

REMEDIATION OPTIMIZATION

EA Engineering, Science, and Technology, Inc., PBC (EA) has been ranked by *Engineering News-Record* as a Top 200 Environmental Firm and a Top 500 Design Firm. We provide site characterization and remediation; environmental, health, safety, and sustainability (EHSS) regulatory compliance; air, water, and natural resources management; infrastructure engineering and management; and information technology solutions to a wide range of industrial and government clients nationwide.

Our clients have repeatedly reinforced their desire to reduce or eliminate environmental liabilities. EA has developed a **Tiered Remediation Effectiveness and Efficiency (TREE)** Process to address the optimization needs for less complex sites and highly complex, mature or recalcitrant sites during all stages of the environmental life cycle continuum.



Tier 1 Eliminate Liability

Optimizations are designed to eliminate or significantly reduce environmental liability by achieving site closure/regulatory case closure in the near-term.

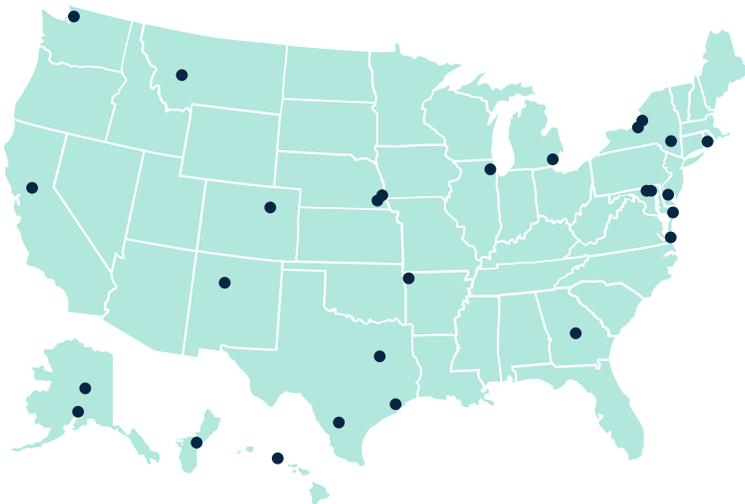
Tier 2 Accelerate Closure

Optimizations are designed to accelerate site closure when the capital costs for near-term site closure are outside of financial constraints or would potentially increase near-term liability but there is a desire to reduce the overall remediation time frame. These actions typically involve the replacement, retrofit, or implementation of new remedial technology that increases remedy efficiency/effectiveness, lowers remedy cost, and operations and maintenance (O&M) cost.

Tier 3 Reduce O&M Costs

Optimizations are designed to reduce O&M costs while maintaining protectiveness at mature and highly complex or recalcitrant sites where Tier 1 and Tier 2 options have been implemented to the extent practical. Lower long-term O&M or *de minimis* life cycle costs can be achieved when done correctly through reduced sampling and monitoring that can yield measurable results and long-term cost savings.

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REMEDIATION OPTIMIZATION

Extensive Experience



Site to Closure

DoD Long-Term Monitoring

At a Department of Defense (DoD) installation, EA was contracted to perform long-term monitoring (LTM) on a cap over a former sodium hydroxide spill. This site had no foreseeable development potential and included annual inspections/long-term groundwater monitoring, and no defined remediation time frame. EA (along with our DoD partners) developed an **Exit Strategy** to assess if site closure could be achieved and at what price as compared to the current LTM strategy. Based on the Exit Strategy assessment, it was determined that site closure was likely but required additional data collection and assessment. We performed EPA recommended fate and transport modeling (SESOL) to validate that without a cap, the groundwater would not be impacted. With regulatory approval, the site was closed, **saved our client over \$1 million** in environmental life-cycle costs and created redevelopment options for the site.



Tier 1



Reducing LTM/O&M Costs

Utility Optimized Exit Strategy

For a utility client, EA developed an Optimized Exit Strategy for a long-term groundwater pump and treat site for a former landfill. We acquired the site in 2017 when the remedy had been active for approximately two decades with a remediation time frame locked in at over 100 years. Our Optimized Exit Strategy is two pronged: (1) reduce LTM costs by leveraging a database of groundwater data from the previous consultants, and (2) develop a road-map for extraction well/system shutdown and prove-out monitoring. The regulatory requirements for LTM were extensive from the onset and increased over time through regulatory requests. EA utilized the database and analyzed data trends. Based on the results of this data analysis, we identified several constituents that were not detected either at all or with detections well below regulatory screening levels with no increasing trends. Additionally, groundwater flow velocity was assessed, and it was determined that the frequency of sampling could be reduced. We proposed a **60% reduction in the LTM program** to the regulatory agency, which was readily accepted.



Tier 3



Accelerating Remediation

Industrial Optimization Study

For an industrial client, EA performed an Optimization Study to assess if the proposed remedy by another consultant would be the most beneficial to our client. We considered all factors including long-term property use, adjacent property owners, other more aggressive remediation technologies, and potential short-term and long-term impacts from the alternate remedies. As part of the study, our team also assessed the long-term effect of matrix back-diffusion of the contaminants from the fractured bedrock aquifer. We determined that the proposed remedy was most effective for our client. At the same time, EA identified that most of the contaminant mass was still located in zones of the aquifer that were not addressed by the current remedy. Our team then proposed and piloted a relatively simple optimization that involved added vacuum to the extraction wells to: (1) increase groundwater recovery rates, and (2) remove the contaminants sorbed to the bedrock fractures above the pumping water levels. Based on the results of the pilot study, the optimization will **increase contaminant recovery by 100-300%**. This relatively simple optimization will **reduce the total remediation time frame by 5 years for less cost**, reducing the client's overall environmental liability sooner.



Tier 2



TREE incorporates industry-standard statistical and numerical multi-media transport models with environmental visualization techniques relying on risk management principals, consensus building among stakeholders, and a

wealth of EA previous experience/lessons learned to assess three tiers of optimization that can be implemented in either a phased or tandem approach and applies each of these variables to the individual needs of each client.

