



The cleanup of Silver Bow Creek has been ongoing since 1999 as part of a Superfund remedial action coordinated by the Montana Department of Environmental Quality (DEQ) in consultation with the U.S. Environmental Protection Agency (EPA). In 2000, the Natural Resource Damage Program (NRDP) of the Montana Department of Justice and the Greenway Service District (GSD) formed a partnership with DEQ, bringing a restoration component to the project that goes beyond the remediation (cleanup) required under Superfund. Since 1999, much of Silver Bow Creek has been transformed from a severely injured, nearly lifeless stream to an ecosystem that is recovering its original character and value.

PROJECT BACKGROUND

Silver Bow Creek originates in Butte, Montana at the confluence of the Metro Storm Drain and Blacktail Creek and flows to the Warm Springs Ponds, the headwaters of the Clark Fork River. Starting in the late 1880s, tailings and other mine wastes containing



Historic Flooding of Silver Bow Creek Deposited Tailings in Milltown Dam

high concentrations of metals were discharged directly to Silver Bow Creek and redistributed through flood events, including a massive flood in 1908. These toxic discharges impacted the stream and floodplain with heavy metals and virtually eliminated aquatic life in the stream. Tailing deposits resulted in a floodplain that was largely devoid of vegetation and generally incapable of supporting wildlife. In 1983, EPA listed the Silver Bow Creek/Butte Area as one of multiple Superfund sites in the Upper Clark Fork River Basin

(UCFRB). The 26 miles of streamside tailings along Silver Bow Creek were designated as the Streamside Tailings Operable Unit (SSTOU). Initially, the Atlantic Richfield Company (ARCO), through its acquisition of the Anaconda Company, was named by the EPA as the primary party responsible for the remediation of the SSTOU and other Superfund sites in the UCFRB. In 1995, EPA and DEQ issued a Record of Decision (ROD) for the SSTOU, identifying the final site remedy and the agencies' cleanup rationale. The major components of remedial action specified in the SSTOU ROD are the excavation of the tailings and related contaminated soils and reconstruction of the stream channel and floodplain.

In a 1999 state, federal, and tribal settlement, ARCO agreed to pay \$215 million to the State of Montana to resolve certain claims, of which \$80 million plus interest was set aside for DEQ and EPA to cleanup Silver Bow Creek. The remaining portion of the original settlement was placed in the UCFRB Restoration Fund. The GSD uses grants from the Restoration Fund to enhance the Silver Bow Creek cleanup, including various habitat improvements and development of a recreation trail and access points along the creek. To date, DEQ, NRDP, and GSD have successfully worked together to remediate and restore more than 90% of Silver Bow Creek and its floodplain.

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REMEDICATION OR RESTORATION?

Remediation is performed according to the remedy selection provisions of the Superfund law and addresses the contamination in a manner that eliminates the most direct threats to human health and the environment. Remedies are performed in accordance with specific legal requirements that set cleanup levels such as water quality standards, or that require actions to be conducted in a certain manner, such as mine reclamation laws. The majority of work necessary to clean up Silver Bow Creek falls under remediation.



**Active Remedial Action in Reach T
(May 2013)**



**Active Remedial Action in Reach T
(July 2013)**



**Post Remedial Action and Before
First Growing Season in Reach T
(November 2013)**

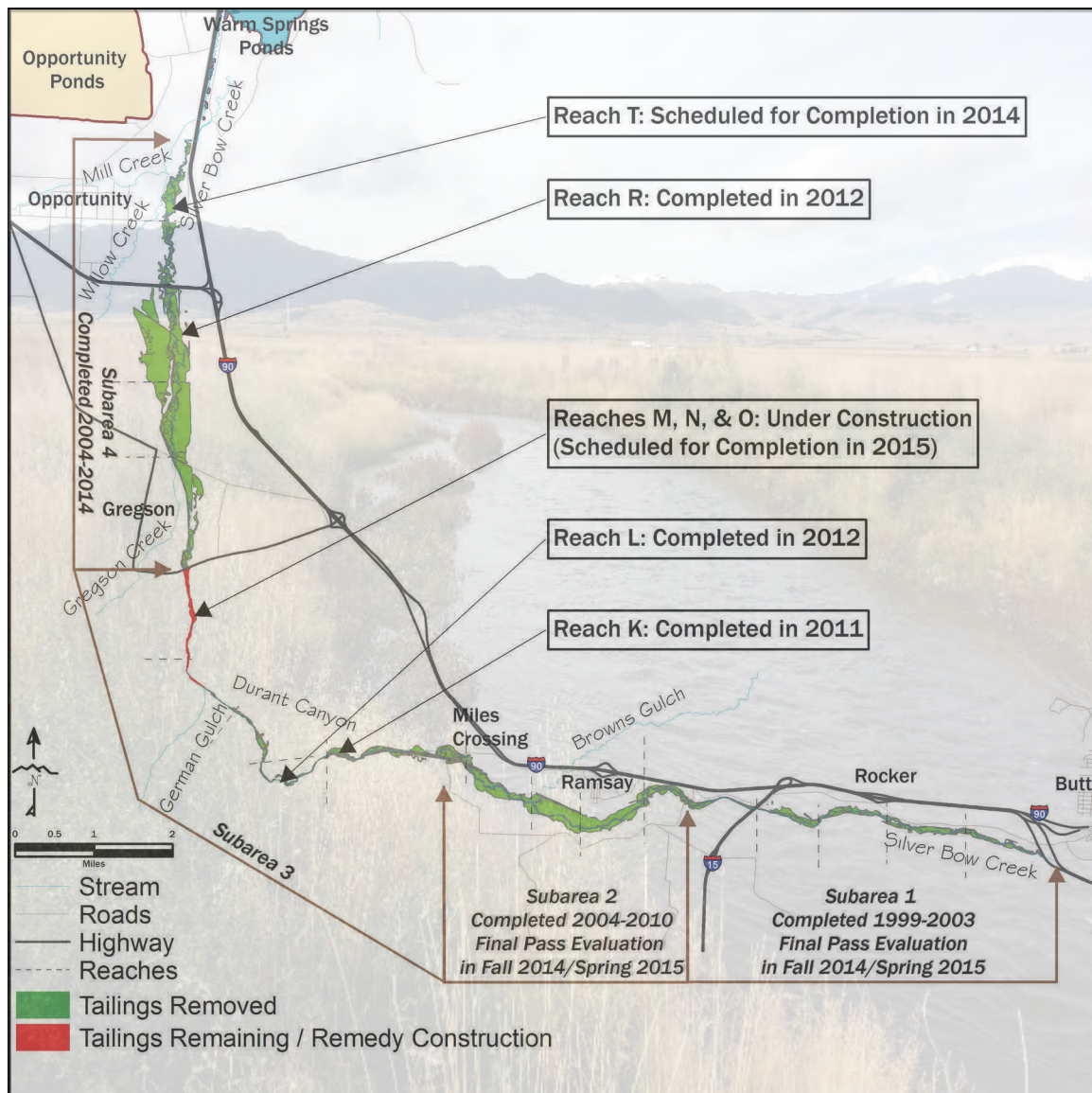
Restoration actions fall under the natural resource damages provisions of the Superfund law. Designated natural resource trustees, including the State of Montana, can obtain damages from parties responsible for the contamination to return the resource to its pre-impact condition and to compensate for the public's lost use of the resource. Damages are typically based on the residual injury to the resource after considering the benefits of remedy because remedies often do not return the area to its completely uncontaminated, or "baseline", condition. Collected monetary damages can be used by the trustee to restore injured resources to their baseline condition, replace lost resources, or acquire the equivalent of the lost resources. Restoration along Silver Bow Creek has enhanced the remedy by returning the area to a more natural condition, helping the stream and floodplain recover to baseline conditions, and providing public access to sections of the restored stream channel and floodplain.

Montana Natural Resource Damage Program - In 1999, the State of Montana received approximately \$130 million for the restoration of injured natural resources in the UCFRB through a partial settlement of its natural resource damage lawsuit against ARCO. From 2000 through 2010, the Governor of Montana approved seven specific grants to the GSD totaling \$15.6 million for projects that coordinated restoration and remedy actions, such as ecological improvements to the stream and floodplain habitat. These combined actions were coordinated through the NRDP, DEQ, and GSD. The GSD took the lead role in constructing and coordinating with DEQ on access feature components, such as trail construction, and acquiring fee title or easements for public recreational use and protection of the remediated and restored floodplain. The NRDP took the lead role in coordinating the ecological components with DEQ, such as additional floodplain enhancement with shrubs, trees, and wetlands. In 2011, the Governor approved an additional \$8 million to the GSD for the Silver Bow Creek Greenway for both access features and ecological enhancements. The NRDP no longer manages a grant program for water and land resources and is working under a plan approved in early 2013 by the Governor, entitled *Final Upper Clark Fork River Basin Aquatic and Terrestrial Resources Restoration Plans*, which is available on the NRDP website.

PROJECT STATUS

The SSTOU is divided into four subareas based upon geologic and topographic features. Silver Bow Creek is divided into 20 stream reaches based on differences in topography and site specific conditions within each subarea.

- * Of the 26 miles of Silver Bow Creek in the SSTOU, 24-1/2 miles are completely reconstructed, with 1-1/2 miles under construction in Reaches M, N, and O in Subarea 3.
- * Approximately 1,480 acres along Silver Bow Creek have been remediated and restored. More than 5.4 million cubic yards of the estimated 5.6 million cubic yards of tailings and impacted soils have been removed from the floodplain.



Subarea 1 - DEQ initiated cleanup activities at the upper end of Silver Bow Creek near Butte in 1999 by removing tailings to a local repository and reconstructing the stream channel and floodplain. Beginning in 2001, mine wastes were transported by train to the ARCO Waste Management Area (near Opportunity). Restoration elements to improve stream habitat were also added to the design. These efforts continued in the downstream direction until all of Subarea 1 was remediated by the end of 2003.

Subarea 2 - Construction in Subarea 2 began in 2004 and was completed in 2010, with additional wetland plants, trees, and shrubs added in 2011. The most notable accomplishment in Subarea 2 was the removal of more than 1.6 million cubic yards of tailings from the Ramsay Flats area that provided space to construct numerous wetlands and allowed Silver Bow Creek to follow a longer, more varied channel alignment. The removal of the entire Ramsay Flats tailings deposit exceeded the requirements of the ROD and was accomplished with a combination of remediation and restoration funds. Although remedial action objectives are largely achieved in Subareas 1 and 2, DEQ will implement a “*final pass*” remedy before the subareas transition into a care and maintenance status. The final pass will address very small deposits of remaining remnant tailings and impacted soils to improve and enhance the remediation as a whole, and will include wetlands enhancement work in key areas.



**Reach R Prior to Remediation
(May 2005)**



**Reach R Post Remediation
(November 2011)**

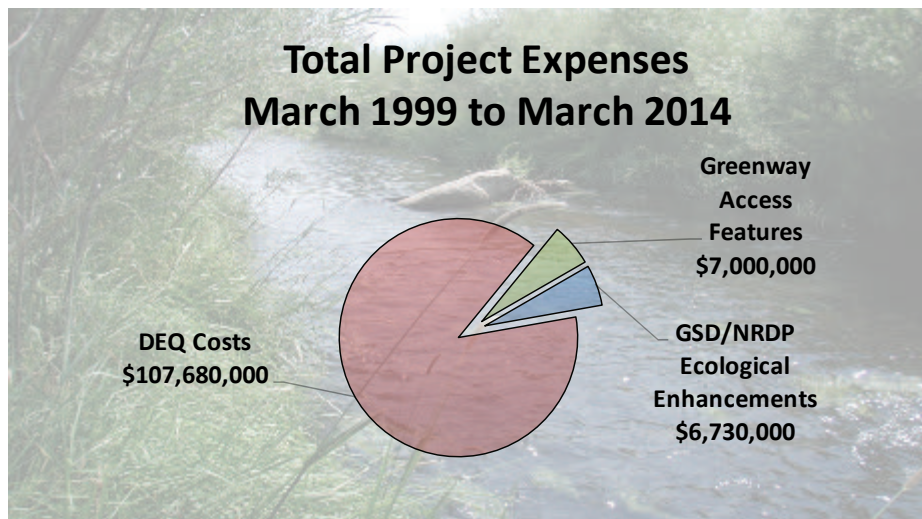


**Reach R Post Remediation
(October 2013)**

Subarea 3 - Cleanup began in Subarea 3 in 2009 and is mostly complete from Miles Crossing to midway through Durant Canyon. While the volume of the tailings deposited in Subarea 3 is less than the other subareas, the narrowness of the canyon combined with the constraints of two active railroads make tailings removal complicated and time consuming. In 2012 and 2013, remedial action efforts included three large-scale stream diversions in which DEQ diverted Silver Bow Creek into a large pipe to provide safe access to the work areas in the narrowest part of the canyon. Remedial design is underway in Reaches M, N, and O, with work nearly completed to the confluence of German Gulch Creek with Silver Bow Creek. The remedial design includes a large-scale fish barrier which will serve to isolate native cutthroat trout in German Gulch Creek and the upper two-thirds of Silver Bow Creek from other fish species in the greater Clark Fork River drainage basin. Using NRDP grant funds, GSD installed a large box culvert system to reroute the stream through a portion of the historical floodplain, lengthening the channel by 0.3 miles and providing access to an additional 19 acres of floodplain. The box culvert also simplified diversion of the stream for cleanup and provides a future trail underpass through one of the active railroads. Construction in Subarea 3 is scheduled to be complete by summer of 2015.

Subarea 4 - Cleanup from Fairmont Road north to the Warm Springs Ponds (end of the SSTOU) has been ongoing since 2004 and is substantially complete. Work completed in the fall of 2012 included tailings excavation and new stream channel construction in the area extending from Highway 1 north to Stewart Street. Cleanup for the area extending from Stewart Street north to the Warm Springs Ponds is scheduled for near completion in the spring of 2014. This work will incorporate numerous features from the remedy and restoration plans, including a series of ponds (approximately 22 acres) and wetlands adjacent to the newly constructed Silver Bow Creek channel. In 2013 and early 2014, DEQ removed areas of isolated remaining remnant tailings and impacted soils in Subarea 4 extending north from Fairmont Road to Stewart Street. These areas will be seeded and planted in the fall of 2014 before DEQ transitions the subarea into a care and maintenance status.

PROJECT EXPENSES



Since 2000, the Governors of Montana have approved GSD/NRDP grant applications totaling nearly \$23.6 million to restore aquatic, riparian, wetland, and upland ecosystems within the entire Silver Bow Creek corridor. Wherever feasible, restoration actions were included in the remediation plans and designs and constructed by DEQ under a single contract. The State of Montana has demonstrated that both remedy and restoration activities can

be conducted as one integrated project while still maintaining clear distinctions between the funding sources for accounting purposes. To date, GSD/NRDP expenses total approximately \$14 million. The remaining \$9.6 million in grant funds will be used for Greenway trail features, mainly in Subareas 2 and 4, and for additional ecological efforts such as plantings and creek work.

COMBINED REMEDIATION AND RESTORATION

Stream Channel Enhancements - The construction of a longer, meandering stream channel, with more pools and varying stream widths, is an example of restoration beyond remedy. The new Silver Bow Creek stream channel has successfully weathered high flows and vegetation is well established on its banks. Pools and other habitat features added through restoration funds are functioning as designed and provide increased aquatic habitat diversity, not only augmenting remedial actions but also enhancing the recovery of aquatic resources to a near pre-disturbance condition. The enhanced habitat will help the fish populations to grow and thrive. The habitat improvements are designed and constructed by DEQ with the incremental costs funded through GSD/NRDP grants.



Enhanced Stream Channel Showing Length and Sinuosity in Reach M

NOTABLE PROJECT ACHIEVEMENTS

Water Quality and Fish - A primary goal of the SSTOU remedy is to re-create a stream capable of supporting fish. Cleanup activities in Silver Bow Creek and upstream areas near Butte have greatly improved surface and groundwater quality compared to pre-cleanup levels. Recent sampling of Silver Bow Creek in the remediated areas showed metals concentrations meeting or near drinking water standards and much closer to meeting aquatic life standards than prior to cleanup. Fish surveys completed in Silver Bow Creek show that populations of westslope cutthroat, brook trout, sculpins, and suckers have been reestablished in the creek.

Vegetation and Wildlife Habitat - Grasses, trees, shrubs, and plants are well established through much of the remediated area. Enhanced shrub and tree planting activities, funded by restoration grants, have enhanced wildlife habitat along with a DEQ-implemented weed management program. Sightings of over 100 bird species, including bald eagles, osprey, swans, blue heron, and sandhill crane are common in the floodplain and wetland areas, as well as deer, moose, beaver, muskrats, and mink.



Subarea 4 Recovered Stream Channel - Post 2011 Flooding

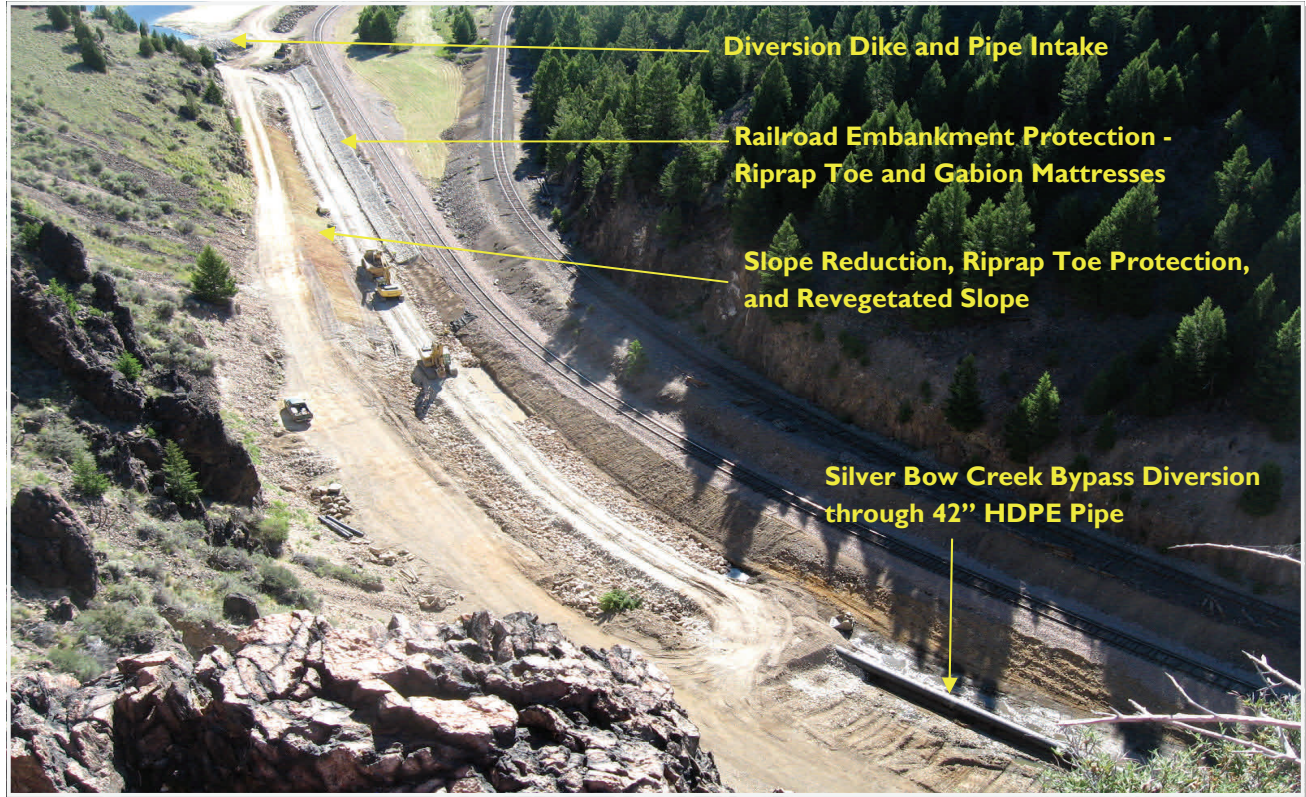
Floodplain Revegetation Enhancements - To enhance the ecological character of the area, DEQ also uses GSD/NRDP grant funds to complete activities such as adding organic matter to soils placed in the floodplain, constructing wetlands, and planting trees and shrubs throughout the floodplain. These efforts have enhanced remedial efforts already completed at the SSTOU and are helping to restore severely injured wildlife habitat along the corridor. The planting efforts are carried out as a carefully coordinated effort between DEQ and NRDP. Restoration funds are also used to enhance unanticipated wetlands or floodplain swales that develop on their own after construction is complete.



Diversion Channel Construction in Reach T
(April 2013)

Phase 9 (Reach T) Diversion and Floodplain Infrastructure - In cooperation with NRDP, DEQ recently completed remedial actions in Reach T which required a number of open-channel bypass diversions to access and dewater the work area. Constructing the new stream channel and floodplain incorporated unique floodplain features including overflow channels to direct floodwaters across the floodplain, wetland ponds/features, and buried riprap and stone toes to protect existing infrastructure and prevent the stream from migrating laterally before vegetation is established. Additional NRDP-funded floodplain protection measures near the stream channel utilized biodegradable coir fabric to hold vegetative media in place during high flow events to aid the recovery and restoration process.

Subarea 3 *Piped Diversions and Railroad Embankment Treatments* - DEQ completed three separate bypass diversions within the Durant Canyon area of Subarea 3 by diverting Silver Bow Creek into a 42-inch high density polyethylene (HDPE) pipe to provide safe access to the work areas in the narrowest portions of the canyon. Work along railroad embankments included removing tailings and installing railroad embankment treatments such as gabion mattresses to protect the completed remedy.



Reach L In-Stream Piped Diversion

Public Access & Trail Construction - Currently, the GSD is constructing a greenway trail along Silver Bow Creek with trailheads, rest areas, bridges, railroad crossings, and other features to provide and control public access to the restored Silver Bow Creek corridor. The GSD acquired easements and lands for public access along much of the stream corridor that is not owned by DEQ. To date, two trailheads and approximately 6-1/2 miles of trail is complete.



Reach R Pedestrian Bridge

Reach R *Pedestrian Bridge* - In cooperation with NRDP and GSD, DEQ installed a pedestrian bridge over Silver Bow Creek to provide access to future pedestrian trail systems that are currently in the design process for Subarea 4. The schedule includes constructing a short segment providing access to the Tailings Observation Area from the Highway 1 rest area in 2014 that will ultimately connect to the entire trail system.

Subarea 4 Tailings Observation Area - DEQ and NRDP have

constructed a unique historic interpretation feature to provide the public with a visual comparison between the existing tailings deposits devoid of vegetation and the reclaimed and revegetated landscape provided by remedy and restoration. A small area of tailings was left in place and isolated from the surrounding area by an armored trail berm that serves not only as a public access trail to view the tailings deposit, but also as a flood-water protection berm. When trail construction is complete in 2014, the public will be able to access this tailings observation area from the Greenway trail access point at the Highway 1 rest area.



Subarea 4 Stream Channel and Observation Area

PROJECT RECOGNITION

The remediation and restoration of Silver Bow Creek, perhaps the largest project of its kind in the United States, has won local, national and international awards for environmental excellence.

- * National Association of Environmental Professionals for environmental stewardship and conservation of excellence (2005).
- * The Green Organisation based in the United Kingdom, International Green Apple Environmental Award (2005).
- * Montana Contractors Association, Environmental Excellence in Habitat Restoration/Enhancement (2006)
- * Montana Wetland Council and Montana Watershed Coordination Council, Special Agency Individuals Award to DEQ Superfund Project Manager Joel Chavez and Project Officer Tim Reilly for their outstanding work in taking the project far beyond procedural requirements (2011).
- * Montana Contractor's Association, Environmental Excellence Award Best Heavy/Industrial Contractor for Subarea 3 Reach L (2012).
- * Engineering News Record (a McGraw Hill Publication), Merit Award in the Water/Environment category for the Subarea 3 remedial action project (2013).

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