Brownfield Feasibility Study:** Evaluation of environmental requirements for both existing and potential future redeveloped conditions
- **Reduction in Greenhouse Gas Emissions:** Specific plans and on-site disposal pits for refuse encountered during future development, without transportation to another landfill

Maximizing Agency and Community Understanding of GSR Benefits

Floyd|Snider is known for proactive engagement with resource agencies to facilitate open discussions around technical and strategic project elements, resolve issues, and streamline regulatory processes, while optimizing decisions to support client goals. We have facilitated numerous stakeholder and public processes, communicating highly technical information to diverse audiences and welcoming input from a full range of participants. This unique skill set and expertise allows us to ensure that resource agencies and community members understand the benefits of incorporating sustainable remediation principles throughout all phases of the project.

As part of the involvement with government agencies during the remedial investigation, feasibility study, and cleanup action plan development phases, we are able to integrate sustainable remediation principles into the project rationale and evaluations, using both quantitative and qualitative measures. We understand how to highlight and present project elements that are in line with GSR principles and guidance, not only to attain the regulatory remedial objectives, but also to support remedial alternatives that achieve client goals.

Floyd|Snider is adept at tailoring its GSR approach to the culture of our clients and their internal business frameworks, in addition to the environmental, regulatory, and business challenges they face.

Helping Clients Receive Recognition for Past Work

Floyd|Snider staff are able to evaluate past or proposed projects to identify GSR elements and associated reductions in environmental impact. We help our clients achieve public and agency recognition for green and sustainable actions in current, past, and future projects that may have gone unnoticed before. This also aids in the recognition of sustainable project elements within a client's own internal sustainability programs.

Floyd|Snider also provides GSR practices in our design and permitting services. We work to identify GSR elements in design packages, remedial action work plans, and permit applications. Common GSR elements that we incorporate into remedial design include the reduction of waste generation, optimization of material use or reuse, and minimization of impacts to resources. Highlighting these aspects allows the resource agencies and public to fully understand the GSR benefits to human health and the environment, in addition to the remedial action itself. Floyd|Snider has applied its agency coordination and permitting experience directly to advancing **renewable energy** through its role supporting Promus Energy (see inset).

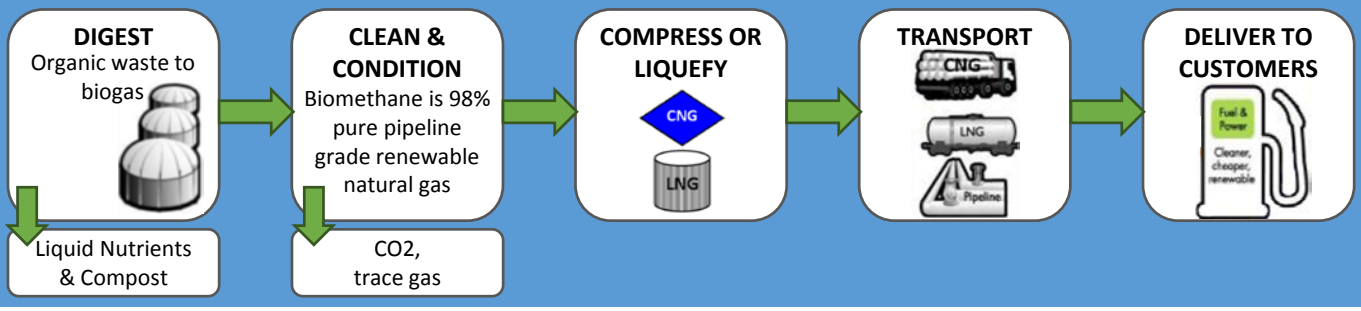
Renewable Energy Permitting Project Example

Promus Energy

Client: Promus Outlook Granger
Location: Outlook, WA

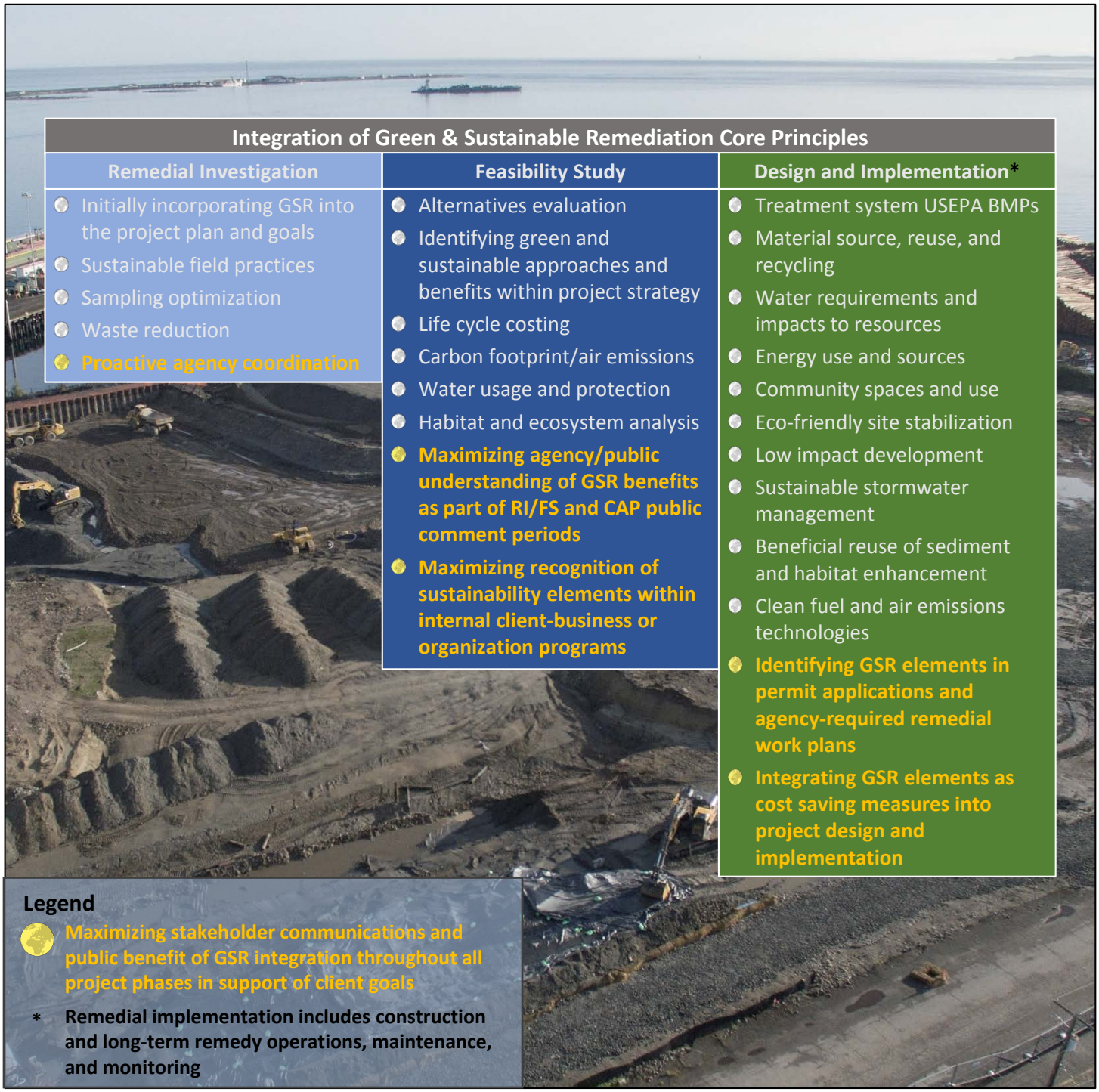
The Promus Energy Outlook Granger (POG) Digester Project converts wastes and regulated pollutants into value-added products as part of a digester-based system. The POG project combines current technology in anaerobic digestion, nutrient recovery from waste products, and bio-gas cleaning methods to produce market quality renewable natural gas from dairy waste and applies that technology to production of products with increasing demand and viability in the marketplace. The system will reduce methane emissions by thousands of tons, generate marketable clean fuel credits, and provide nutrient-enriched bio-fertilizers, reclaimed water, and fiber products. Floyd|Snider provided:

- **Support of Other Sustainable Programs:** Investment in the project through implementation of a cash flow structure that helped facilitate early project success
- **Increased Agency Understanding of Sustainable Benefits:** Permitting analysis, securing all permits, and preparing a SEPA analysis
- **Clean Air Permitting:** Managed modeling and analysis for an Air Operating Permit from the Yakima Regional Clean Air Agency



INTEGRATION OF GREEN AND SUSTAINABLE REMEDIATION PRINCIPLES

Floyd|Snider has integrated GSR core principles throughout its business practices in remedial and redevelopment strategy, uplands and sediment remediation, and stormwater compliance. We continually adopt the best available approaches to green and sustainable site investigation, remedial alternatives development, and design and construction implementation. The following graphic provides an overview of how the GSR principles are integrated throughout the remediation process.



CORE PRINCIPLE: REMEDIAL INVESTIGATION

Integration of Green & Sustainable Remediation Core Principles		
Remedial Investigation	Feasibility Study	Design and Implementation

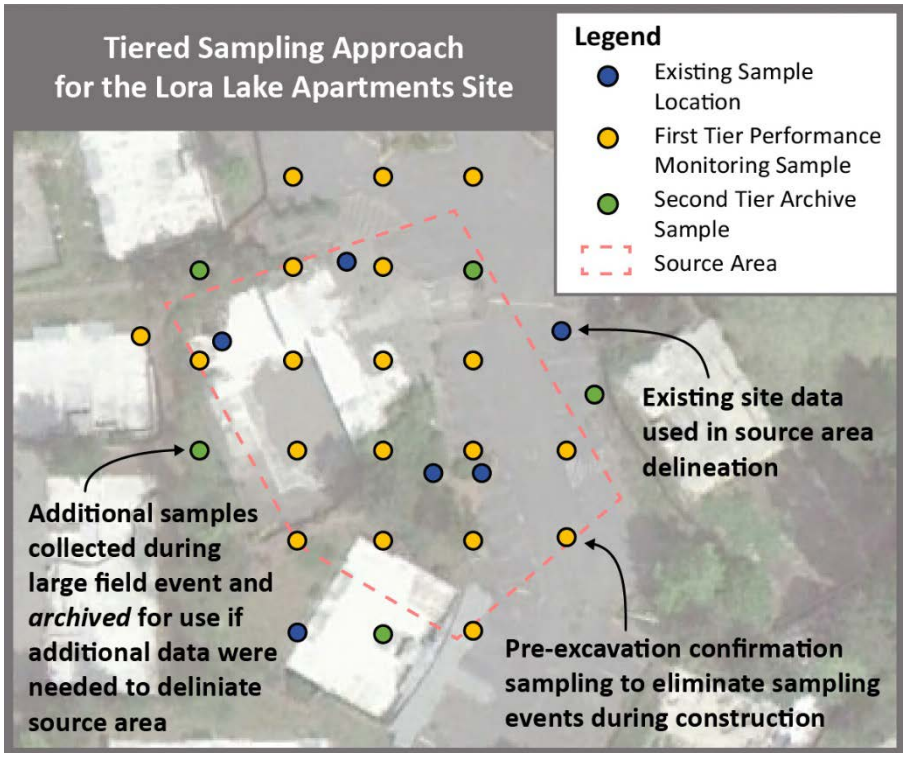
Sustainable Approaches to Remedial Investigation Field Efforts

Floyd|Snider applies decades of environmental assessment and remediation expertise when incorporating sustainable and cost-saving investigation methods on remedial projects. Being sustainability-driven in field practices allows us to reduce the environmental impact of our project work, independent of sustainability considerations in remedial decision-making.

We tailor the scope of each environmental investigation to achieve regulatory and client goals while appropriately limiting investigations to lessen project impacts to the environment. This includes minimizing disturbance to resources and ecosystems, optimizing the efficiency of field activities to reduce redundancy, avoiding significant investigation-derived waste (IDW), and reducing fuel consumption associated with multiple mobilizations.

Our sampling plans draw on several cost effective and environmentally green techniques based on our past investigative experience. Thorough investigation of site history and existing data, combined with subsurface pre-characterization, can minimize field mobilizations and sampling. For example, characterizing site groundwater through historical data and screening samples from test pits or temporary well screens provides a basis for designing an efficient monitoring well network with fewer well installations, and reduced resource consumption, waste generation, and project costs.

Our green and sustainable approach may include establishing the investigation scope in tiers by discussing data gaps in detail with agency personnel early in the process. Analytical costs can also be successfully managed by collecting both composite and discrete soil samples, and initially submitting only composite samples for analysis while discrete samples are archived (see inset and next page). The reduced waste and cost benefits of the composite and archived discrete approach are high relative to the risks, which are very low when holding times and dilution factors are carefully integrated into the sampling plan.



Remedial Investigation Project Example

Sampling Program Optimization and Waste Reduction at the Lora Lake Apartments Site

Client: Port of Seattle
Location: Burien, WA

Floyd|Snider is leading remedial actions at the Lora Lake Apartments Site, located immediately northwest of the Seattle-Tacoma International Airport. Our team developed the Remedial Investigation and Feasibility Study, Cleanup Action Plan, and remedial design package, and performed confirmation monitoring data collection. Remedial construction began in June 2017. The remedy is addressing primarily dioxin/furan contamination in soil, groundwater, and freshwater lake sediments resulting from historical barrel washing operations.

- **Tiered Analysis Approach:** Successful negotiation with Ecology to use USEPA Method 1613 to analyze the samples collected for dioxins/furans with an extended 1-year holding time
- **Footprint Reduction:** Substantial cost- and time-savings, and reduction in resource consumption, field mobilizations, and IDW because the archived samples were held and then analyzed only if the initial samples did not successfully identify the extent of contamination
- **Tiered Sampling Approach:** Collection of over 550 soil samples with tiered analyses of archived samples conducted on approximately 20 percent of the boring locations and full delineation of the vertical and horizontal extent of site contamination

Floyd|Snider is continually adapting its field methods to integrate green and sustainable practices, attain client and community goals, and practice environmental stewardship. The following green and sustainable practices are utilized during standard field work:

- **Minimization of additional mobilizations to a site** through careful planning, including tiered investigations and thoughtful deployments.
- **Reduction in greenhouse gas emissions** with fuel-efficient vehicles and carpools for field-related work, and a no-idling policy.
- **Reduction in waste** through use of dedicated equipment at recurring sampling areas and minimizing drilling spoils and purge water disposal.
- **Minimization of IDW** through use of low-flow or no-purge groundwater sampling techniques.
- **Reduction in drilling spoils** by using sonic or direct-push drilling, when site conditions allow.
- **Reduction in travel emissions** though remote monitoring, when possible.
- **Avoidance of harmful decontamination water generation** through use of biodegradable detergents, instead of organic solvents or acids, when decontaminating sampling equipment.

CORE PRINCIPLE: FEASIBILITY STUDY

Integration of Green & Sustainable Remediation Core Principles

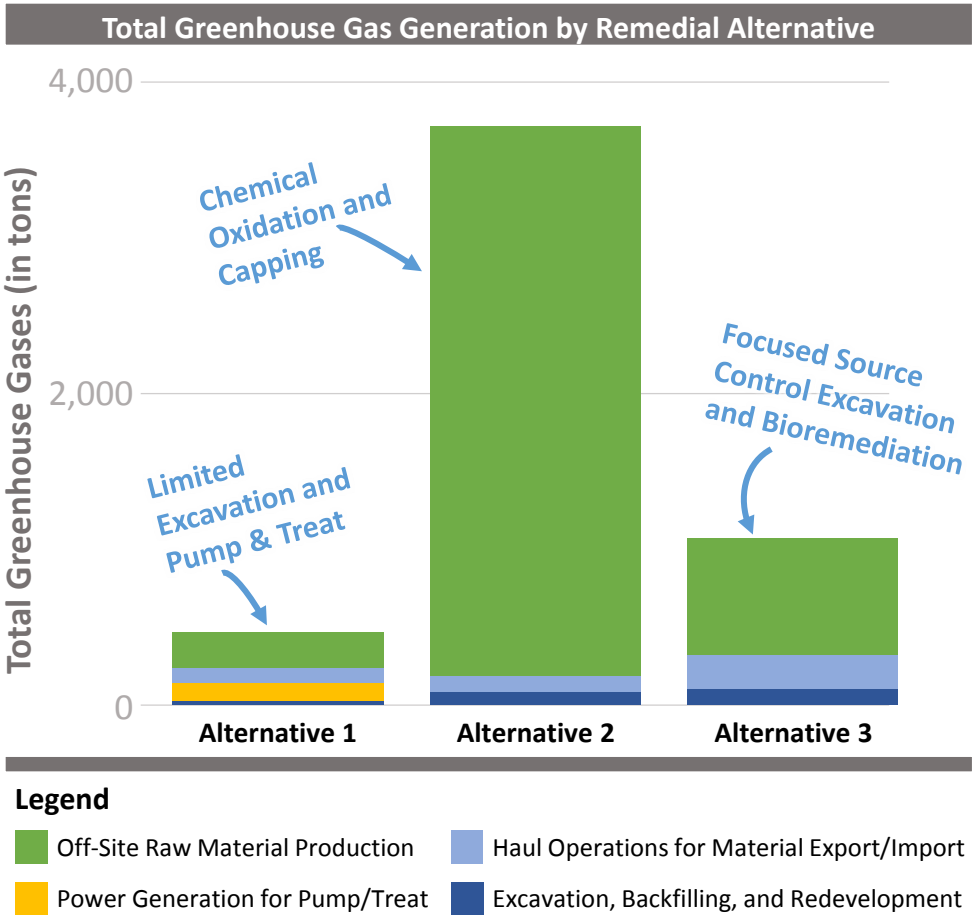
Remedial Investigation	**Feasibility Study**	Design and Implementation

Sustainability in Remedial Alternatives Evaluation and Feasibility Studies

The remedial evaluation stage of the cleanup process offers a key opportunity to include sustainability considerations. Floyd|Snider excels at developing strategic remedial alternatives to optimize cost, effectiveness, and sustainability. Our approach allows for the incorporation of stakeholder and public interests such as future land use and cost efficiency, environmental benefits such as beneficial reuse and native habitat development, and timely completion of remedial actions, while also meeting the cleanup criteria of state and federal regulatory standards. We also incorporate sustainable remediation that is beneficial to our clients through evaluating potential environmental liabilities and risks, and projecting the long-term and lifecycle costs of remedial and redevelopment options.

Whenever possible, we quantify the environmental footprint of remedial actions based on the five core sustainability elements, and can incorporate the results into the feasibility study process. Metrics that may be evaluated during remedy development and selection include:

- Environmental impacts of consumables, air emissions, and water usage from remedial activities
- Opportunities for material recycling and reuse
- Maximization of future land use for clients or the public



For example, we utilized USEPA's Spreadsheets for Environmental Footprint Analysis (SEFA) to conduct an environmental footprint analysis for the generation of greenhouse gases that would be released under remedial alternatives evaluated as part of a feasibility study for a project in Port Angeles, Washington (see figure). Alternative 3 was selected and implemented and included focused source control excavation, bioremediation, and institutional controls. The SEFA tool provides rigorous quantitative analyses for remedial alternative impacts and clear formats for communicating the results.

Floyd|Snider also offers tiered sustainability reviews that can be adapted and incorporated into feasibility studies and remedial alternative selections. These reviews can range from qualitative assessments to in-depth quantitative analysis consistent with U.S. Sustainable Remediation Forum (SURF) Guidance.

The tiered approach can be tailored to the size and complexity of the project, as well as the client's goals for stakeholder involvement, remedial objectives, and site redevelopment. We work to incorporate the tiered sustainability evaluation during feasibility studies at the early stages of a remedy selection and also during different project phases for long-term environmental stewardship of complex remediation projects. For example, the adaptive remediation program for the B&L Woodwaste Site (see inset) included a qualitative sustainability evaluation to compare in situ remediation with continuation of the pump and treat technology currently in use.

Adaptive Remediation at the B&L Woodwaste Site

- Evaluated adaptive remediation options consistent with SURF tiered sustainability approach
- Reviewed monitoring data, risk evaluations, and spatial and temporal boundaries for strategy development
- Conducted a cost benefit analysis for continued pump and treat compared with in situ remediation
- Optimized treatment strategy for chemical consumption and waste generation reductions

Overview of Floyd|Snider GSR Projects

	Green & Sustainable Remediation in Practice										
	Remedial Investigation			Feasibility Study			Design and Implementation				
Showcase Projects	Sustainable Field Practices	Strategic Sampling Approach	Innovative Investigation Methods	Integration with Client Goals	Incorporated Land and Ecosystem Services	Alternative Evaluation and Agency Engagement	Adaptive Management Long-Term Stewardship	In Situ Treatment	Reduced Material Consumption/ Waste Generation	Sustainable Redevelopment	Improved Water Resources
Everett Landfill/Tire Fire Site			•	•	•	•	•		•	•	•
Promus Energy				•	•	•	•		•	•	•
Lora Lake Apartments Site	•	•	•	•	•	•	•	•	•	•	•
B&L Woodwaste Site	•	•	•	•	•	•	•	•	•		•
Kenmore Waterfront Industrial Site		•		•	•	•	•			•	•
Vigor Shipyards LNAPL Recovery	•		•	•				•	•		•
Elliott Bay Seawall Replacement				•	•	•	•		•		
Port of Seattle Terminal 10	•			•			•		•	•	•
Port of Port Angeles K Ply Mill	•	•	•	•		•			•	•	•
Fox Avenue Site	•	•	•	•		•	•	•			•
Former Reichhold Site	•	•	•	•		•		•	•	•	

CORE PRINCIPLE: DESIGN AND IMPLEMENTATION

Integration of Green & Sustainable Remediation Core Principles		
Remedial Investigation	Feasibility Study	**Design and Implementation**

Sustainable Design and Implementation

Floyd|Snider is skilled in developing strategic cleanups for clients who often have complex, interrelated remediation and redevelopment goals. Because of this, we have had the opportunity to design and implement a number of innovative remedies with tangible benefits to water resources and ecosystems, smart and substantial reuse of materials and reductions in waste, and remediation systems that reduce or recapture energy.

Floyd|Snider considers core elements as project goals early in the design process. For example, sustainability principles for protecting water resources were the basis for the design and successful operation of stormwater infiltration basins protecting a sensitive shoreline from industrial stormwater at the **Kenmore Waterfront Industrial Site**. When **protecting water resources and land and ecosystem** services were considered on the **Lora Lake Apartments Site**, the resulting design combined remediation of contaminated sediment, soil, and groundwater with rehabilitation of wetlands that protect the water bodies and greatly enhance habitat and biodiversity. At the **B&L Woodwaste Site,** another site where wetlands are prominent, a containment barrier wall, groundwater recovery and treatment system, and in situ treatment remedy were designed and constructed to maintain wetlands function, and minimize ecosystem impact and energy use. The projects are described in the following insets.

Design and Implementation Project Example

Kenmore Waterfront Industrial Site Rehabilitation with Stormwater Infiltration

Client: Pioneer Towing
Location: Kenmore, WA

Floyd|Snider assisted in infiltrating the stormwater and rehabilitating a contaminated shoreline at the mouth of the Sammamish River, where the salmon-bearing river discharges into Lake Washington. The property is a former landfill, regulated under Ecology's MTCA cleanup program.

- **Stormwater Management:** Upgrading the industrial gravel work surface at the property, and stormwater management to eliminate the potential impact of industrial stormwater to sensitive shoreline vegetation and aquatic receptors
- **Infiltration of Treated Stormwater:** A stormwater management system that directed all site stormwater to infiltration basins, with primary treatment prior to infiltration, a design based on best practices for bioremediation of stormwater
- **Continued Monitoring:** Port-remedy groundwater monitoring confirming that infiltration was not negatively impacting subsurface contamination

Design Project Example

Integrating GSR with Client Objectives at the Lora Lake Apartments Site

Client: Port of Seattle
Location: Burien, WA

Floyd|Snider has incorporated USEPA's Core Elements of Green Remediation during the remedial alternatives analysis, design, and construction at the Lora Lake Apartments site. Preventing impacts to water resources and protecting land and ecosystem services have been accomplished through the following:

- **Rehabilitation of Wetlands:** Conversion of the man-made lake to a rehabilitated scrub shrub wetland maximized ecological benefits to surrounding flood plain and reduced airplane bird strikes
- **Protection of 303(d)-Listed Water Body:** Incorporation of native plantings and elimination of warm water and low dissolved oxygen inputs improved the health of the adjacent Miller Creek
- **Protection of Surrounding Wetlands:** Wetland habitat was increased and restored to historical natural conditions through planting selections, with significant focus on biodiversity and ecosystem services
- **Footprint Reduction:** A bioswale was constructed for stormwater retention and infiltration to minimize runoff
- **Reduction in Waste Generation:** This included reuse of demolished concrete, use of non-contaminated site soils as backfill, selection of biodegradable erosion control fabrics, and reuse of downed trees for Miller Creek bank stabilization and wetland rehabilitation

Design and Implementation Project Example

Adaptive Management of Pump and Treat and In Situ Treatment in Contaminated Wetlands at the B&L Woodwaste Site

Client: B&L Woodwaste Custodial Trust
Location: Milton, WA

Floyd|Snider and Ecology are adaptively managing the remediation of a multi-acre arsenic groundwater plume in a wetlands setting. The team designed and implemented the phased cleanup, which included:

- **Protection of Surrounding Wetlands:** Passive containment of leachate with a perimeter slurry wall; routing clean groundwater around the barrier to maintain local wetland function and reduce ecosystem impacts
- **Minimizing Impact to Water Resources: G**roundwater recovery and treatment system for hydraulic containment that replaces treated water back to the surrounding wetland ecosystem
- **Footprint Reduction:** Protection of the nearby salmon-bearing stream with in situ bioremediation of arsenic, minimizing the need for energy-intensive groundwater recovery
- **Reduction in Greenhouse Gas Emissions:** Use of gravity flow throughout the groundwater treatment process to reduce energy consumption; use of a sophisticated controller system for automation and remote monitoring, substantially reducing travel to the site by the plant operator
- **Reduction in Waste Generation:** An on-site lab is used to avoid unnecessary resource consumption, minimize transport of samples off-site, and reduce lab waste generation

The green and sustainable practice of **reducing materials consumption and waste** has been a major feature in several Floyd|Snider projects. Our clients have appreciated the common-sense logic of recycling and of reducing landfill waste and vehicle emissions, in addition to the considerable cost savings through these designs. At **Vigor Shipyards**, hundreds of thousands of gallons of petroleum product recovered from the subsurface has been blended into a usable industrial fuel product and re-sold. Our waste development plan for the **Elliott Bay Seawall** proposed sustainable reuse of 90% of the jet grout spoils from the project, which were estimated to account for over half of the potential waste by volume for the project. At the Port of Seattle's **Terminal 10**, Floyd|Snider designed and implemented stormwater upgrades and other redevelopment activities that included recycling of metal debris and concrete, and on-site reuse of soils and riprap. Large quantities of concrete were also reused on-site as part of the Port of Port Angeles **Former K Ply Mill** cleanup and redevelopment project. These projects are described in the following insets.

Reducing Materials Consumption and Waste

Implementation Example

Vigor Shipyards Beneficial Reuse of Recovered LNAPL

Floyd|Snider works to recover petroleum fuel released during past use of the shipyard as a bulk fuel facility, a part of the Harbor Island National Priorities List site. LNAPL is recovered via pumps and skimmers to one of two aboveground containment tanks.

- 390,000 gallons of pure petroleum product recovered
- Recovered LNAPL blended with other petroleum products locally and turned into certified Refined Fuel Oil
- Refined Fuel Oil product sold to end-users for use as industrial fuel for energy recovery

Design/Implementation Example

Integrating Landfill Cover Systems with Reuse at the Everett Landfill/Tire Fire Site

The Floyd|Snider team led an innovative and economically significant approach to materials reuse by designing and achieving regulatory approval for a landfill cap integrated with extensive waterfront re-development.

- Landfill cover over a low permeability layer and soil fill layer with active landfill gas collection
- Designed and installed as part of commercial, residential, and waterfront park development, maximizing beneficial use without jeopardizing the cover

Construction Design Example

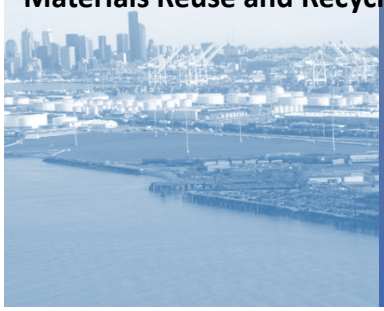
Contaminated Materials Management for Elliott Bay Seawall Replacement

A sustainability plan was developed for management of and innovative reuse for jet grout spoils generated during construction of the new seawall, setting a standard for sustainable practices at surrounding properties.

- Waste diversion from landfills and beneficial reuse of jet grout spoils
- Immediate reuse of 20% of spoils as controlled density fill
- Future reuse of 70% of cured and processed spoils for future use as fill on other projects

Redevelopment/Design Example

Materials Reuse and Recycling at Port of Seattle Terminal 10



Floyd|Snider designed and implemented stormwater upgrades and other redevelopment activities at this former Superfund Site on Harbor Island. GSR activities included recycling of metal debris and concrete, and on-site reuse of soils and riprap.

- Removed 25 tons of metal debris and 195 tons of concrete, which were taken off-site for recycling and reuse
- Reused riprap to prevent need to import additional material
- Reused suitable clean soils as backfill, preventing ~4,000 CY being sent to landfill

Design/Implementation Example

Materials Reuse at Former K Ply Mill

Soil and groundwater contamination included a large pool of floating hydraulic oil and a 600-foot-long TPH and benzene plume. Floyd|Snider completed the cleanup remedy, including mill demolition, excavation, and groundwater bioremediation.

- Employed green and sustainable BMPs early to find on-site and nearby sources of backfill material
- Imported and reused over 8,000 CY of crushed concrete from the former mill and the Elwha River dam, avoiding excess truck air emissions

Floyd|Snider has also designed and implemented cleanups of soil and groundwater using bioremediation. At the **B&L Woodwaste Site**, in situ treatments were implemented that stimulated bacteria-based reactions to remove arsenic from groundwater, preventing impacts to sensitive wetlands and dramatically reducing the energy required for cleanup. A Floyd|Snider team also successfully deployed an in situ bioremediation strategy at the **Fox Avenue Site** to remediate a chlorinated solvent groundwater plume and prevent it from reaching the Duwamish River using recycled waste sugars (see inset).

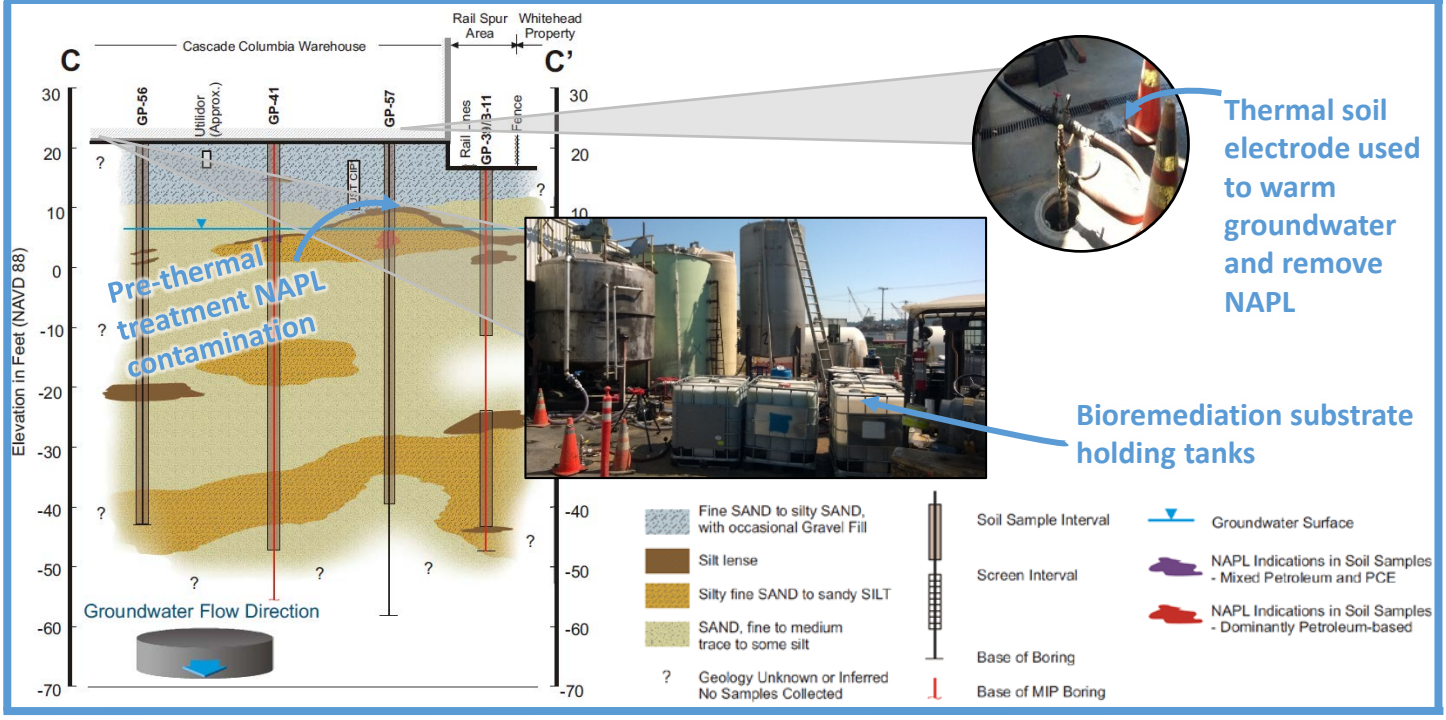
In Situ Bioremediation Project Example

Fox Avenue Site (former Great Western Chemical)

Client: Fox Avenue Building, LLC
Location: Seattle, WA

Chlorinated solvent contamination in groundwater and DNAPL in soil 65 to 70 feet below ground surface was remediated using in situ bioremediation.

- **Innovative GSR Technologies:** Injection of a sugar substrate to promote reductive dechlorination by biostimulation of microbial populations in the soil
- **Reduction in Greenhouse Gas Emissions:** Avoidance of excavation and associated transport gas emissions and off-site landfill disposal
- **Reuse of Materials:** Beneficial use of a sugar substrate (a mixture of soda and beer) that is recovered during the recycling of unopened beverages at a local beverage recycling company
- **Protection of Groundwater:** Reduced COC concentrations across most of the site by 99% relative to historical highs within 3 years of initial injection and without adverse impacts to the background groundwater conditions



Through the use of on-site bioremediation treatment cells and on-site reuse of treated soil, a large volume of pentachlorophenol-contaminated soil remained on-site for treatment at the **Former Reichhold Chemical Site,** thereby avoiding off-site transportation and disposal, and minimizing greenhouse gas emissions associated with transport (see insert).

Design and Implementation Project Example

On-Site Soil Bioremediation/Reuse at the Former Reichhold Site

Client: SSA Tacoma
Location: Tacoma, WA

Floyd|Snider assisted with the sustainable large-scale bioremediation and on-site capping of pentachlorophenol- and dioxin/furan-contaminated soil at the former Reichhold Chemical property. Floyd|Snider prepared remedial design and construction bid documents, and provided construction management and compliance verification sampling. Key sustainable project elements included:

- **Bioremediation:** Application of the reagent Daramend for bioremediation of approximately 13,000 CY of contaminated soil in treatment cells, followed by placement of treated soil as fill
- **Reduction in Greenhouse Gas Emissions:** On-site bioremediation and capping of over 3,400 CY of contaminated soil to avoid contaminant and greenhouse gas air emissions relative to off-site disposal, which would have required transport out of state for micro-encapsulation and disposal or for incineration
- **Innovative GSR Techniques:** Use of vapor-suppressant foam to manage air emissions from pentachlorophenol and related compounds during excavation

Floyd|Snider's application of GSR in design and implementation has added value to a range of cleanup and redevelopment projects. We strive to support our clients in achieving project goals in an environmentally and socially responsible manner. For additional information about our projects and GSR services, visit our website at www.floydsnider.com/exp-sustainability.php.

We are also a Benefit Corporation and are committed to being a socially and environmentally responsible company. Additional information on our mission and annual assessments can be found in our Benefit and Sustainability Annual Report.

You can also contact us directly to discuss how our GSR program can be applied to your project.

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