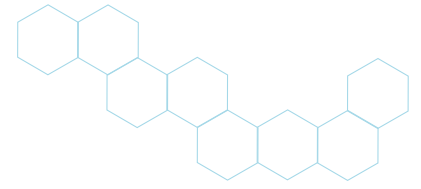


Coastal Resilience Services

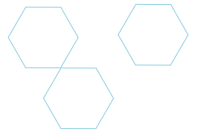


A sustainable solution requires understanding the entirety of the problem.

Integral Consulting identifies science-based solutions to coastal-related challenges by taking a holistic, systems approach to understanding the risks posed by the physical system to social, economic, and ecological aspects of coastal communities and facilities. We evaluate the benefits, costs, and trade-offs among different adaptation approaches, leading to sustainable community planning and facility and resource management.

Our team's portfolio of scientific expertise—geology, oceanography, modeling, ecology, and economics—allows us to unravel the complex processes that make communities and facilities vulnerable to coastal change. We understand how to measure, analyze, and explain the interactive processes driving change today, and we have the tools to project how the interactions will evolve in the future.

- COASTAL SITE CHARACTERIZATION & ASSESSMENT
- COASTAL VULNERABILITY / RISK ASSESSMENT
- COASTAL HAZARD ADAPTATION
- POST-EVENT ASSESSMENT / RESILIENCE PLANNING



Coastal Site Characterization and Assessment



Do you understand the potential hazards your coastal zone locality is facing? Our site characterization and assessment service has multiple tiers that allow for increasingly detailed investigations that lead to an understanding of the causative processes that need to be addressed to improve resilience. Initial tiers can include geomorphic, habitat, and physical process evaluations that identify areas for more detailed investigation. Additional tiers may include geologic framework, shoreline change, sediment budget, ecological feedbacks, or fiscal impact and economic analyses. Site assessments, surveying, and monitoring provide mapping and detailed reporting for each site characterization.

Post-event Assessment and Resilience Planning

The best planning in the world won't stop the storm from coming. Numerous pre-storm mitigation efforts can be implemented, but once a storm arrives, some impact is inevitable. Integral staff have years of expertise in evaluating event impacts to coastal systems and in working directly with clients to develop solutions to increase resilience, accelerate recovery, and mitigate future impacts. Thorough and robust damage evaluation allows for proactive disaster preparation, including understanding what may be required for recovery and insurance claims.

Coastal Hazard Adaptation

Integral is a preeminent innovator in applying holistic systems approaches to guide communities and facilities through the complex process of planning for the inevitable impacts of sea level rise on property, infrastructure, and critical ecosystems. Our customizable decision-support framework toolkit, Coastal ADAPT (Adaptation Decision and Planning Toolkit) is implemented in phases, first providing the critical baseline information for selecting appropriate adaptation strategies, and then modeling their implementation to evaluate potential secondary impacts and unintended consequences. As part of this framework, we carefully and clearly lay out the trade-offs and secondary consequences of each strategy to support effective decision-making.



Coastal Vulnerability and Risk Assessment

Coastal communities and facilities along our nation's coastline are perpetually at risk due to a complex interplay of processes that drive coastal change. Integral is a leader in developing cutting-edge approaches to assess vulnerability and risk. Our approach is to carefully identify the vulnerabilities of various infrastructure components or resources that stem from exposure to different physical processes and from coastal hazards related to critical location and elevation details. Risk is determined by what physical process or failure mechanisms may cause the vulnerability and exposure that results in damages. We provide clear, powerful communication of the issues and results of the assessments, including maps, reports, and community outreach engagement.



Selected Projects



Resilient Coastal Adaptation Project

Ventura County, California

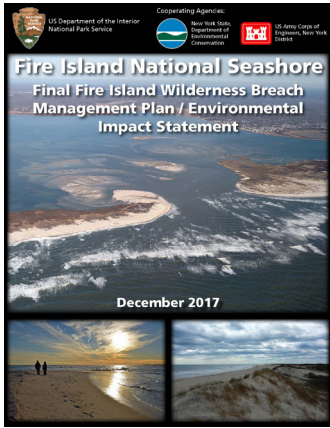
Integral's Coastal Resilience team, working for the County of Ventura, conducted a vulnerability and fiscal impact study to support adaptation planning and local coastal plan policy updates. This project included a vulnerability assessment of coastal erosion, wave flooding, tidal inundation, and nuisance flooding accelerated by sea level rise.

After refined coastal hazard modeling and geospatial data analyses, projected future risks were mapped to critical community sectors including land use, oil and gas, and other critical infrastructure. By integrating the hazard analysis with economic and fiscal impacts, the team holistically projected future impacts to agriculture, coastal recreation, and infrastructure and property damages.

Working with the County, Integral provided technical and risk communication to support a variety of stakeholder and public engagements. Adaptation planning encompassed the evaluation of both engineered and nature-based solutions, tackling the thorny subject of existing revetments and limitations on future coastal armoring. The adaptation approaches also identified natural living shoreline approaches, including development of a dune restoration and management plan, sand retention with cobble groins, and sediment management, to improve coastal recreation and reduce engineering and maintenance costs.

The project was awarded the 2020 Best Practices Merit Award from the California Chapter of the American Planning Association.





Storm Response and Resilience Planning

Fire Island, New York

Hurricane Sandy made landfall along the New Jersey coastline on October 29, 2012. The storm surge caused extensive damage to the barrier island systems throughout the mid-Atlantic and especially on Fire Island, New York, which contains numerous coastal communities, a national seashore, and several county and state parks. Detailed pre-and post-storm mapping allowed for understanding which areas were most heavily impacted, and careful monitoring revealed information about beach and dune recovery. A combination of field data analyses and modeling was implemented to identify which areas of the island were most resilient versus vulnerable. Active engagement serving on panels with federal, state, and local managers and planners allowed for the transfer of critical scientific knowledge for dealing with the aftermath of the disaster and developing plans for resilient restoration and management.



Landslide and Sea Cliff Retreat Hazard Analyses

California

Large coastal landslides and episodic sea cliff retreat threaten communities, coastal scenic highways, and other critical infrastructure along high-relief coasts. Integral staff have worked with the State of California, California Department of Transportation, and federal agencies to investigate sea cliff retreat and landslide processes along the California coast. Innovative field and remote sensing techniques, combined with geologic mapping, were used to develop both localized and broad regional perspective on historical events—where and why they occurred. The analyses defined the primary drivers of failure events, which can be variable alongshore; identified the sea cliffs likely to be most vulnerable in the future; and developed state-of-the-art statistical modeling tools to forecast where and under what conditions sea cliffs were likely to fail in the future.

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