

Providing a unique
combination of
strategic insights
and depth of
technical expertise



Restoration, Engineering and Geomorphology

Eastern Focus

Restoration, Engineering, Geomorphology (REG) Services



Cardno is the home of innovation and strategic planning. We have over 900 professionals specializing in environmental sciences, biology and ecology, hydrology and geosciences, and water resources engineering.

The Restoration, Engineering and Geomorphology Group is made up of geomorphologists, restoration design engineers, fish biologists, riparian and wetland scientists, hydrologists, and hydraulic engineers who routinely collaborate on restoration projects.

Our ecosystem restoration is based on an approach that has resulted repeatedly in successful projects: a foundation of the best available science, a thorough understanding of policy and stakeholder interests, and high-quality engineering. We combine water resources engineering with an understanding of natural systems to develop practical, effective and sustainable solutions. Our approach incorporates the highly dynamic and variable nature of natural systems, often to protect infrastructure and sensitive resources including pipelines, roads, habitat and recreational facilities. We have experts who understand the cause and effect relationships between watershed and water infrastructure development; and its influence on river and stream channel processes.

Combining the skills of our engineering professionals with those of our geomorphologists and ecological and biological experts allows us to develop holistic and sustainable solutions, optimizing the habitat improvement potential and creating as close to a natural functioning system as possible. We are proud of our ability to be innovative, to maximize environmental benefits within its existing physical and regulatory constraints.

Our experience includes conceptual planning, scientific research, alternatives evaluation, design, permitting, plans and specifications, construction supervision, and post project monitoring. We are proficient at setting up and using an array of engineering and scientific software associated with water resources management in both the natural and built environments. We have extensive design and construction experience related to channel stabilization, modification and restoration—in other words, we have experience putting projects in the ground. We are proficient at facilitating multiple agencies and organizations with diverse interests and responsibilities. We are successful in reaching agreement with guiding agency, academic, and interested stakeholders through complex technical and permitting issues.

We apply geomorphic principles and an understanding of fluvial/alluvial, lacustrine, estuarine, and shorezone processes to both small scale, site-specific habitat improvements and large, watershed-scale restoration projects. This approach to restoration allows us to create designs that provide naturally-functioning channels and floodplains that are self-maintaining and have low maintenance requirements.



REG Services

- > Watershed Management
- > Land Use Planning and Assessment
- > Stormwater Management
- > Surveying, Data Collection
- > Geomorphic and Biologic Field Assessments
- > Hydrology and Hydraulics Modeling (1D and 2D)
- > Hydrology Modeling (e.g., HMS, SWMM, HSPF)
- > Hydraulic Modeling (RAS, RMA, River 2D)
- > Erosive Work and Sediment Transport Modeling (e.g. RAS, HEC-6, SAM)
- > Channel Stabilization and Habitat Restoration Design
- > Biotechnical Engineering Design, including Engineered Logjams
- > Fish Passage (Fish Crossing)
- > Geographic Information System and AutoCAD
- > Construction Oversight
- > Post Construction Monitoring
- > Environmental Documentation and Permitting
- > Mitigation Planning

Upper Truckee River, Middle Reach Stream Habitat Restoration

Client: Public Works Department, City of South Lake Tahoe, CA

Cardno is providing engineering and restoration services to improve fisheries, wildlife habitat and water quality to Lake Tahoe. The effects of airport development, the creation of a marina and land use practices reduced floodplain connectivity and modified flow conditions of the river. As a result, the ecological values and water quality characteristics have been impacted. Cardno has been retained by the City of Lake Tahoe, the U.S. Forest Service, and the California Tahoe Conservancy to restore four distinct and contiguous reaches of the Upper Truckee River, a combined length of five miles of river channel.

For each project, Cardno ENTRIX was responsible for the design of the channel and floodplain restoration elements and development and evaluation of alternatives (including identification of a preferred alternative. Additionally, we led or significantly contributed to the completion of environmental review of the projects under CEQA, NEPA and TRPA requirements. Following completion of environmental review, Cardno was responsible for completing final project design and acquiring and managing implementation of environmental permits.

2011 Tahoe Regional Planning Agency ‘Best in Basin’ Winner: Upper Truckee River Restoration, Middle Reach

Monteith Park Watershed Restoration Project

Client: City of Charlotte Stormwater Services Huntersville, North Carolina

Cardno is providing turn-key stream, wetland, and watershed restoration services to City of Charlotte Stormwater Services leading the design/build efforts of the upper watershed of Monteith Creek. Cardno was responsible for site identification, securing the conservation easement, and developing stakeholder involvement with City of Charlotte Stormwater Services (CSWS), Mecklenburg County Stormwater Services, and the Monteith Park Homeowners Association.

In addition, Cardno is actively assisting in the development of the environmental credit valuation of the site, detailed design, and construction management for stream restoration, erosion control, wetland restoration, stormwater treatment,

and vegetated buffer restoration. A primary goal for the project is to develop mitigation credits for the City of Charlotte Umbrella Mitigation Bank.

Allatoona Creek Habitat Restoration and Stream Stabilization Project

Client: Cobb County Water System

Location: Cobb County, Georgia

A Cardno team of scientists and engineers were awarded a contract to perform stream restoration on 2,200 linear feet of Allatoona Creek in Georgia. This project is funded by a grant. Cardno performed a fish population study and found 17 species of fish inhabiting the stream including the federally listed Cherokee darter (*Etheostoma scottii*). Our staff also performed a habitat structural assessment and found that large sections of the project reach have good quality existing aquatic habitat. Based on these studies, Cardno modified the design approach so that preservation of existing habitats is prioritized and only minimal earth moving will occur during construction.

The modified design approach includes bank stabilization and planting in areas where the stream is actively eroding, placement of root wad revetments at key locations where banks are vulnerable to erosive forces, improvements to the riparian buffer to provide increased shade, and construction of habitat features at specific locations on the channel bed, downstream of the high quality habitat. No other locations on the bed of the channel will be impacted during construction. The project owner and regulatory agencies have been very pleased with the change in approach developed by Cardno. All parties agree that taking relatively simplistic measures to improve habitat conditions with minimal disturbance will represent the best path forward to utilize the grant

funding. Our staff was also responsible for final design, preparation of construction documents, permitting, and construction oversight.

Milburnie Dam Removal and Stream Restoration

Client: Restoration Systems LLC

North Carolina

Cardno has been hired to provide scientific and engineering services related to the removal of the Milburnie Dam in North Carolina. The first stage of dam removal is to slowly draw down the impoundment pool behind the dam to the level at which the deconstruction work will be completed. The draw down must be completed slowly to limit the sediment mobilization and transport through the dam structure. Cardno is very familiar with the significant potential for erosion and the impact on water quality that can result from river restoration and dam removal construction. We will prepare a sediment and erosion control plan required in order to obtain a sediment and erosion control permit.

Cardno is developing design documents to include a 30% conceptual design plan set; a 90% design plan set for permitting review, and a final set of bid documents. A sediment management plan, engineering report, and associated plan sheets, notes, and details to be included with construction documents. Also being developed is a No-Rise certification application and associated documents including a technical report, HEC-RAS output, and associated figures.



About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].