

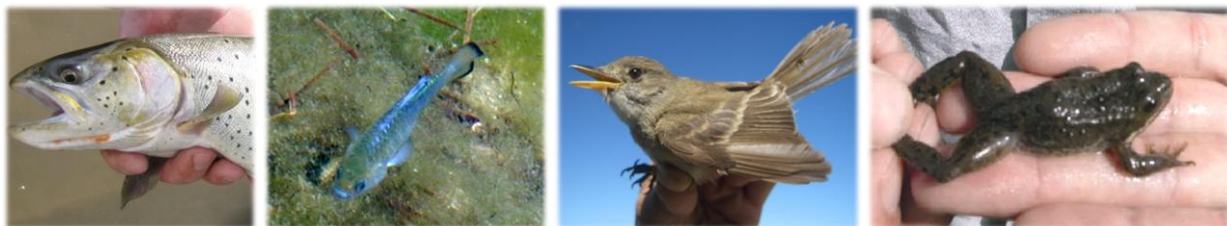
OTIS BAY ECOLOGICAL CONSULTANTS - STATEMENT OF QUALIFICATIONS

Otis Bay Ecological Consultants (OBEC) is a small ecological consulting firm based out of Washoe County, Nevada, whose primary specialties are river rehabilitation and enhancement, spring rehabilitation and enhancement, and upland landscape restoration of Great Basin and Mojave ecosystems. OBEC provides a unique mix of expertise in the fields of biological, environmental, and physical sciences as they apply to ecosystem restoration, ecosystem protection, and sustainable ecosystem recovery. Its team of experts has proven experience working with sensitive species and associated habitats. OBEC has a record of completing successful restoration projects that have increased populations of conservation target species while enhancing aesthetic values of the land and creating opportunities for outdoor recreation.

Mission Statement

The primary mission of OBEC is to restore the processes and functions of native ecosystems in order to preserve our biological heritage. OBEC focuses on the restoration of physical and ecological processes to sustain an ecosystem's native species while simultaneously promoting the system's values for human enjoyment. To improve critical ecological functions, OBEC designs restoration projects that apply knowledge of natural environmental processes in disturbed systems. In order to restore a sustainable ecosystem, OBEC employs the following methods:

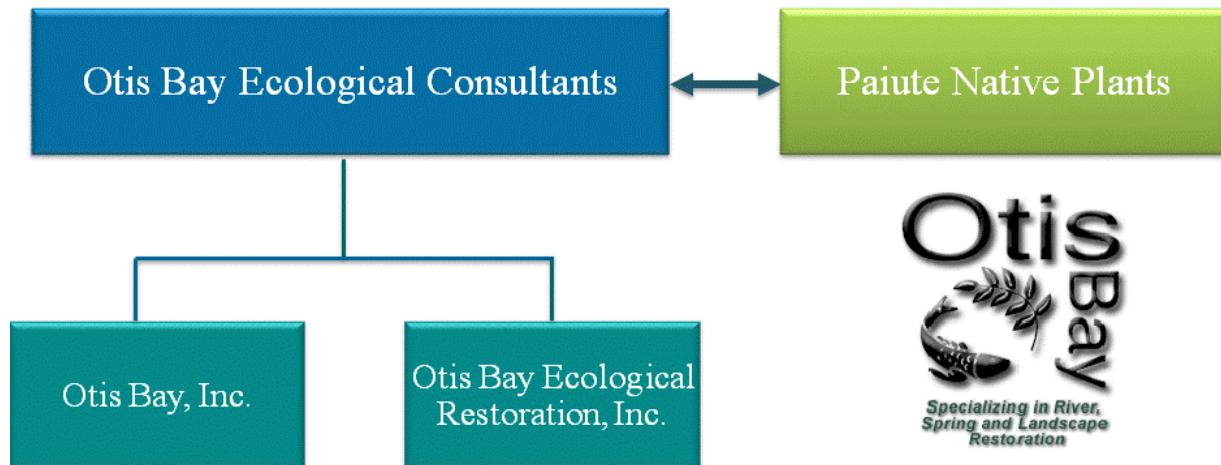
- Site assessments and studies of the physical and biological environment are designed to understand the ecological processes that maintain riverine, spring, wetland, riparian, or upland environments and which, in turn, support native plant and wildlife communities.
- The pre-disturbance condition is characterized to determine the degree of disturbance.
- Less disturbed sections of the project system, and/or an analog system in a similar environment, are examined and used as models for a restoration template.
- Analytical techniques (e.g., modeling and mapping) are implemented to develop appropriate restoration designs.
- Designs are developed that are consistent with natural features and that will be supported and sustained by natural processes.



OBEC's habitat restoration projects aim to preserve and protect a number of conservation priority species such as (from left to right): the Lahontan cutthroat trout (Threatened – Humboldt, Truckee, Carson and Walker Rivers, and McDermitt Creek), the Ash Meadows pupfish (Threatened - Ash Meadows NWR), the southwestern willow flycatcher (Endangered - Pahranaagat NWR), and the Columbia spotted frog (Imperiled in NV - Reese River), along with many other species not pictured here.

Otis Bay Team Background

Otis Bay Ecological Consultants (OBEC) is an integrated team of two small business corporations that work closely together to restore native riparian and upland landscapes. Otis Bay, Inc. is the primary design and ecological consulting team that provides planning expertise to guide construction implemented by its affiliate company, Otis Bay Ecological Restoration, Inc. OBEC works closely with a third partner company, Paiute Native Plants, Inc., a Native American owned company that specializes in the production of native plants for ecological restoration projects. Working together, these three companies complete ecological restoration projects from initial concept and design phase, through to construction, implementation, and re-vegetation. As a team, these three companies have a breadth of diversified experience that spans decades, assuring successful and ecologically responsible restoration solutions.



We are capable of completing quality projects that range from large scale river restoration to small wetland and spring restoration. OBEC has substantial experience in ecosystem-based instream flow studies, restoration monitoring, and conservation planning for sensitive species. OBEC is knowledgeable in dealing with resource and regulatory agencies on the state and federal level, and we have developed expertise in our ability to work with engineers to develop feasible solutions for the needs of both humans and the environment.

Team members have training and expertise in the following fields:

- *Ecological Engineering*
- *Civil Engineering*
- *Landscape Architecture*
- *Soil Bioengineering*
- *Hydrology*
- *Geomorphology*
- *Geology*
- *GIS Analysis and Mapping*
- *Hydrogeology*
- *Plant Ecology*
- *Botany*
- *Wildlife Ecology*
- *Multivariate Statistics*
- *Plant Propagation*

Team members are also highly capable and trained in the following technical skills:

- *Habitat Assessments*
- *Restoration Assessments*
- *Restoration Recommendations*
- *Restoration Design*
- *Vegetation Mapping and Monitoring*
- *Wetland Delineation*
- *Revegetation Planning & Implementation*
- *Wildlife Monitoring*
- *Instream Ecosystem Flow Studies*
- *Sediment Transport Assessments*
- *GIS Modeling*
- *Land and Topographic Surveying*
- *HEC-RAS Hydraulic Modeling*
- *Auto-CAD Drafting*
- *Construction Engineering*
- *Construction Machinery Operation*
- *Fish Barrier/Passage Design & Construction*
- *Technical Report Writing*
- *NEPA Permitting*
- *Public Presentations*

Major Projects



OBEC strives to restore natural river patterns and habitat diversity to benefit wildlife and provide recreational opportunity for all to enjoy. Examples of river restoration components include: 1) riffles and variable channel bed substrates that create places of faster flowing water and habitat for aquatic invertebrates and fish; 2) off-channel wetland habitats that create lush riparian zones critically important for many wildlife species; 3) natural channel meanders and a connected floodplain that are essential components of river function and ecosystem integrity; and 4) recreational trails and facilities that invite the community to enjoy the restored river. Photo location – Truckee River, NV.

Nevada Projects

Truckee River

Truckee River Ecosystem-based Instream Flows – *Client: US Fish and Wildlife Service (USFWS), 1995*

OBEC helped to develop an ecological instream flow model for the Truckee River that encompassed life history characteristics of river-dependant processes. Using this model, OBEC formulated a matrix for water release based on water availability within and between years. This ecological instream flow regime was implemented beginning in 1995 and remains in operation today. Benefits of the ecosystem instream flow prescription for the Truckee River include the natural recovery of cottonwood-willow riparian forest and improved habitat conditions for aquatic organisms.

Truckee River Geomorphic Assessment and Preliminary Restoration Design – *Client: US Army Corps of Engineers, 2003-2004*

OBEC completed a watershed-scale ecologic, geomorphic, hydrologic, and restoration assessment of the lower Truckee River from Vista to Pyramid Lake, Nevada, to identify sites suitable for restoration and habitat enhancement activity. OBEC proposed Truckee River restoration activities to recover lost riparian forest, wetland, and wildlife habitats, improve water quality, and boost threatened and endangered fish populations.

McCarran Ranch Property – *Client: The Nature Conservancy of Nevada (TNC), 2003-2006*

OBEC developed and implemented a restoration plan for approximately 5 miles of the Truckee River corridor. The restoration design included river construction that entailed riffle, point bar, pool, and channel meander creation, bank stabilization, and wetland habitat construction. Bank and upland restoration featured weed management and native riparian and upland vegetation community planting efforts, underground burrow habitat construction, and recreational trail construction. The project also included field surveys and analyses of the historical abundance and habitat use of birds and amphibians along the Truckee River to assess the current status of populations and habitat availability.

102 Ranch – *Client: TNC, 2008*

In an ongoing series of large-scale river restoration efforts on the lower Truckee River, OBEC hydrologists conducted on the ground topographic surveys and HEC-RAS modeling to determine potential river and wetland designs for restoration on the 102 Ranch. OBEC then provided design, construction work and construction oversight for the creation of multiple new river meanders, riffles, wetlands, and adjacent sloped uplands.

Lockwood Property – *Client: Washoe County, 2008-2009*

OBEC developed a restoration plan for approximately one mile of the lower Truckee River corridor that included the design and construction of a new channel meander, an outdoor-recreation park, and visitor facilities.

Crystal Peak Park Spawning Channel, Truckee River, Nevada – Client: Washoe County Parks, 2009

Based on studies of redd sites, OBEC designed and constructed a spawning channel for Lahontan cutthroat trout on a cold-water section of the Truckee River in an effort to increase trout populations.

Marble Bluff Fishway, Lower Truckee River – Client: USFWS, 2010

OBEC designed and constructed a naturalized channel to replace the existing fishway located by the Marble Bluff Dam, thereby improving passage and spawning opportunities for the endangered cui-ui sucker, Lahontan cutthroat trout and other native Truckee River fish.

Dorostkar Park Revegetation, Reno – Client: Nevada Land Conservancy and Washoe County Parks, 2011-2012

OBEC designed and implemented an invasive weed control and revegetation plan for Dorostkar Park, a unique and valuable asset to the Truckee Meadows community. Three gardens containing native shrubs such as mountain mahogany, big sagebrush, and antelope bitterbrush were planted and have been successful.

Wadsworth Tile Drain Wetland – Client: Pyramid Lake Paiute Tribe, 2014

Otis Bay designed and constructed a wetland for treatment of agricultural drain water entering the Truckee River via the Wadsworth tile drain.

Ash Meadows National Wildlife Refuge (AHME)

Kings Spring and Point of Rocks Restoration – Client: USFWS, 1997-1998 (Kings) and 2001-2002 (Point of Rocks)

In the 1970s, prior to the establishment of AHME, springs located at Point of Rocks and Kings Spring were excavated and developed for agricultural use. OBEC completed site analyses of the spring drainages, then designed and constructed restored spring pools and stream channels for several endangered and endemic aquatic and riparian species. For the Kings Spring restoration, OBEC re-connected the spring with an adjacent alluvial fan to restore sediment input, re-created a natural spring pool with rock shelves to provide breeding areas for the Ash Meadows pupfish, and constructed a natural, meandering outflow channel. At Point of Rocks, OBEC constructed several spring pools and an outflow channel with native plantings. Today the native mesquite and ash forest is recovering nicely, and visitors to the area can now learn about and view the rejuvenated springs along a recreational boardwalk area that highlights the history, ecology, and recovery of the Kings and Point of Rocks Springs.

Ash Meadows Geomorphic and Biological Assessment – Client: USFWS, 2005-2006

Ash Meadows supports endemic and rare animal and plant species found nowhere else in the world. OBEC and Stevens Ecological Consulting completed a comprehensive geomorphic, hydrologic, ecologic, and restoration assessment of AHME to provide recommendations for riparian ecosystem preservation and restoration. This report continues to provide a valuable reference for ongoing restoration projects.

Habitat Design and Construction of the Jackrabbit Spring Outflow Channel – Client: USFWS, 2006-2009

To restore aquatic habitat for native spring-dwelling fish, OBEC removed tamarisk and cattails, removed existing berms, filled in artificial impoundments with local soils, constructed a stream channel, placed local rock in the streambed, and replaced two undersized culverts to facilitate fish passage. Planting crews collected locally-established native plants and transplanted them to the restoration site. Observers found both of the conservation target fish species, the Ash Meadows pupfish (*Cyprinodon nevadensis mionectes*) and the Ash Meadows speckled dace (*Rhinichthys osculus nevadensis*), in the new outflow channel shortly after construction.

Ash Meadows Paleoecology Study – Client: USFWS, 2007-2010

A study of paleoecological conditions at Ash Meadows was completed to improve the understanding of historical vegetation composition. Soil cores collected for pollen, ostracode, charcoal, and radiocarbon analysis in this study provided data to help inform restoration and management decisions by determining Ash Meadows habitat types prior to European settlement.

School Spring Pupfish Refuge – Client: USFWS, 2007-2010

In 2008, OBEC removed deteriorating concrete pools containing exotic and invasive aquatic invertebrate species and created a better, more naturalized, stable spring channel habitat to harbor rare native pupfish, springsnails, and other aquatic invertebrates. This restoration served as an experiment to determine the best approach to habitat construction and restoration for other springs within the Warm Springs complex. The restored School Spring now serves as a storage site for native aquatic species for additional Warm Springs restoration efforts.

Indian Springs Restoration – Client: USFWS, 2008-2011

The Indian Springs Restoration focused on the restoration of natural spring hydrology to increase habitat for rare endemic species, while preserving areas containing rare, threatened, and endangered alkali meadow plants. Components of habitat restoration at North and South Indian Springs included the restoration of spring outflow channels to their approximate historical locations, eradication of non-native crayfish and mosquitofish, creation of naturalized spring habitats with natural downstream thermal gradients for thermal endemic aquatic species, and recovery of the native bank vegetation.

Upper Carson Slough Restoration – Client: USFWS, 2008-2011

OBEC restored the lower Fairbanks spring channel in the Upper Carson Slough to enhance habitat for sensitive native fish and aquatic invertebrates. Construction crews excavated naturalized channels, installed a concrete box culvert under one road crossing, installed two concrete fish barriers, placed channel bed substrate into the new channel, and sloped and graded channel banks for re-vegetation. Native fish were locally salvaged and placed into the restored channel.

Upper Carson Slough Backcountry Trail Plan – Client: USFWS, 2010-2011

OBEC designed a recreational hiking trail system around restored spring sites in AHME that includes loop and spur trails, parking areas, overlook areas, and boardwalk designs.

Upper Carson Slough and Crystal Spring Management Units Assessment – Client: USFWS, 2007-2012

OBEC built upon knowledge gained from previous studies and spring restoration projects on AHME to develop spring restoration strategies in the Upper Carson Slough and Crystal Spring Management Units. This report addressed removal of hydrologic barriers and returning spring channel alignments to patterns that can be sustained by natural processes in a dynamic system. Factors such as existing topography, natural hydrology, archaeological site locations, rare species locations, and presence of weeds or invasive aquatic species were considered in the restoration design process.

Walker River

Rosaschi Ranch Re-vegetation – Client: Humboldt-Toiyabe National Forest and USFWS, 2004-2005

OBEC assessed and developed a re-vegetation plan for the Rosaschi Ranch, a property on the East Walker River that is renowned for quality trout fishing. OBEC implemented the first phase of the re-vegetation plan, which included wetland creation and riparian tree and shrub plantings.

West Walker River Fly Fishing Ranch – Client: Clear Creek Ranch, 2008

OBEC completed abiotic water measurements, benthic aquatic invertebrate surveys, and fish snorkel surveys to determine if a stretch of the West Walker River could sustain a recreational cold-water fishery. The completed report included a habitat assessment, recommendations for instream and riparian habitat improvements, and a conceptual recreational trail plan to accommodate fly-fishing enthusiasts and nature lovers.

Walker River Biophysical Assessment – Client: USFWS, 2008-2010

OBEC completed a comprehensive biophysical assessment of the Walker River Basin to determine the condition of the ecosystem. Our team 1) modeled hydrology, hydraulics, and sediment transport in the basin to determine the degree of alteration; 2) analyzed channel planform changes in river channel sinuosity and length, active channel area, and channel width; 3) conducted baseline bird monitoring along the river corridor; 4) determined the extent (via complete riparian mapping) and condition of the riparian forest; and 5) evaluated changes in riparian vegetation community types, for the purpose of developing recommendations for recovery of the riverine ecosystem. This extensive biophysical assessment is part of a large, ongoing project intended to aid in ecosystem recovery of Walker Lake and the Walker River.

Tamarisk Removal and Native Re-vegetation on the Walker River Paiute Reservation – Client: Walker River Paiute Tribe, 2008-2010

OBEC initiated an 80-acre demonstration plot in 2008 to test tamarisk removal and native re-vegetation procedures. Since 2009, treatments have been gradually expanded as part of a strategic plan to remove tamarisk and re-establish native plant communities to over 1,600 acres of Tribal Lands.

Sediment Transport Study – Client: USFWS, 2011-2013

OBEC established sampling sites and a sampling protocol for collection of bedload and suspended sediment samples throughout the Walker River, Nevada. Sediment data was analyzed to develop relationships between sediment transport and streamflow of the Walker River.

Mason Valley Restoration Planning – Client: USFWS, 2012-2013

OBEC coordinated with clients, determined desired goals, performed field studies, completed assessments of existing habitat conditions, developed models to determine appropriate restoration designs for wildlife and recreational use, and completed designs for a channel restoration pilot project on the Mason Valley Wildlife Management Area near Yerington, NV.

Mason Valley Channel Restoration – Client: Sweat, LLC, 2014

OBEC completed an environmental assessment for implementation of channel restoration on the Mason Valley Wildlife Management Area. Project components included tamarisk removal, vegetation enhancement, and construction of river meanders, wetlands, hillocks, trails, a footbridge and parking areas.

Walker River Paiute Tribal Land Vegetation Mapping and Enhancement – Client: USFWS, 2013-2014

Sampling was conducted along approximately 20 miles of Walker River corridor within the Walker River Paiute Reservation, beginning about 16 miles upstream and ending about 4 miles downstream of Weber Reservoir. Using this data, OBEC designed a plan for enhancing the ecological function of the Walker River upstream of Schurz, NV.

Desert National Wildlife Range – Moapa National Wildlife Refuge

Upper Muddy River – Client: Clark County and TNC, 2005

OBEC completed a geomorphic assessment of a thermal spring-fed river and prepared recommendations for the restoration and preservation of a desert riparian ecosystem. The project area includes habitat for thermal endemic invertebrates and fish such as the endangered Moapa dace.

Moapa Wildlife Preserve-Endangered Fish Habitat and Visitor Interpretive Facilities – Client: USFWS, 2001-2006

The Moapa Valley National Wildlife Refuge's Warm Springs complex harbors several rare aquatic species including the Moapa dace (*Moapa coriacea*), Moapa speckled dace (*Rhinichthys osculus moapae*), Moapa White River springfish (*Crenichthys baileyi moapae*), Moapa pebblesnail (*Pyrgulopsis avernalis*), Moapa water strider (*Rhagovelia becki*), and the Moapa naucorid (*Usingerina moapensis*). OBEC developed and constructed a restoration plan for a series of geothermal springs and the surrounding riparian areas to protect these and other native species within the Warm Springs system. Spring restoration included the removal of recreational swimming structures and the restoration of natural springs and outflow channels. A fish-viewing window was designed and constructed along one side of stream channel so that visitors could view some of the rare aquatic species in their natural habitat. OBEC also provided the design and construction of additional visitor facilities that include a picnic area, paved trail, an informational kiosk, restrooms, and a parking lot.

Apcar Stream Channel – Client: USFWS, 2009-2010

OBEC created naturalized spring pool and channel habitat with variable water flows, temperature gradients, and bottom substrates to provide habitat for the endangered Moapa dace and a suite of other sensitive aquatic species. Invasive, non-native palm trees were removed and native re-vegetation efforts are ongoing to promote a natural riparian bank community.



OBEC's restoration projects incorporate attractions designed to enhance public visitation and recreation. Examples include (from left to right): 1) a stream-viewing chamber showcasing rare endemic fish in a natural stream at Moapa NWR; 2) informational signs along a walking trail at Lockwood Park on the Truckee River; 3) a refugium to house the endangered Pahrump poolfish at Corn Creek National Wildlife Refuge; and 4) a boat launch on the Truckee River that has become a popular swimming and fishing spot.

Desert National Wildlife Range - Pahrnat National Wildlife Refuge

Pahrnat Roundtail Chub Refugia and Spring Restoration – Client: USFWS, 2010-2012

OBEC developed design and restoration plans of Cottonwood and L Springs to create natural habitat for the endangered Pahrnat roundtail chub and rare Pahrnat speckled dace. OBEC constructed the project in 2010 and was commended on the timeliness and quality of the project.

Refuge-wide Wetland Restoration Design – Client: USFWS, 2010-2013

OBEC developed a restoration plan with recommended actions to improve natural wetland habitats on the Pahrnat National Wildlife Refuge. Multiple task reports were completed: 1) Black Canyon channel restoration and environmental assessment; 2) a habitat enhancement plan for the endangered southwestern willow flycatcher, sandhill crane, and other migratory birds; and 3) assessment and improvement of water control structures on the refuge. Structural designs for 3 dikes that control water in the Middle Marsh were developed, along with a channel restoration plan for the Headquarters area, to improve habitat function, quality, and acreage for conservation priority species. Areas on the refuge were prioritized for habitat enhancement or restoration based on need, presence of conservation priority species, and feasibility.

Black Canyon Restoration – Client: USFWS, 2012

Channel restoration in Black Canyon was proposed to transform a fallow agricultural field that was infested with invasive knapweed into productive wildlife habitat. OBEC consulted with refuge managers and designed a channel based on existing water budget restraints. Channel construction was completed in 2012, and native plantings were conducted in 2013-2014.

Humboldt River

Maggie and Susie Creek Fish Barrier Design – Client: Bureau of Land Management (BLM), 2010-2011

Maggie and Susie Creeks are tributaries to the Humboldt River and are designated recovery sites of the federally threatened Lahontan cutthroat trout (LCT), but non-native fish in the Humboldt River threaten native LCT through predation, competition, and hybridization. OBEC completed fish barrier designs for both Maggie and Susie Creeks that included construction material recommendations, barrier design plan drawings, construction specifications, and a construction sequence.

North Fork of the Humboldt River Fish Barrier and Fish Passage – Client: USFWS, 2013-2014

OBEC designed a fish barrier that includes a fish passage feature which can be opened or closed at the discretion of wildlife biologists. The fish barrier and closed passage would initially prevent upstream migration of brook trout into 4 miles of native Lahontan Cutthroat Trout (LCT) habitat. If brook trout can be successfully eradicated from the stream in the future, then the fish passageway could be opened to allow LCT passage. To enhance potential fish passage, OBEC also designed step-pool features within the downstream section leading up to the fish barrier. OBEC completed a geotechnical investigation and hydrologic analysis to determine appropriate fish barrier design materials, construction sequencing, and earthwork needs.

Pratt Creek Infiltration Gallery – Client: USFWS, 2012

To prevent fish from entering an irrigation storage pond, OBEC designed a water diversion that also acts as a fish barrier. A piped gallery structure covered with rock was constructed to allow water to infiltrate the gallery while excluding fish and debris.



An example of a desert spring project: OBEC restored Corn Creek on the Desert National Wildlife Range in southern Nevada from a concrete-lined ditch to a natural meandering channel with native desert and riparian plant communities.

Desert National Wildlife Range – Corn Creek Field Station

Desert National Wildlife Refuge Corn Creek Restoration and Refugium – Client: USFWS, 2002

To aid conservation efforts for the endangered Pahrump poolfish (*Empetrichthys latos latos*), OBEC restored several spring pools and their associated outflow channels to their historical nature. OBEC also designed and provided construction oversight for a Pahrump poolfish refugium.

Corn Creek Spring Restoration and Revegetation Design – Client: USFWS, 2011

OBEC restored the Corn Creek spring head and outflow channel to its likely pre-disturbance condition. The restoration project entailed construction of a naturalized outflow channel that divided into multiple channels and terminated in a marsh/riparian area. OBEC designed a vegetation plan to revegetate the restored spring channel and support unique native wildlife, fish, and springsnail species that are endemic to this area.

Carson River

Assessment and Recommendations to Recover the Middle Carson River – Client: BLM, 2004-2008

OBEC completed a comprehensive geomorphic, hydrologic, ecologic, and restoration assessment of the middle Carson River to provide recommendations for riparian ecosystem preservation and restoration.

Ruby Lake National Wildlife Refuge

Relict Dace Restoration – Client: USFWS, 2011-2012

In 2011, OBEC removed invasive vertebrate and invertebrate species (primarily bass and signal crayfish) from several drainages and constructed ponds with crayfish and fish barriers to prevent non-native species from re-entering relict refugia areas. Results of genetic testing, biological surveys, and background research were used to locate three source populations of relict dace for stocking new refugia ponds. Relict dace were introduced into new refugia ponds in 2012.

Reese River

Reese River Basin Columbia Spotted Frog Habitat Restoration – Client: USFWS, 2004

OBEC completed a design-build project to enhance and create spotted frog habitat. Twenty ox-bow pond wetlands were built with varying shapes, sizes, and depths to include frog breeding, foraging, and overwintering microhabitat features.

Reese River Water Diversion – Client: Yomba Shoshone Tribe, 2007

OBEC rebuilt a deteriorating water diversion that was blocking fish passage and promoting a deep headcut erosion. OBEC removed the old diversion and designed a diversion that would direct water as needed by the Tribe, allow for fish passage, and arrest the migrating headcut.

McDermitt Creek

McDermitt Creek Fish Barrier – Client: USFWS, 2009-2010

OBEC designed and constructed the McDermitt Creek Fish Barrier in the Quinn River drainage to protect native Lahontan cutthroat trout. OBEC has designed and constructed many fish barriers across Nevada. This project was the first American Recovery and Reinvestment Act project completed in this state.

Amargosa Valley

Parker Ranch – *Client: TNC, 2004*

OBEC developed a restoration plan for spring pools and channels on the 524-acre Parker Ranch to protect and restore its unique biological resources, including the endemic Amargosa toad (*Bufo nelsoni*), Oasis Valley speckled dace (*Rhinichthys osculus* ssp.), and a rich neotropical migratory bird community.

Stuart Ranch

Stuart Ranch Biophysical Assessment and Ecological Recovery Plan – *Client: BLM, 2009-2010*

In order to analyze current disturbance conditions and propose restoration alternatives, OBEC completed vegetation mapping, hydrology analysis, faunal research, cultural background and soil analysis on the Stuart Ranch property. Located in the Meadow Valley Wash, this property contains important potential habitat for the endangered southwestern willow flycatcher and sensitive fish species. Because this site also harbors important cultural resources, OBEC developed a recovery plan to enhance the existing habitat for wildlife and a recreational trail and public use plan to protect historic cultural artifacts.

Willow Creek

Willow Creek Watershed Assessment – *Client: US Forest Service, 2007*

OBEC completed a watershed assessment to aid resource and recreation management actions. A former dam along Willow Creek was overtopped during a flood event, resulting in stream channel incision and degradation of riparian habitat. This assessment recommended ecologically appropriate solutions for removing the dam and restoring the incised stream channel, and also provided a recreational use plan to protect restored natural resource areas.

Silver Creek

Gabion Fish Barrier – *Client: Nevada Department of Wildlife, 2012*

OBEC designed and constructed a fish barrier to prevent non-native trout present in lower Silver Creek from accessing approximately 8.7 miles of potential Bonneville cutthroat trout habitat in the upper Silver Creek basin. Rock-filled gabions were used to construct the fish barrier according to parameters developed by the Nevada Department of Wildlife.

Florida Project

Virginia Key Ecosystem Restoration – *Client: U.S. Army Corps of Engineers, 2012-2013*

The Virginia Key Ecosystem Restoration Project involved removal of non-native, invasive plants within 50 acres of coastal dune, tropical hardwood hammock, and wetland habitats. Native plantings of approximately 25,000 native plants were conducted in these areas as well as in an additional 8 acres of dune habitat. OBEC also constructed a multi-use recreational trail to provide visitors with more opportunities to explore the park.

California Projects

Owens Valley

Hines Spring, Owens Valley – *Client: Los Angeles Department of Water and Power (LADWP), Inyo County, and Ecosystem Sciences, 2004-2005*

OBEC completed a site assessment and restoration design for water mitigation. Although Hines Spring is dry, OBEC deemed it a potential mitigation refuge site for native Owens Valley fish, including the endangered Owens River pupfish (*Cyprinodon radiosus*) and two California Species of Special Concern, the Owens speckled dace (*Rhinichthys osculus* ssp.) and Owens sucker (*Catostomus fumeiventris*).

Baker and Hogback Creek Restoration Design, Owens River – *Client: LADWP, Inyo County, and Ecosystem Sciences, 2004-2005*

OBEC completed a site assessment, vegetation map and restoration design/management plan for yellow-billed cuckoo habitat along Baker and Hogback Creeks. Otis Bay worked with multiple agencies and landowners to determine land management and re-vegetation options to enhance nesting habitat for yellow-billed cuckoos (*Coccyzus americanus*) along these two creeks.

Utah Projects

Provo River Restoration – *Client: Utah Reclamation Mitigation and Conservation Commission (URMCC), 1998-2004*

As the restoration project manager for URMCC, Chad Gourley initiated channel design and construction of the Provo River within a federally purchased corridor for river, riparian, wetland, and upland ecological restoration. As restoration efforts progressed, Mr. Gourley supervised seven ecological studies designed to monitor and adaptively manage the restoration project's goals of creating habitat for native species' recovery. Restoration continues today, with 12 miles of river restored to date.

East Fork of the Sevier River – *Client: State of Utah, 1988*

As the project leader, Chad Gourley supervised the relocation of 2,500 feet of river channel as part of a highway construction project. Following project completion, the Utah State Division of Wildlife documented a 400% increase in fish biomass in a five-year period.

Studies and Research



OBEC conducts a variety of ecological studies to monitor and aid in the design of its restoration projects. Samples depicted here include (from left to right): 1) vegetation mapping along multiple riparian systems including the Walker River, shown here; 2) macroinvertebrate sampling at Moapa NWR; 3) a cottonwood dendrochronology study on the lower Truckee River; and 4) fall migration bird banding at Pahranaagat NWR.

Nevada

Mud Meadows

Macroinvertebrate Sampling – OBEC biologists inventoried aquatic macroinvertebrates in hot springs and mapped spring vegetation communities for completion of a spring complex habitat assessment.

Little Valley

Impacts of Livestock Grazing on Riparian Birds – OBEC conducted a study of bird populations and avian nest success to identify relationships with livestock grazing regimes.

Truckee River

Instream Flows, Truckee River – OBEC assessed instream flow requirements to restore and maintain a healthy ecosystem throughout the Truckee River corridor.

Storm Drain Assessment, Truckee River – OBEC assessed the impact of combining several small storm drains into a single, large drain that empties into the Truckee River in Reno, Nevada

Instream Flows, South Truckee Meadows – OBEC assessed instream flow requirements for both biological and geomorphic goals.

Cottonwood Dendrochronology, Truckee River – OBEC completed a tree ring study to date cottonwood establishment along the river corridor and determine relationships with managed river flows.

Tamarisk Dendrochronology, Truckee River – OBEC collected tamarisk root crowns from a site near Marble Bluff Dam on Pyramid Lake Paiute Tribal Lands to determine ages of tamarisk shrubs. Statistical analyses were used to decipher past drivers of tamarisk establishment.

Bird Communities and Habitats along the Truckee River – OBEC completed a multiple-year study of breeding birds along the Truckee River and their habitats to develop priorities for habitat enhancement and restoration projects, and to determine progress toward native bird recovery under current habitat restoration attempts.

Status and Habitat Use of Amphibians and Reptiles of the Truckee River Corridor – OBEC completed a two year study of distribution, abundance, and habitat use of native amphibians and reptiles along the Truckee River corridor. The study was designed to aid in conservation planning for these species and restoration designs for their habitats.

Carson River

Riparian Vegetation Mapping on the Carson River - To determine the health of the river corridor and formulate restoration actions, OBEC mapped all riparian vegetation types along the Carson River.

Macroinvertebrate Sampling – OBEC sampled aquatic macroinvertebrates along the middle Carson River from the Nevada state line to Lahontan Reservoir. Data is presented in OBEC's Middle Carson River Assessment report.

Walker River

Sediment Transport Study, Walker River– OBEC implemented this study to determine the amount, type, and rate of sediment moving with flows in the river. This information helps river managers to better manage the sediment load in the Walker River system for the combined enhancement of river operations and ecosystem function.

Breeding Bird Communities and Habitat Modeling on the Walker River – OBEC completed point count and area search surveys to develop models for nesting bird habitats along the Walker River corridor that will assist with restoration design development.

West Walker River – Studies that included macroinvertebrate sampling, sediment size distribution, and water clarity were completed to assess a stretch of stream for trout habitat suitability.

Vegetation Mapping – Using high-resolution orthoimagery, OBEC field-mapped and digitized fine-scale vegetation maps of the lower Walker River riparian corridor from the Mason Valley Wildlife Management Area downstream to below Weber Dam.

Vegetation Distribution Analyses – Fine-scale vegetation maps were paired with environmental variables (e.g., distance above surface water, groundwater depth, soil characteristics, disturbance levels) to determine sites that are suitable and unsuitable for plants of interest.

Ash Meadows National Wildlife Refuge

Ash Meadows Macroinvertebrate Inventory – In collaboration with Dr. Larry Stevens, Otis Bay biologists collected and catalogued terrestrial and aquatic invertebrate specimens from the Ash Meadows National Wildlife Refuge. Collections were made with malaise traps, UV light sampling, dip nets, kick nets, and extensive spot sampling. Collected specimens are housed at the Museum of Northern Arizona in Flagstaff.

Spring Sediment Study – OBEC collected spring pool measurements for multiple springs in the Ash Meadows National Wildlife Refuge. Because many of the springs have been altered from their historical dimensions, sediment samples were collected to determine relationships between sediment particle size and spring discharge. These relationships were examined to develop potential spring pool restoration recommendations.

Pahrnagat National Wildlife Refuge

Fall Migration Bird Banding, Pahrnagat NWR – OBEC conducted a 3-year inventory of fall migrating songbirds to determine current habitat use and to guide potential habitat restoration actions.

Moapa National Wildlife Refuge

Macroinvertebrate Sampling, Pederson Spring – OBEC biologists sampled and identified macroinvertebrates inhabiting a restored stream channel on the Moapa National Wildlife Refuge to monitor restoration success.

Utah

Diamond Fork Creek

Breeding Bird Study – Data from a 3-year study of breeding birds, habitat assessment, and multivariate analysis of bird-habitat associations were used to derive recommendations for habitat conservation.

Instream Flow Study – OBEC completed an assessment of environmental instream flows to support a broad array of native organisms.

Provo River

Bird Communities and Habitats – In collaboration with the Utah Division of Wildlife Resources, OBEC studied bird populations and habitat use to determine riparian habitat restoration recommendations for the Provo River Restoration Project.

Spotted Frog Restoration and Habitat Enhancement Planning – OBEC completed a six-year study of Columbia spotted frog (*Rana luteiventris*) populations and natural movements, designed wetland habitats, and participated in a successful repatriation effort.

