Stephens Park Stream Bank Restoration Project

Vail, CO

Colorado Water Conservation Board – Healthy Rivers Fund Grant Final Report

DRAFT - April 1, 2012
I. PROJECT SUMMARY

The reach of Gore Creek flowing through the Town of Vail has been subjected to numerous disturbances over the past 30 years (the past 6 years the Town has seen unprecedented development) that has led to increased encroachment into the public stream tract, excessive snow removal, snow dumping and use of traction sand and cinders, lack of proper stormwater pollution prevention and best management practices (BMPs), improper fishing, erosion and lack of education has led to increasingly impaired conditions in Gore Creek, and ultimately, the Eagle River. In 2010, Town of Vail completed the Gore Creek Stormwater Pollution Prevention Plan, identifying necessary measures to improve the health of Gore Creek and lesson the impact of development. Throughout the planning process, a group of concerned citizens and fly fisherman, Town of Vail environmental staff, and the Eagle River Watershed Council began to recognize and document their concerns over the decreasing fish and insect population and negative impacts of urban development and improper practices in Town. Erosion and negative impacts from high use was noted at Stephens Park, in West Vail. Since then, the Gore Creek Restoration Task Force (GCR Task Force) has been formed. Members began a volunteer effort to perform a survey of the Creek and identify clear, suggested measures for improvement, including education needed to reduce the human impact on the Creek health. This led to the application to the Colorado Water Conservation Board’s (CWCB) Healthy Rivers Fund to implement a stream bank restoration project at Stephens Park and a small grass roots education program.

Originally this restoration project was small, budgeted at only $12,000 and designed to provide a simple re-vegetation effort. However, because of the attention of the CWCB and the Healthy Rivers Fund, the impacts of the use and the gravity of the situation at the park became apparent, the project eventually grew to a budget of $65,000. In the end, the Stephens Park project efforts culminated in a $95,000 major overall that has resulted in improved water quality, increased wildlife and an improved guest experience.

II. PROJECT BACKGROUND

The Town of Vail adopted Environmental Sustainability Strategic Plan Goal 3 states that the Town of Vail shall “ensure that the natural environment, specifically air and water quality, water quantity, land use and habitat are maintained to current or improved levels of biological health.” To that end, the purpose of the Stephens Park Stream Bank Restoration Demonstration Project is to implement stream bank stabilization and re-vegetation at the east end of Stephens Park designed to mitigate erosion, sedimentation, and degraded vegetation. Restoring this site will prevent further damage to the riparian area, improve water quality and habitat. Accessibility and recreational opportunities will be greatly enhanced. The current condition of the site has an eroding bank approximately 100 feet long that has been exacerbated by recreational use such as dog fetching and whitewater/fishing access, causing sedimentation, habitat loss and reduced water quality.

Improvements needed are: re-grading the stream bank, riparian improvements, re-vegetation, access improvements including rock work, pathway improvements, and a ramp for accessibility), and turf and irrigation repair.

Total project costs are estimated at $65,000 (includes all 2010 construction and design work, permitting, and contingency). Initial assessment and design work has already been completed by RiverRestoration in 2009 ($6,800 already incurred cost). Working with Town residents, staff has written and received a $6,000 grant from the Colorado Water Conservation Board (CWCB) for construction of this project. In addition, the Eagle River Watershed Council has remaining
funds from 2009 to cover the cost of this project as it fits their mission of improving water quality in the region.

Stephens Park has a high use of multiple recreation; including an off leash dog park, Frisbee golf, whitewater access, fishing, and picnic area. The Park is located on a floodplain terrace at the right of the channel. The right bank of the park has eroded approximately 100 feet in length (Attachment A). This erosion was likely initiated from excessive bank trampling coupled with loss of riparian vegetation at the creek access. There are few large trees and the bank does not have significant root mass on the floodplain bench in this area. Creek processes exacerbate the erosion.

The CWCB recognized the value of the stream bank stabilization opportunities at Stephens Park as well as the visibility and recognition for the Healthy Rivers Fund in Vail, and awarded the Town a $6,000 matching grant toward riparian improvements at this site.

III. SCOPE OF WORK

At the upstream extents of the Stephens Park reach, Gore Creek is encroached by the South Frontage road on the right bank. The channel drops significantly just after the road encroachment. Downstream there are localized areas of the bank that are eroding from the encroachment of the paved pathway, random trampling of the bank, and loss of vegetation. Beavers have likely used healthy mature trees to construct dams; resulting in loss of root mass on the bank and contributing to the erosion. Beaver dams in the reach may need periodic maintenance so that the channel hydraulics and shear forces on the banks are not significantly changed. Beaver screens may need to be installed to protect mature vegetation on the bank.

- **Site Assessment and Survey**: Conducted on November 10, 2009, which included topographic and hydrographic survey of the channel and banks. These data were used to develop the AutoCad base map and the channel profile for the hydraulic model.
- **Hydraulic Modeling**: Developed to analyze potential improvements within the floodway.
- **Final project Design**: The final project design including materials and methods are found in Attachments A and B.
- **Bank re-grading**: Due to erosion, the current steep drop-off will need to be leveled.
- **Bank Stabilization**: Bank stabilization at Stephens Park includes in-channel modifications to hydraulics for concentrated access. A letter is to discuss how the proposed modifications comply with Town of Vail and Federal floodplain development guidelines is found in Attachment C.
- **Boulder work**: Approximately 20 boulders will be excavated and reused for the project.
- **Eddy pool**: An eddy pool will be created to slow flows near the input to Gore Creek at the Stephens Park entrance. This will enhance wildlife habitat, reduce erosion and allow for easier output for kayakers.
- **Accessibility**: An accessible access ramp has been included in the bank terracing on both of the design alternatives. Accessible access may be desired to facilitate fishing access for a wider group of citizens and visitors. Potential funding partners may be AXS Vail Valley, and the CDOW "fishing is fun" program.
- **Riparian vegetation Installation – Volunteer Planting Project**: There is an opportunity to incorporate riparian enhancements for increased cover of native
vegetation. Riparian plantings would require protective fencing to keep dogs and wildlife out until successful establishment. Riparian plantings are recommended to increase the root mass and bank stability. Thorny plantings such as prickly gooseberry, raspberry, and rose may be a good option for natural barriers to prevent random trampling of the bank and direct access to less fragile bank areas. Volunteers will be recruited from the annual

V. BUDGET

<table>
<thead>
<tr>
<th>Project Scope and Budget</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total Cost</th>
<th>Funding Sources</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1. Site Setup - Final contract with RiverRestoration to finalize design and firm schedule Sept1-Sept 30, 2010</td>
<td>1</td>
<td>LS</td>
<td>$3,676</td>
<td>$3,676</td>
<td>Eagle River Watershed Council (ERWSC) Town of Vail Grant funding ($3,676)</td>
<td>15-May-10</td>
<td>1-Jun-10</td>
</tr>
<tr>
<td>Mobilization/bonding/insurance</td>
<td>1</td>
<td>LS</td>
<td>$1,200</td>
<td>$1,200</td>
<td>ERWSC Town of Vail Grant funding ($1,200)</td>
<td>15-Jun-10</td>
<td>30-Jun-10</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>$4,876</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 2. Best Management Practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Traffic Control</td>
<td>1</td>
<td>LS</td>
<td>$500</td>
<td>$500</td>
<td>ERWSC Town of Vail Grant funding ($500)</td>
<td>25-Aug-10</td>
<td>30-Sep-10</td>
</tr>
<tr>
<td>Establish Construction signage/staging fence/sign for public notice of HRF partnership</td>
<td>1</td>
<td>LS</td>
<td>$500</td>
<td>$500</td>
<td>ERWSC Town of Vail Grant funding ($500)</td>
<td>22-Aug-10</td>
<td>30-Sep-10</td>
</tr>
<tr>
<td>Purchase and plant native riparian grass mix</td>
<td>0.08</td>
<td>AC</td>
<td>$200</td>
<td>$2,500</td>
<td>ERWSC Town of Vail Grant funding ($2,500)</td>
<td>16-Aug-10</td>
<td>30-Aug-10</td>
</tr>
<tr>
<td>Haul route restoration</td>
<td>1</td>
<td>LS</td>
<td>$1,000</td>
<td>$1,000</td>
<td>ERWSC Town of Vail Grant funding ($1,000)</td>
<td>16-Aug-10</td>
<td>30-Aug-10</td>
</tr>
<tr>
<td>Protect in place facilities and mature vegetation, stabilize with fencing</td>
<td>1</td>
<td>LS</td>
<td>$500</td>
<td>$500</td>
<td>ERWSC Town of Vail Grant funding ($500)</td>
<td>16-Aug-10</td>
<td>30-Aug-10</td>
</tr>
<tr>
<td>Establish other BMPs as needed</td>
<td>1</td>
<td>LS</td>
<td>$500</td>
<td>$500</td>
<td>ERWSC Town of Vail Grant funding ($500)</td>
<td>Ongoing</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>$5,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task 3. Bank Stabilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re-grade eroded bank</td>
<td>125</td>
<td>CY</td>
<td>$10</td>
<td>$1,250</td>
<td>ERWSC Town of Vail Grant funding ($1,250)</td>
<td>1-Sep-10</td>
<td>7-Sep-10</td>
</tr>
<tr>
<td>Order sandstone slabs, have them delivered and placed along bank access points</td>
<td>35</td>
<td>Tons</td>
<td>$300</td>
<td>$12,250</td>
<td>ERWSC Town of Vail Grant funding ($12,250)</td>
<td>1-Aug-10</td>
<td>1-Sep-10</td>
</tr>
<tr>
<td>Care of water (establish turbidity curtain)</td>
<td>1</td>
<td>LS</td>
<td>$1,000</td>
<td>$1,000</td>
<td>ERWSC Town of Vail Grant funding ($1,000)</td>
<td>17-Aug-10</td>
<td>30-Sep-10</td>
</tr>
<tr>
<td>Install erosion control blanket</td>
<td>1925</td>
<td>SF</td>
<td>$3</td>
<td>$4,838</td>
<td>ERWSC Town of Vail Grant funding ($4,838)</td>
<td>25-Aug-10</td>
<td>25-Aug-10</td>
</tr>
<tr>
<td>Install 3’ minus gravel bedding</td>
<td>4</td>
<td>CY</td>
<td>$10</td>
<td>$40</td>
<td>ERWSC Town of Vail Grant funding ($40)</td>
<td>1-Sep-10</td>
<td>15-Sep-10</td>
</tr>
<tr>
<td>Install filter fabric</td>
<td>55</td>
<td>SY</td>
<td>$2</td>
<td>$110</td>
<td>ERWSC Town of Vail Grant funding ($110)</td>
<td>1-Sep-10</td>
<td>15-Sep-10</td>
</tr>
<tr>
<td>Subtotal</td>
<td></td>
<td></td>
<td>$19,488</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
V. ADDITIONAL ENVIRONMENTAL EDUCATION BENEFITS

In addition to habitat and stream bank restoration, recreational opportunities and an enhancement of a well utilized park, this project provides an excellent opportunity for demonstration of environmental stewardship in Vail. As host of the Colorado Watershed Assembly’s (CWA) Annual Watershed Conference at the Vail Cascade October in 2009, the Town hosted an environmental education tour to the Black Gore Creek Basin of Last Resort on Hwy I-70, and a tree planting event on the Vail Golf Course. As part of the Stephens Park project, event organizers requested an expert from the Resources Conservation Service (NRCS) provide a willow planting workshop at Stephens Park and allow volunteers to help with
the re-vegetation effort as a part of the demonstration project. This event serves as a great opportunity for Vail to provide visitors an environmental education opportunity, and showcase the Town’s dedication to the environment and outstanding park environment, while reducing the costs of landscaping at the site.

VII. **TIMELINE**

<table>
<thead>
<tr>
<th>2010-2011 Season</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 1 – April 1</td>
<td>Final Project Design</td>
</tr>
<tr>
<td>April 1 – April 15</td>
<td>Flood Plain Analysis – Army Corps of Engineers/Town Engineer</td>
</tr>
<tr>
<td>April 15 – May 30</td>
<td>Department of Wildlife Review</td>
</tr>
<tr>
<td>May 30 – June 30</td>
<td>Construction documents – Release RFP</td>
</tr>
<tr>
<td>June 30 – July 30</td>
<td>Finalize construction contract</td>
</tr>
<tr>
<td>Aug. 1 – Aug. 30</td>
<td>Finalize planting selection, order plants, coordinate with CWA planting event</td>
</tr>
<tr>
<td>Sept. 1-Sept. 30</td>
<td>Construction (excavation, boulder work)</td>
</tr>
<tr>
<td>Oct. 5-7</td>
<td>Willow planting workshop</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2011-2012 Season</th>
<th>Interpretive Sign Development and Education Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>November – February</td>
<td>Artist painting – Stephens Park, flora/fauna study, insect assessment, rules and regulations development for public use.</td>
</tr>
<tr>
<td>March</td>
<td>Digitize artist painting, develop text, set in resin</td>
</tr>
<tr>
<td>May</td>
<td>As weather and ground thaw allows, poor concrete, install interpretive sign at Stephens Park</td>
</tr>
</tbody>
</table>

VIII. **Results**

Final bank restoration completed in accordance with the details in the planning document, found in the binder in attachment B.

- **Construction complete as of November, 2011**
  - Flagstone bank stabilization
  - Pervious surface path and ramp - ADA Accessibility
  - Additional stone seating area
  - Bank around 40 ft- tall spruce trees stabilized
  - Eddy pool installed, fish habitat enhanced
- **Volunteer Planting Event, October 2011**
Roughly 30 volunteers from the annual Colorado Watershed Conference took part in the planting event, installing native willows, alders, rose bushes and other vegetation lining the bank at Stephens Park.

- Interpretive Sign Developed (Attachment D) (installation May 2012)
  - A local artist, Charmayne Bernhardt, was commissioned to paint the Stephens Park site, bank view, complete with identification of local flora and fauna.
  - Text was developed to explain to visitors the importance of the riparian area, aquatic life identification, the restoration project, and rules of the park.

VIII. ATTACHMENTS

A. Stephens Park Re-vegetation Project Site Design
B. Stephens Park Project Planning Binder
C. Flood Plain Compliance Letter
D. Stephens Park Interpretive Sign
E. Photo Album
Option 2: Stephens Park Recreation Enhancement

Vail, Colorado
December 18, 2009

Native Spruce and deciduous plantings.

Native upland seed plantings.

Accessible Ramp; 5% slope.

Willow stake plantings.

Install Boulders to enhance riffle and eddy

Eddy Pool

Install steps for fishing access. Install erosion control blankets with native riparian seed, shrubs and Willow stake plantings.

Sandy Beach

Install erosion control blanket with native riparian seed, shrubs and Willow stake plantings.

Grade bank 5:1 slope. Install erosion control blanket with native riparian seed, shrubs and Willow stake plantings.

Grade bank 5:1 slope, grading back to existing. Install erosion control blanket with native riparian seed, shrubs and Willow stake plantings.

Stabilize bank and enhance recreation access with sandstone terracing, 5:1.
TOWN OF VAIL
STEPHEN'S PARK BANK STABILIZATION
PRELIMINARY DESIGN
PROJECT LIMITS
**Silt Fence (Typical)**

- Wooden posts 6' on center
- Filter fabric (overdrip or equivalent)
- Flow resistant
- Silt fence
- Backfill trench

**Turbidity Curtain (Typical)**

- Filter fabric
- Unit of construction
- Silt fence
- Backfill trench
- Floral cloth or equivalent
- Flow resistant
- Orientation (when installed)

**Turbidity Curtain Section (Typical)**

- 1/4 in. tie rope
- 5/8 in. polypropylene rope
- Fold for compact storage
- Floatation
- Economy fabrics available
  - 16 oz. 200 GSM, standard
  - 1/4 in. chain
- Non-reinforced vinyl

**Turbidity Curtain (Typical)**

- Typical layout: streams, ponds, and lakes (protected and non-ideal)
- Anchor pt.
- Stream flow
- Shoreline
- Unit of construction
- Shoreline curtain
- Anchor pt.
- Turbidity curtain
- State or anchor piles (typical)

**Straw Bale (Typical)**

- Properly installed straw bale (cross-section)
- 1. Excavate the trench
- 2. Place and stake straw bales
- Angle post stake
- Strand bale
- Inside edge bale
- Outside edge bale
- Shoreline curtain
1. Construct Shell Using All Natural DE, Biodegradable Erosion Control Blankets, Type 1, Type 2, Type 3.
2. Stake Basket In Place, Cut Holes Through The Layers. Then, Tap The Plastic Holes In The Top. Staple Around Place Every 1".
4. Excavate 4" Of Soil To 42" Deep Trench Along The Top Of The Slope, The Trench Shall Be Along The Length Of The Installation. (Shovel Basket Along Trench Fill With Compact A.I. Revet Basket Through Top Of Slope, And Secure With Shakes Every 12")

EROSION CONTROL BLANKETS

D-3
Friskin County Whitewater Park Plant List

Transitional Seed Mix

<table>
<thead>
<tr>
<th>species</th>
<th>common name</th>
<th>percent</th>
<th>notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deschampsia caespitosa</td>
<td>Tufted Hairgrass vns</td>
<td>10</td>
<td>Seed should be planted into straw mat at a rate of 32 lb PS/acre through broadcast seeding</td>
</tr>
<tr>
<td>Elymus lanceolatus ssp. lanceolatus</td>
<td>Thickspike Wheatgrass ‘Critt’n’</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Elymus lanceolatus ssp. psammophillus</td>
<td>Streambank Wheatgrass ‘Sodur’</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Elytrigia intermedia ssp. intermedia</td>
<td>Skinder Wheatgrass ‘San Luis’</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Passcoryon smithii</td>
<td>Western Wheatgrass ‘Abita’</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Poo palustris</td>
<td>Fowl Bluegrass vns</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Trees and Shrubs

<table>
<thead>
<tr>
<th>species</th>
<th>common name</th>
<th>quantity</th>
<th>size</th>
<th>spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer negundo ‘Sensation’</td>
<td>Sensation Boxelder</td>
<td>12</td>
<td>2.5&quot; B&amp;B</td>
<td>35' o.c.</td>
</tr>
<tr>
<td>Betula occidentalis</td>
<td>Western River Birch</td>
<td>7</td>
<td>5'</td>
<td>15-20' o.c.</td>
</tr>
</tbody>
</table>

Riparian Shrubs

<table>
<thead>
<tr>
<th>species</th>
<th>common name</th>
<th>quantity</th>
<th>size</th>
<th>spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salix exigua</td>
<td>Coyote Willow</td>
<td>70</td>
<td>177</td>
<td>6' o.c.</td>
</tr>
<tr>
<td>Salix lutea</td>
<td>Yellow Willow</td>
<td>30</td>
<td>22</td>
<td>10' o.c.</td>
</tr>
</tbody>
</table>

TOWN OF VAIL
STEPHENS PARK BANC STABILIZATION
PRELIMINARY DESIGN
PLANT INSTALLATION

NOT FOR CONSTRUCTION

TOWN OF VAIL
GORE CREEK

D-4

04-28-2010

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES

NOTES
Mr. Tom Kassmel  
Town of Vail  
75 S. Frontage Road,  
Vail, CO 81657  
(970) 479-2235

RE: Stephens Park Bank Stabilization, Floodplain Compliance

Dear Tom,

Proposed bank stabilization at Stephens Park includes in-channel modifications to hydraulics for concentrated access. This letter is to discuss how the proposed modifications comply with Town of Vail and Federal floodplain development guidelines.

TOV: 12-21-10: DEVELOPMENT RESTRICTED: (E) The Administrator may require any applicant or person desiring to modify the flood plain by fill, construction, channelization, grading, or other similar changes, to submit for review an environmental impact statement in accordance with Chapter 12 of this Title, to establish that the work will not adversely affect adjacent properties, or increase the quantity or velocity of flood waters. (Ord. 16(1983) § 1: Ord. 12(1978) § 4)

Existing Conditions

A floodplain model in HEC-RAS format was obtained from Town of Vail. Three geometry profiles were developed; Duplicate Effective, Existing and Proposed Conditions. The Duplicate Effective is the imported geometry titled “Imported Geo01mbrevised”; which is the most current FEMA flood model for Gore Creek at the Stephens Park reach. The Existing Conditions model is the Duplicate Effective with the insertion of seven additional cross sections surveyed by RiverRestoration in the Fall of 2009. The Proposed Conditions model is the Existing Conditions model with cross sections modified to represent worst case scenario channel changes and analyze hydraulics of the proposed conditions.

No hydrologic analysis was performed; flood flows were based on the Federal Insurance Study reported values. The 100year discharge is 2620cfs through the Project reach. This flow was likely exceeded on June 6, 2010 and water surface elevations crested 7854.5 feet elevation near river station 11+00. Additional bank erosion occurred as a result of this event.

The existing FEMA model does not specifically represent flood conditions at the project area. FEMA cross sections are located 150 feet upstream or 350 feet downstream of the
proposed work. The discrepancy between the Duplicate Effective and Existing conditions model is the resolution of channel geometry of the reach. The geometry in the FEMA model is based from aerial and ground topography over long distances. The geometry in the Existing conditions model is based from site-specific channel geometry surveyed by RiverRestoration Fall 2009. The Existing conditions model shows greater detail of channel geometry and a more accurate representation of flood flow conveyance. The Existing conditions base flood elevations are predicted slightly lower than effective values interpolated between River Station (RS) 1298.6 and 643.1.

The Proposed Conditions model increases the backwater effect over existing conditions but remains below the interpolated values of the effective model. All predicted water surface elevation changes are absorbed in the steep channelized section upstream of RS 1298.6. The Proposed Conditions do not adversely affect adjacent properties, or increase the quantity or velocity of flood waters appreciably over effective values published by FEMA. This is because of the steep banks and steep channel. Zone X, Floodplain and the Floodway are coincident here. Although Proposed base flood elevations are higher than Existing conditions, the flood waters will remain within the Effective floodway delineation and not overtop the existing river banks. The floodway and 100 year floodplain delineation lines are not appreciably moved. Table 1 compares the Effective base flood elevation with the Duplicate, Existing and Proposed condition hydraulic models.

Please contact me with any questions or comments.

Sincerely,

Jason Carey P.E.
River Engineer
jason.carey@riverrestoration.org
(970) 947-9568

cc. Gregg Barrie, Kristen Bertuglia
### Table 1 Base Flood Elevations for Stephens Park Reach (2620cfs) 07/12/10

<table>
<thead>
<tr>
<th>River Station</th>
<th>Effective</th>
<th>Duplicate</th>
<th>Existing</th>
<th>Change</th>
<th>Alternative 2</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2126.81</td>
<td>7877.7</td>
<td>7877.83</td>
<td>7877.83</td>
<td>0</td>
<td>7877.83</td>
<td>0</td>
</tr>
<tr>
<td>1832.98</td>
<td>7872.04</td>
<td>7872.04</td>
<td>0</td>
<td></td>
<td>7872.04</td>
<td>0</td>
</tr>
<tr>
<td>1314</td>
<td></td>
<td>7858.99</td>
<td>7858.99</td>
<td>0</td>
<td>7858.99</td>
<td>0</td>
</tr>
<tr>
<td>1298.7</td>
<td>7859.1</td>
<td>7858.99</td>
<td>7858.81</td>
<td>-0.18</td>
<td>7858.8</td>
<td>-0.01</td>
</tr>
<tr>
<td>1251</td>
<td>7858.23</td>
<td></td>
<td>7856.97</td>
<td>-1.26</td>
<td>7856.96</td>
<td>0.01</td>
</tr>
<tr>
<td>1172.5</td>
<td>7856.99</td>
<td>7855.43</td>
<td>-1.56</td>
<td></td>
<td>7855.43</td>
<td>0</td>
</tr>
<tr>
<td>1140</td>
<td>7856.47</td>
<td>7854.64</td>
<td>-1.83</td>
<td></td>
<td>7854.79</td>
<td>0.15</td>
</tr>
<tr>
<td>1100</td>
<td>7855.83</td>
<td>7854.41</td>
<td>-1.42</td>
<td></td>
<td>7854.94</td>
<td>0.53</td>
</tr>
<tr>
<td>1043</td>
<td>7854.93</td>
<td>7853.99</td>
<td>-0.94</td>
<td></td>
<td>7854.13</td>
<td>0.14</td>
</tr>
<tr>
<td>800</td>
<td>7851.07</td>
<td>7851.21</td>
<td>0.14</td>
<td></td>
<td>7851.21</td>
<td>0</td>
</tr>
<tr>
<td>643.1</td>
<td>7848.58</td>
<td>7848.58</td>
<td>0</td>
<td></td>
<td>7848.58</td>
<td>0</td>
</tr>
<tr>
<td>576.1</td>
<td>7847.76</td>
<td>7847.76</td>
<td>0</td>
<td></td>
<td>7847.76</td>
<td>0</td>
</tr>
<tr>
<td>Stephens Park Bridge</td>
<td>564.2</td>
<td></td>
<td></td>
<td></td>
<td>564.2</td>
<td>0</td>
</tr>
<tr>
<td>564.1</td>
<td>7846.86</td>
<td>7846.86</td>
<td>0</td>
<td></td>
<td>7846.86</td>
<td>0</td>
</tr>
<tr>
<td>516.5</td>
<td>7845.23</td>
<td>7845.23</td>
<td>0</td>
<td></td>
<td>7845.23</td>
<td>0</td>
</tr>
<tr>
<td>74.1</td>
<td>7840</td>
<td>7838.17</td>
<td>7838.17</td>
<td>0</td>
<td>7838.17</td>
<td>0</td>
</tr>
<tr>
<td>-14</td>
<td>7836.14</td>
<td>7836.14</td>
<td>0</td>
<td></td>
<td>7836.14</td>
<td>0</td>
</tr>
<tr>
<td>Kinnickinnick Bridge</td>
<td>-30</td>
<td></td>
<td></td>
<td></td>
<td>-30</td>
<td>0</td>
</tr>
<tr>
<td>-30</td>
<td>7835.92</td>
<td>7835.92</td>
<td>0</td>
<td></td>
<td>7835.92</td>
<td>0</td>
</tr>
<tr>
<td>-84.8</td>
<td>7836.35</td>
<td>7836.35</td>
<td>0</td>
<td></td>
<td>7836.35</td>
<td>0</td>
</tr>
<tr>
<td>-247.3</td>
<td>7834.72</td>
<td>7834.72</td>
<td>0</td>
<td></td>
<td>7834.72</td>
<td>0</td>
</tr>
</tbody>
</table>

**INTERPOLATED VALUES**
Willow Riparian Habitat

What is a Riparian Zone?
A riparian zone is the land and vegetation along the banks of a creek, stream, or river. This interface provides critical functions related to biological and water quality. In undeveloped urban areas, the riparian zone can act as a green buffer, protecting the surrounding area from erosion and flooding.

Native Fauna
Native fauna benefit from a healthy riparian corridor as a food source and as a cover from predators. Riparian areas also support biodiversity by providing shelter, food, and water for birds, mammals, and aquatic organisms.

Gold Medal Fisheries
Cow Creek provides numerous recreational opportunities. Gold Medal waters are dependent upon a healthy riparian and aquatic ecosystem.

Why is the riparian zone important?
Habitat
The riparian zone along Cow Creek is one of the richest, most diverse habitats in Vail. The many plants, birds, insects, and fish pictured here are dependent on this habitat. The topographically diverse vegetation provides cover, shelter, and food for animals and insects to live and reproduce.

Water Quality
Riparian zones play a vital role in protecting and improving water quality. The meandering bends of the channel, in combination with vegetated stream banks, slows stream flows and dissipates stream energy reducing erosion and flood damage. The riparian buffer filters stormwater runoff of sediment and contaminants.

Gold Medal and Stream
Cow Creek is a high altitude, cold water, Gold Medal Trout fishery that can be damaged by higher temperatures that raise oxygen levels. Shading created by riparian vegetation keeps temperatures cool and provides cover from predators.

Aquatic Invertebrates
Aquatic invertebrates are an important indicator of stream health. These insects require clear, cool water and stable flows. Their reproductive cycles are dependent upon a healthy riparian buffer, and they are primary elements in the aquatic food chain.

Riparian Vegetation
Riparian and aquatic plants stabilize the stream bank, filter sediment, and provide food for riparian invertebrates, birds, and other animals.
Eroded bank, sediment building, no vegetation