



water and natural resources

river and riparian restoration

geomorphic assessments and sediment transport

watershed master planning

federal, state, and local regulatory support

hydraulic and hydrologic modeling and analysis



HanmiGlobal Partner



RIVER AND RIPARIAN RESTORATION

Services and Project Example

- Stream design for habitat and natural form/function
- Streambed/streambank stabilization including bioengineered treatments
- Stream corridor assessment/survey
- Technical support for grant fund acquisitions
- Construction costing, bid support, and oversight
- Design-build approach and native revegetation transplanting

Upper South Boulder Creek Aquatic Habitat Improvements; Gilpin County, CO

This creek is a popular fishing destination; however, water delivery from the Moffat Tunnel creates unnaturally high peak flows that posed a challenge to fish survival. Otak engineers designed deep water pools, point bars, and roughness elements targeted to specific discharges based on hydrologic/geomorphic analyses and hydraulic models. Otak located enhancement features based on the locations of existing grade breaks and overhanging vegetation, as well as existing angling access points and adjacent roadway and railroad embankments. The constructed project, which included coordination with multiple stakeholders and received praise from the local angling community, maintains the site's natural appearance, disperses energy at high flows, and supports fish survival in this challenging environment.



GEOMORPHIC ASSESSMENTS AND SEDIMENT TRANSPORT

- Geomorphic characterization, process modeling, hazard mapping
- Channel evolution assessments
- Sediment transport analyses and modeling
- Bed stability and scour analyses
- Sediment budgets
- Terrain modeling (LiDAR, Softcopy Photogrammetry)

Left Hand Creek Geomorphic Risk Assessment; Boulder County, CO

Staff developed a master plan for a flood-ravaged watershed to identify projects that increase the resiliency of the watershed to future flood events. The plan incorporated geomorphic, biologic, and hydrologic risk assessments performed throughout the watershed. Given the sediment loads available in the flood-prone watershed, the geomorphic assessment involved channel evolution and habitat quality assessments, and addressed sediment transport processes that guided appropriate conceptual designs to successfully address the highly challenging unstable state of post-flood sediments and prevent further destabilization or loss of restoration investments. The River Styles framework was used to develop concepts that communicate risk and channel trajectories for every project reach.



FEDERAL, STATE, AND LOCAL REGULATORY SUPPORT

Otak offers full-service permitting capabilities for our projects:

- Sections 404 and 401 of the Clean Water Act, including coordinating concurrence from commenting agencies (CPW, USFWS, US EPA, CDPHE, CDRMS)
- Floodplain permitting (FEMA and local regulations)
- NEPA baseline, alternative, mitigation measure development
- Colorado Discharge Permit System permits
- Local land use planning, grading, right-of-way permits
- UDFCD Maintenance Eligibility Program acceptance
- Monitoring inspections and reporting for permit compliance
- Water quality monitoring and analyses

McIntyre Gulch Permitting, Design, and Construction; Denver, CO

On this award-winning channel enhancement project, staff worked with several regulatory agencies to secure floodplain development and Section 404 permits, as well as UDFCD concurrence. Throughout construction, we communicated design changes to each agency and obtained permit modifications. Staff also provided long-term monitoring, reporting, and regulatory coordination for final UDFCD Maintenance Eligibility Program acceptance and Section 404 permit release.

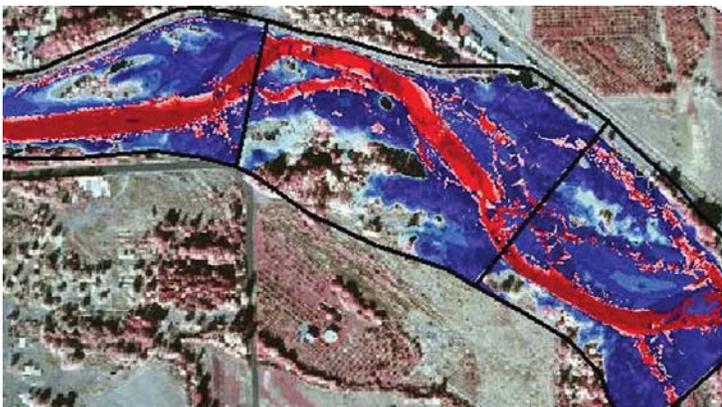
The engineers and scientists that make up **Otak's Colorado Water and Natural Resource Team** are known for innovative solutions that maximize natural form and function for complex restoration and engineering projects, which always entail diverse and sometimes directly competing technical issues and project goals. We are dedicated to meeting our clients' needs and solving project challenges through constant innovation and applying our breadth and depth of technical expertise. The team is motivated by a shared vision of ecologically- and process-based river restoration that works with the river to promote natural form and function within site constraints, rather than attempting to tame it with hard engineering. Our approach is founded on a comprehensive understanding of river and hillslope processes and strives to utilize the natural materials that are key components of the processes and contexts of the river systems. Individual sites or reaches are assessed holistically to successfully accommodate processes that operate at the site-, reach-, and watershed-scale allowing us to efficiently produce defensible designs that incorporate prevailing process regimes (e.g., sediment transport, flood) and onsite natural materials to re-establish river and biologic function. This approach has been consistently proven by projects that maximize stream health and function and simultaneously increase safety and reduce future infrastructure damage. We share the belief that it is only through this combination of improved flood protection and stream health that we can create resiliency in our communities, economies, and river systems.

“This was an outstanding project that exemplifies how much more can be achieved when forces join together...enhancements to fish habitat in South Boulder Creek could not have been done by any of us alone.”

- Sylvia Clark, USFS Boulder District Ranger on the Upper South Boulder Creek Habitat Improvement Project

“We have benefited from your unique engineering skill sets, which are heavily blended with ecological practices...the Watershed Council, the local community, and the guides who use the river to earn a living are extremely happy with this restoration project.”

- Eagle River Watershed Council Board on the Eagle River at Edwards Restoration Project



HYDRAULIC AND HYDROLOGIC MODELING AND ANALYSIS

- 1D hydraulic modeling (HEC-RAS, HEC-GeoRAS)
- 2D hydrodynamic modeling (River2D, FESWMS, iRIC)
- GIS and spatial data modeling (ArcHydro)
- Flood frequency analysis
- Hydrologic modeling (HEC-HMS, HEC-GeoHMS, VIC, PRMS)
- Bridge and culvert hydraulic design and assessment

Naches River 2D Modeling of Stream Channel Dynamics; WA
Staff examined stream channel dynamics using 2D hydrodynamic model (River2D) on a reach of the Naches River; a wandering gravel-bed river located in Washington State. Using a LiDAR data set and 2D hydraulic model output, spatially distributed process variables (e.g., shear stress and stream power) were computed. In a geographic information system, fuzzy logic was used to model flow transition zones and the resulting data model, through its incorporation of system spatial and temporal variability, provided an alternative to the static classifications traditionally employed in fluvial research. Resource managers, armed with an explicit assessment of model uncertainty, can then optimize the allocation of limited resources on projects with the greatest probability of success.



WATERSHED MASTER PLANNING

- River and riparian restoration opportunity identification
- Project prioritization using decision matrix
- Erosion hazard/channel migration zone assessment/mapping
- Flood recovery, flood hazard mitigation
- Floodplain mapping and risk assessment
- Technical support for grant fund acquisition
- Stakeholder engagement and capacity/consensus building

Fall River and Fish Creek Corridor Master Planning; Estes Park, CO
Staff led two watershed master planning efforts, applying a risk-based approach for comprehensive understanding of the stream corridors. Through coordination with project stakeholders, recommendations were made for recovery and restoration projects and policies that will lead to increased resiliency for the community, as well as for the stream corridors, while also positioning these watersheds for best performance in upcoming flood recovery implementation funding awards. By adding the new tools of flood consequence and geomorphic hazard identification to previous inundation mapping, these projects improve hazard prediction and inform planning and prioritization efforts to identify the most critical and cost effective mitigation and restoration projects.



“From the initial design phase through the finished product, their performance has been second to none. I have been very impressed with the amount of knowledge and technical skills...all jobs are completed without missing any steps...permitting to construction...all designs are built to fit the budgets without sacrificing the overall goals.”

- Paul Klees, C Lazy U Ranch Project Manager on Willow Creek Restoration Projects



- Brian Varrella, Chair for Colorado Association of Stormwater and Floodplain Managers, recognized our team for...

“tremendous commitment to engineering excellence in floodplain management” and “exemplified leadership in recovery and commitment to the communities of the Front Range and Eastern Plains.”



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- 1 East River at Roaring Judy Construction; Crested Butte, CO
- 2 Mesa Trail Ranch Flood Recovery Stream Stabilization and Enhancement for South Boulder Creek; Eldorado Springs, CO
- 3 Ralston Creek Flood Repair and Bank Stabilization; Arvada, CO
- 4 River Point at Sheridan Water Quality Swale; Sheridan, CO
- 5 C Lazy U Ranch Willow Creek Stabilization and Enhancement; Granby, CO

Front Cover Eagle River Restoration at Edwards, CO—photo looks downvalley from a high bluff at the wide floodplains of this unique reach of the river; with the abrupt return to narrow v-shaped valley conditions visible in the background. Otak engineers served as technical lead for this multi-phased project that restored 1.6 river miles and over 80 acres of riparian corridor and reconnected over 50 continuous miles of high-quality riparian and aquatic habitat that were fragmented by past degradation.



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