# Section 2: Design Principles and Standards

The river corridor should be a safe, functional and convenient experience for the users. The resource functions and values of the river including the water, riparian and wetland habitat, wildlife, scenic vistas, and other benefits should be preserved and restored as much as feasible. To achieve these goals the design principles and standards offer benchmarks. The design principles and standards apply to projects along the river corridor and offer guidance to river adjacent development. These principles grew out of consultation with the river corridor work group, citizens, property owners, government agencies, and the City staff in concert with the technical expertise and experience of the planning and design team.

View from existing path looking northeast near Oak Grove Road

# Section 2.1 Design Principles

1. All riverfront planning and development must respect private property. The trail and trail facilities should not adversely impact places of business, homes, roads, floodplain, or the natural environment. This includes accommodating parking and restroom needs that can be directly attributed to trail usage. Structures, including bridges and underpasses, must not impede flood flows or raise flood level.

2. The river corridor should serve multiple objectives in addition to recreation, such as: transportation route, drainage way maintenance, public access, stormwater conveyance, open space, conservation and wildlife habitat.

3. Trails should accommodate multiple human powered uses including walking, jogging, bicycling, skating, and where appropriate, equestrians, and be accessible to people with disabilities.

4. Trail safety standards should be consistent with nationally accepted standards including the AASHTO Guide to the Development of Bicycle Facilities, the Manual of Uniform Traffic Control Devices and include patrol, user education and enforcement of safety regulations.

5. The river corridor should offer a variety of experiences in pleasant settings. There should be a range of active and passive recreation opportunities that include a range of natural, cultural observation, and educational activities such as wildlife viewing, "working river" interpretation, settlement history and more.

6. Proposed improvements must meet applicable review and permitting requirements including FEMA, U.S. Army Corps of Engineers regarding wetlands, US Fish and Wildlife Service regarding threatened and endangered species, birds of prey and migratory birds, state stormwater management requirements, and local land use code requirements.

7. Any and all adverse impacts of the trail on the river environment or the adjacent properties should be resolved through mitigation, repair or restoration. Construction specifications, maintenance procedures and supervision must adhere to best practices and all permit requirements (including any applicable permits required by the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service or others) to avoid adverse channel impacts or habitat and resource damage.

8. Promote improved water quality by cleaning up and restoring riverbanks, prohibiting activities such as chemical storage or other potential contaminants near the river. Use vegetated areas of adequate width to buffer the rivers from industries, residences, parking lots, trails and other activities that might have an adverse impact.

# Section 2.2 Components and Design Standards

**Trail Surface and Cross Sections**
*Refer to City Engineering Standards online at www.cityofmontrose.org; Document Center/Codes and Regulations/City Regulations: Title 9 Chapter 4 and 5.*

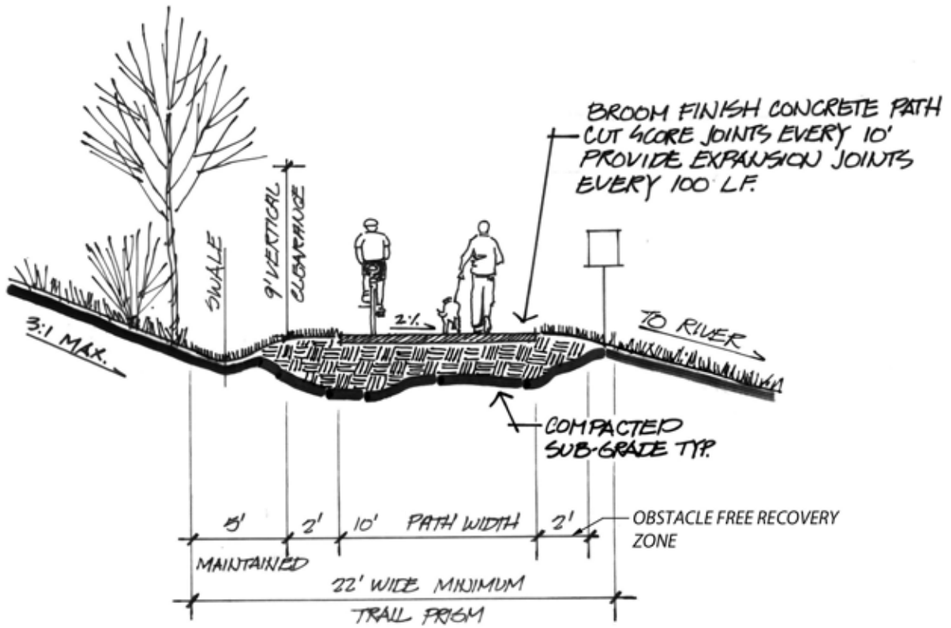
To best meet the range of predicted trail users, the trail cross-sections and surfaces should meet the following design criteria.

- For the primary through trail and direct spurs, install minimum 10'-wide trail with 2' soft surface shoulder. Broom finish perpendicular to travel direction to avoid slipping and have smooth (saw cut) joints.
- All primary trail surfaces, access ramps, bridges, and other structures must be strong enough to carry a 12,000-pound emergency vehicle.
- For crusher fine surfaces on secondary trails, a compacted 6" thick layer of 3/8"-minus crushed rock material is recommended, laid to withstand erosion. Sub-grade should be properly prepared with a ¼ inch per foot cross slope. Geo-textiles and soil sterilent may be required, depending on conditions. Do not build crusher fine trails in flood-prone or washout-prone areas.
- Proper sub-grade and base preparation should be provided to ensure the surface is stable. Use geo-textile on unstable or soft soils.
- The trail alignment shall meet guidelines provided by Guide for the Development of Bicycle Facilities by American Association of State Highway and Transportation Officials. A design speed of 20 miles per hour shall be utilized in design of the trail unless otherwise specified by the City. The design speed for grades over 4% shall be increased to 25 miles per hour. Provide minimum curve radius of 15'. The alignment shall preserve stands of existing vegetation whenever possible and minimize the amount of cut, fill, and retaining walls when practical.
- Running slopes shall be kept to a minimum; grades greater than 5% are undesirable. The grade of trail shall meet guidelines provided by Guide for the Development of Bicycle Facilities by American Association of State Highway and Transportation Officials. Where terrain dictates, grade lengths are recommended as follows:

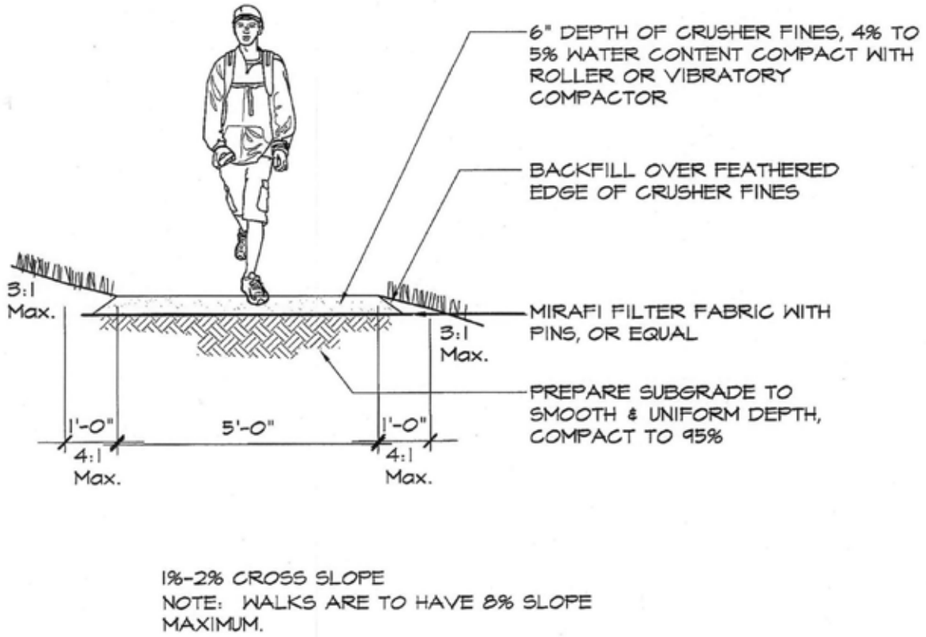
| | | |
|---|---|---|
| a. | Less than 5% | Any length |
| b. | 5-6% | Up to 800 feet |
| c. | 7% | Up to 400 feet |
| d. | 8%* | Up to 300 feet |
| e. | 9%* | Up to 200 feet |
| f. | 10%* | Up to 100 feet |
| g. | Grades over 10%* | Shall be reviewed by the City |

* Provide a handrail for grades over 8%.

- Where feasible, provide equestrian routes on a separated path.
- Site grading shall provide for drainage away from the trail surface. The concrete trail shall have a 2% cross slope to promote drainage. Culverts shall be installed to provide drainage under the trail as opposed to sheet flow drainage across the trail surface. Drainage swales shall be installed with 3:1 side slope off of the soft-surface trail edge. A 2:1 side slope will be considered where space is limited or on steep cross slopes. Sumps at drainage inlets and outlets shall be a minimum of 3 feet off edge of soft-surface trail and shall provide an adequate buffer between the trail and sump.

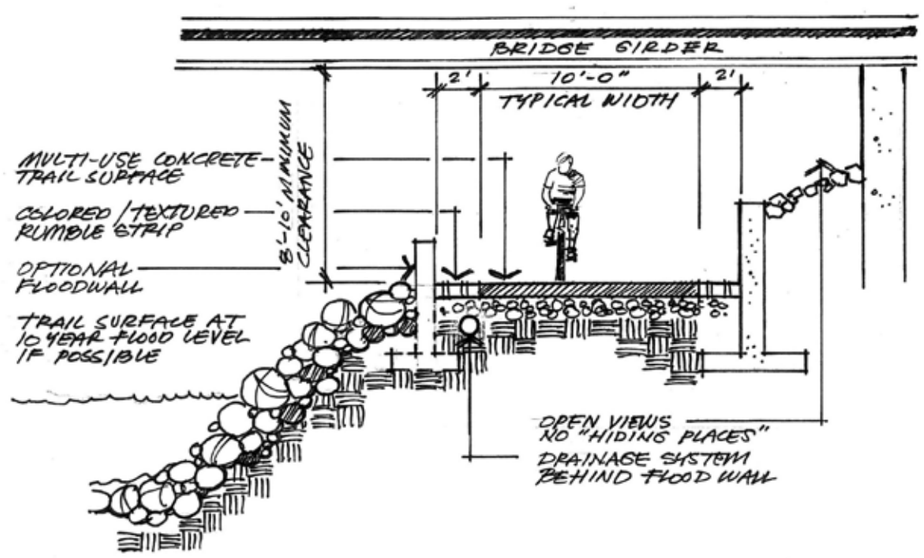



Trail Section, typical. Steeper existing side slopes may necessitate a wider overall trail corridor width.




Crusher Fines Trail

This underpass in Durango provides an open passage versus a box culvert tunnel.




Pedestrian underpass and warning strip detail for hazardous areas.

- Along steep embankments or anywhere else that a shoulder cannot be provided, a 44"-high guardrail should be installed—54" with more dangerous drop offs. (See guardrail specification below).
- Where a deck or boardwalk is required, such as through a wetland area or along an embankment that is too steep for a standard trail, appropriate materials and design must be used. Concrete, recycled plastic decking or other structural systems might be employed.
- The trail system should be designed to withstand flooding.
- In general, bicyclists and roller-skaters should be encouraged to reduce speed when entering congested areas by using signage and other "bicycle traffic calming" cues such as gateway elements that suggest a transition from rural trail to a more urban mixed-use trail/walkway.
- Pursue sustainable design techniques including, whenever feasible, use of materials found on site, local, recycled and low energy materials, use of solar and low energy lighting, minimizing impervious surfaces, native planting, and surface stormwater management techniques.
- When in close proximity to a street, trails should be separated from auto traffic by using a minimum 5'-wide buffer zone, grade separation, or a 44" -high safety railing or barrier.
- The river trail should be coordinated with other trails and on-street connections. Where the trail intersects streets and sidewalks, designs must take into account safe on-street bicycling and pedestrian uses and ADA requirements.
- Provide opportunities for loop routes of varying distances where possible.
- Locate all furnishings, trees, signs and other obstructions a minimum of 3' away from the path to allow the path right-of-way to be mowed and plowed. Ensure that sight lines are maintained.

**Pedestrian Bridges and Underpasses**

Bridge spans must meet the following criteria:

- They should be able to carry weight of maintenance and emergency vehicles (12,000 pounds) unless alternative access is available.
- They should be wide enough to accommodate both trail traffic and people who may want to linger on the span to enjoy the view. Absolute minimum width should be 10' (but 12' is preferable).
- All railings should be at least 44" high (54" on highly elevated decks and bridges). It is recommended that only clear-span crossings be utilized, as opposed to low water crossings. This will avoid washouts and sediment build-up problems. Clear spans should be placed above the 100-year flood level wherever possible, but in some instances may be lower, provided the structure will not raise the 100-year flood level (a hydraulic engineer should be consulted).
- In some locations, the trail will go under bridges or through low areas subject to flooding. In these cases, the trail should be substantially anchored (with concrete, rock, or similar system) and armored with rock to prevent wash out. A hydraulic engineer should be consulted to ensure the underpass is durable and will not adversely impact flood conveyance.
- When designing bridges, make sure bridge does not interrupt wildlife movement through corridor.
- Bridge piers shall be designed for safe boating/tubing in changing river water conditions.
- Provide overlooks on bridges as feasible.

Underpasses must meet the following criteria:

- Adequate lines of sight upon approaching and passing through the underpass. (See AASHTO standards). Provide

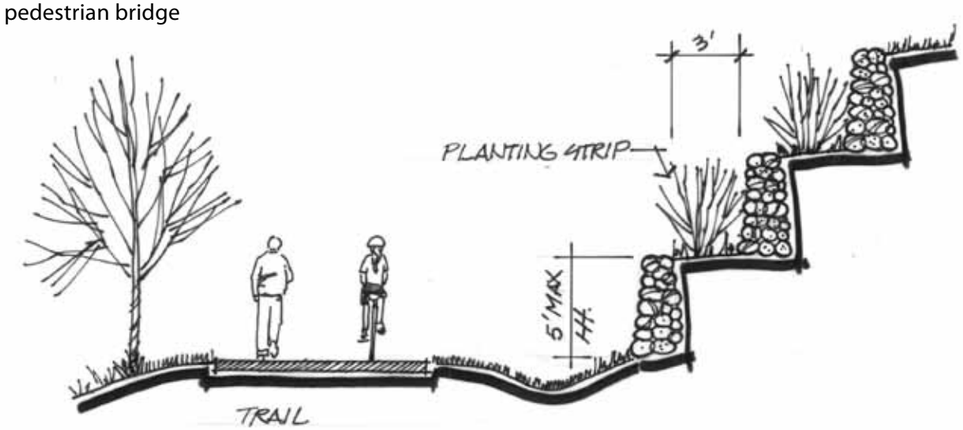
appropriate safety signage and cautions per the Manual of Uniform Traffic Control Devices MUTCD. Provide lane striping where appropriate.

- Open, wider underpasses coordinated with bridge spans are preferred to narrower box-culvert facilities. The dimensions of the underpass should not be less than 10' high (12' for equestrians preferred) by 12' wide unless flood levels prohibit. In this instance 8'6" is the minimum head clearance with an alternative route provided for equestrians.
- Provide safety lighting in underpass ceilings and at the entrances to the underpass.
- Generally design underpasses to be above the 5-year flood level, but strive to minimize need for at-grade street crossings during higher water events such as the 10-year or even 25-year flood wherever feasible. Design at-grade crossings to minimize hazards including warning signage, barriers to dangerous crossings and leading trail users to safe intersections.
- Consult a hydraulic engineer to minimize risks to users during high water and storm events. Provide escape routes ADA accessible and warning signs where appropriate. Avoid any unseen or dangerous stormwater outlets impacting the trail.
- Provide floodwalls where high water requires it to allow minimum head clearance. Provide drainage for nuisance water that may collect in the underpass.
- Provide attractive headwalls on entries into tunnels and underpasses. Use of stacked stone and stone veneers encouraged.

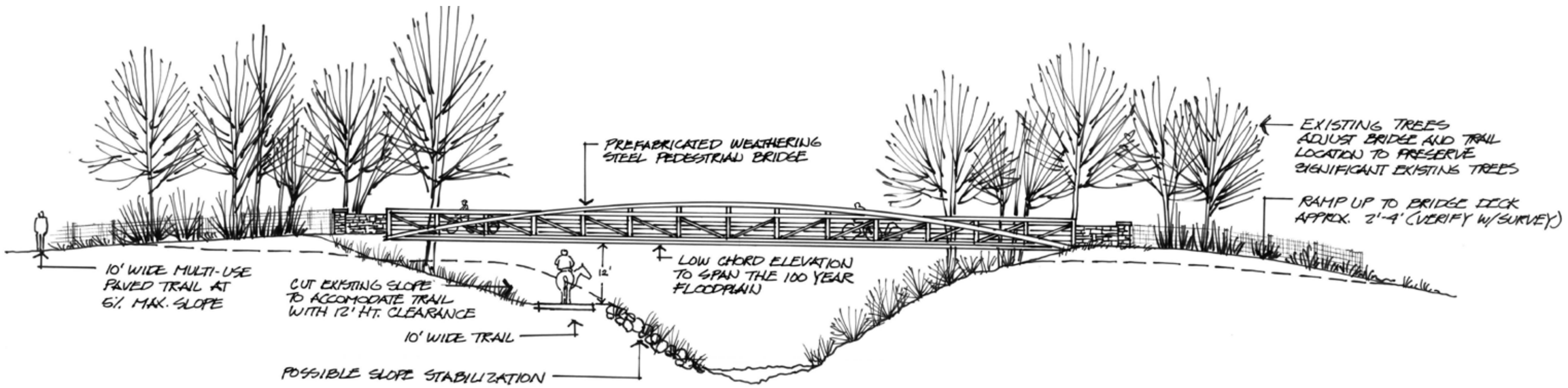
**Retaining Wall Slope Stabilization**
In general, any slope in excess of 3:1 grade will require stabilization or retention to control erosion.

- Where possible, it is desirable to keep wall height less than 5'. On very steep slopes this may require stepping walls. Provide minimum 3' horizontal planting strip between walls. Natural building materials encouraged including stacked boulders, deep raked stone veneer, and gabion walls. Walls can be constructed of concrete, anchored block system, stone or other appropriate material. Cast-in-place walls to have color and/or textures with formliners or textured surfacing using neutral colors and patterns complimentary to the natural setting.
- Plant vines and shrubs to buffer visual impacts of walls visible from the river and trail.

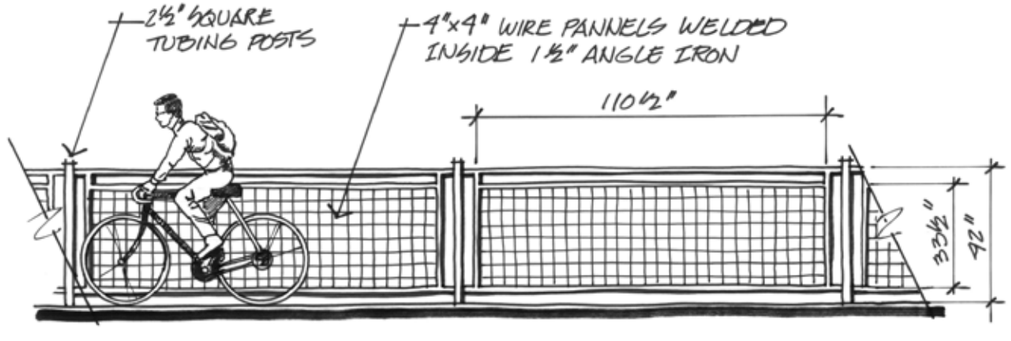
Overlook on pedestrian bridge



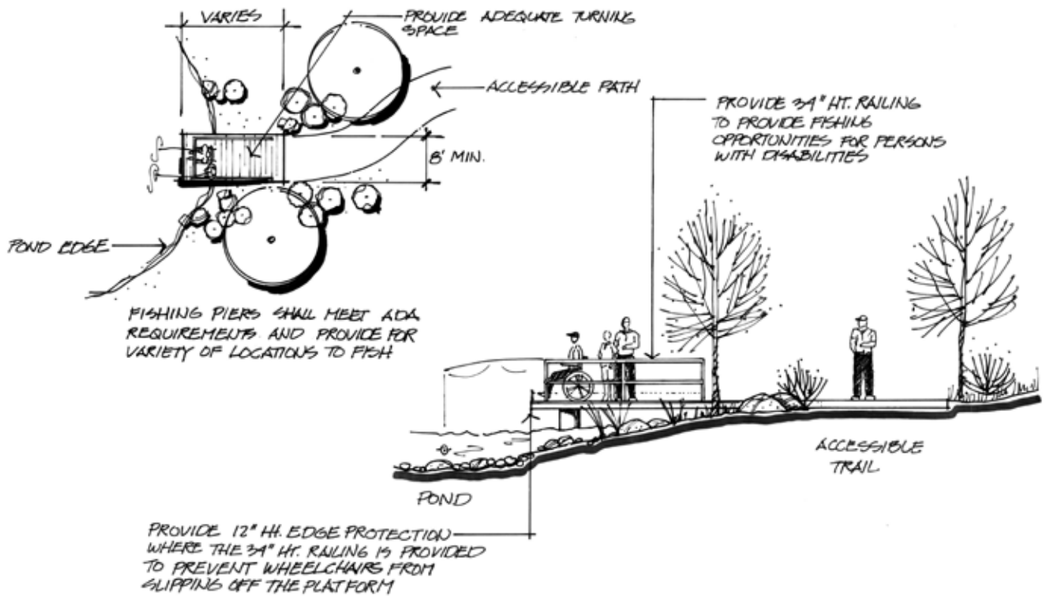

Boulder walls stabilize slopes near the Arkansas River in Buena Vista. The lower boulders are grouted for stabilization during floods (upper right). Step walls to allow for wildlife passage and provide space for planting screening vegetation.



Model railing design at River Landing Shopping Center.




The railing installed at River Landing Shopping Center provides a standard for use in other locations along the river corridor.




ADA accessible Fishing Pier

- Generally, a 44" (54" on highly elevated decks and bridges) hand railing should be placed on the downhill side of the trail if the drop off exceeds 30" in height and there is less than a 5'-buffer zone.

**Handrailing/Bike Guardrail**

Handrailing and/or bike guardrails will be required in a number of locations including bridges as well as places where a drop-off or other hazard exists and adequate shoulders cannot be provided. Handrailing and bike guardrails should meet the following criteria (See also AASHTO guide).

- The handrailing/bike guardrail should be 42" (54" on highly elevated decks and bridges) high. If there is a drop off in excess of 30" or other hazard openings on the rail should not pass a 4" sphere (confirm if necessary with local codes).
- The rail should withstand a 250 lb. load with 1/2" deflection with a w=50 pound per linear foot transverse and vertical load capacity.
- Rails should not present sharp or protruding edges and ends should be flanged and marked with MUTCD-specified hazard panels to reduce the chance of injury from collision.

**Lighting**

Trail lighting increases visibility and safety. The intensity of lighting should relate to surrounding uses with minimal lighting along open space corridors and higher levels near promenades, businesses and active areas.

- Light fixtures should be dark sky compliant with a full-cutoff shield to minimize light trespass, light pollution and views of point sources of light.
- Solar and low energy, long lasting fixtures encouraged. Lower light levels are encouraged.
- Fixture heights should be approximately 12 - 15' in height corten steel or similar dark brown color.
- Trail lights should be a minimum of 2' off the edge of the trail. Limit pole base footing height to 12" above finish grade in landscape locations.
- Lights should be spaced along the trail to create points for the user to connect lighted areas at night. The trail lights are not meant to wash the entire trail with light. Provide lighting at trailheads or connections to streets, intersections, sharp curves and areas where night commuting safety can be enhanced.
- If funding is not available to install lighting at the time of initial trail construction, install conduits at crossing points under the trail.
- Wildlife habitat should be considered when specifying exact light locations.

**Trail Access and Parking**

Two types of access points are recommended in this plan: intermodal and ride/walk-up.

- An intermodal access serves automobiles, bicycles, pedestrians, wheelchairs, equestrians and other users seeking access to the trail system. The facility is designed to accommodate users arriving by auto, as well as those who arrive on foot, bike or other means. An intermodal access area offers adequate parking (15 to 50 or more spaces depending on location), possibly restrooms, informational signage, and other amenities such as benches, bike racks, emergency phones, picnic tables, drinking fountains and trash receptacles. It should accommodate vans, buses and horse trailers, as well as cars, and should include at least one parking and loading space adequate for disabled users (12.5' wide with disabled parking symbol).
- Intermodal access points may be combined with parks, shared commercial parking lots, park-n-rides and other facilities. They should be carefully planned and located, with landscape buffers, if necessary, from adjacent uses. They should not

be located directly adjacent to residences or other uses where there might be a conflict or security problem.

- Ride-up/walk-up access points are locations where people from local neighborhoods, employment centers, or other adjacent areas can access the trail corridor on foot, bicycle or wheelchair. Auto parking is not provided. There should be adequate informational signage and minimal amenities such as benches and trash receptacles.
- Generally, all types of access points should include access control that admits maintenance and emergency vehicles but not other motorized vehicles. The access point should have a trailhead sign with a system map showing "you are here" marker, disabled access and distance information, and a list of trail user responsibilities. All facilities must be designed to accommodate users with disabilities. To discourage unauthorized motor vehicle access, a defining entry feature using bollards, pavement texturing and signage should be used. Solid bollards or posts in the center of the entry should not be used because the posts may be hard to see and may create an obstacle for bicyclists. However, flexible/"rubberized" bollard products may be considered as a center traffic post.

**Rest Areas/Overlooks/Amenities**

Rest areas and overlooks should be provided at regular intervals along the trail. Several kinds of rest areas could be offered including rest pads, standard rest areas, overlooks, and trail pavilions. All rest areas and overlooks should be designed to move users off the main trail to eliminate any possible traffic hazard.

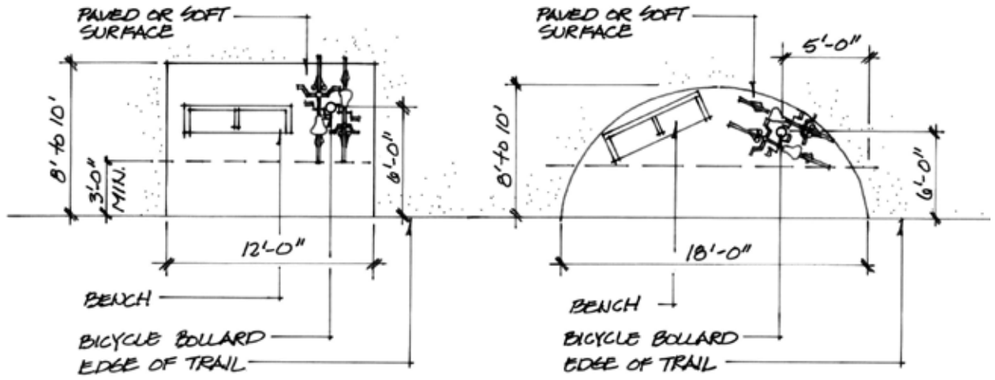
- Rest pads can consist of a 10' x 10' (minimum 5'x') stopping point just off the trail with a simple bench and perhaps informational or donor credit signage. These should be located every one mile maximum depending on grade.
- Standard rest areas should be located every one to two miles and should include a crushed stone or concrete pad with benches, an informal bike rack, informational signage and, perhaps, a drinking fountain.
- An overlook is a special kind of rest area tied to a view of special interest, such as a wildlife or historic area. In addition to the standard rest area features, an overlook would likely include interpretive signage describing the area being viewed.
- Consider storm shelters, sunshade structures and picnic shelters appropriately grounded for lightning.

**River Access**

Water recreation activities such as canoeing, kayaking, and rafting along the river should be considered where feasible and hazardous obstructions such as low-head dams should be addressed.

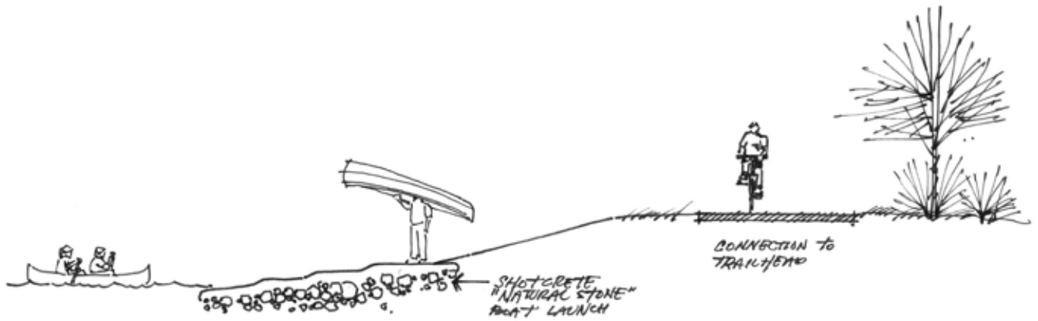
- Provide boater access and take out points, and signed portages where necessary.
- Provide safe, shallow entry areas with slopes less than 10% for a minimum of 15'.

A shallow, protected area constructed along the Arkansas River in Salida provides stepped access to the water, reducing bank erosion.

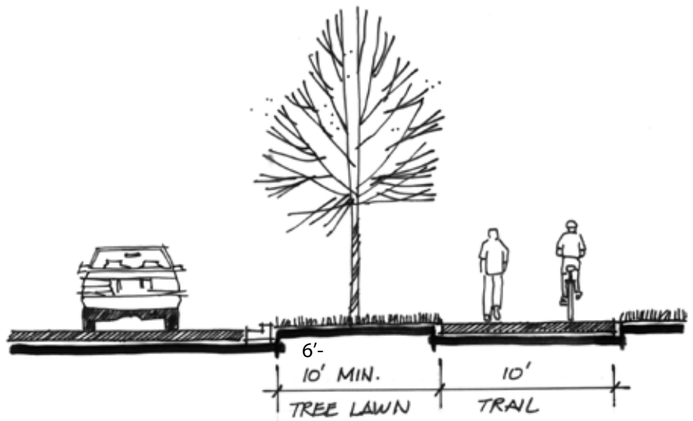



Typical Rest Areas

Typical Fishing Platform




Typical Water Access




Detached Trail at future Rio Grande Avenue alignment and other locations where trail may follow a roadway.

Sculpture adds interest to a previously blank wall along the Animas River Trail in Durango.


Mile marker along trail at Three Springs in Durango

- Provide areas of lawn or hard surface (such as flagstone terraces) adjacent to water access areas for clean temporary storage and loading of gear.
- Add fish ladders at diversions and dam sites as feasible.
- Provide routes for safer boating access at the time of reconstruction of diversions and dams.

**On-Street Bicycling**

Overall it is a goal of this plan to have a continuous multi-use trail separated from streets. However, some segments may require temporary on-street connections or alternative on-street routes. The standards are included here as an aid in planning an integrated system where off-street and on-street elements interface. Note that on-street standards are subject to change (See AASHTO Guide to the Development of Bicycle Facilities) and will vary depending upon factors such as traffic speeds and volume. A traffic engineer with expertise in bicycle facilities design must be consulted for bike facility projects and all street design must be in conformance with current City of Montrose, county and state agency design standards.

Pavement should be smooth and free of ruts, holes, debris or other obstructions or hazards including storm grates with openings perpendicular to the direction of bicycle traffic. All joints and edges must be kept smooth so not to catch a bicycle tire or promote bicycle swerving. Ramps to on-street routes should meet both AASHTO and ADA standards of width, grade and line of sight. Several types of on-street conditions are addressed as follows:

- For shared traffic lane with parking—narrower lane—In each direction provide a wider than 12' shared traffic lane (14' preferred). Install yellow diamond-shaped "Share the Road" signage at either end and throughout the corridor. Where transitioning from a designated bike lane, provide merge lanes for bicycles at either end of this type of corridor with "Bike Lane Ends" signage.
- For shared lane with curb and no parking—In each direction provide a demarcated minimum 4'-wide bicycle lane (in addition to the curb pan) defined with a 150mm (6") wide solid white stripe leaving a 12'-wide lane for traffic. 5'-wide bike lanes are recommended on hills and where traffic is heavy. Provide "Bike Route" and "Share the Road" signs at appropriate locations.
- For shared lane with curb and parking—wide lane—In each direction provide a demarcated 13' to 14'-wide maximum parking/bicycle lane defined with a 150mm (6") wide solid white stripe leaving a 12'-wide lane for traffic. Delineate 8' x 20' parking stalls with solid white lines. Provide "bike route" and "share the road" signs at appropriate locations. For shared lane with shoulder (no parking on road)—Provide a demarcated bike lane that is at least 4'-wide in each direction. The painted demarcation line should be a 150 mm (6") wide solid white line.
- For shared lane with shoulder (no parking on road)—Provide a demarcated bike lane that is at least 4'-wide in each direction. The painted demarcation line should be a 150 mm (6") wide solid white line.

**Signage, Wayfinding and Interpretive Elements**

The informational system includes: entry monuments, gateway signs, information signs with maps, directional signs, traffic and safety signage, mile markers, interpretive signs (including historic sites and markers), displays, artistic/sculptural elements and artifacts. The informational system should have the following qualities:

- The signage and way-finding system should be an attractive, distinct, uniform system of signs, displays and possibly artistic elements that guides and informs both local and out of town users with respect to the trail corridor and other amenities. Use international symbols that are easily understood by most users.
- All trail signage shall be designed to meet guidelines provided by Guide for the Development of Bicycle Facilities by American Association of State Highway and Transportation Officials (AASHTO). A consistent style and information system should be provided for all greenways, trails and parks throughout the community.
- At major entry points, key gateway signs should be provided. These include: a map of the system, accessibility information, estimated travel time, user safety guidelines, emergency contact, leave no trace information, code of conduct, and other pertinent information.

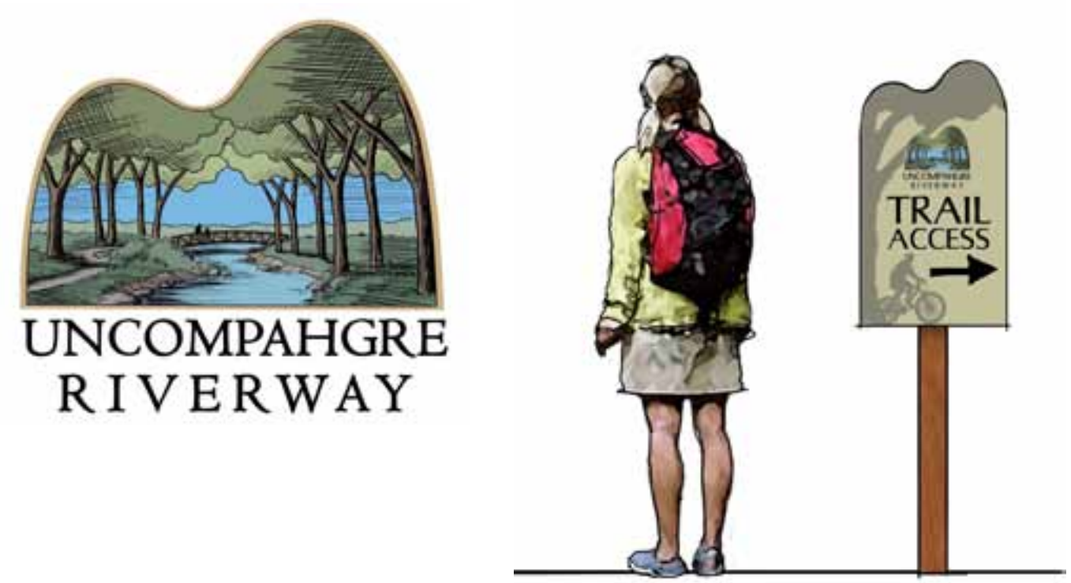
- Structures should be designed for easy repair and maintenance.
- Signs and other structures should be set back from the trail at least three feet —or properly marked or protected when setback is not feasible, to avoid hazards to trail users.
- Mile markers should be provided every ¼ mile for user guidance, maintenance and emergency reporting.
- Signs, displays, mileposts, and artifacts should be kept in good condition. Text and content should be kept current and updated.
- Cluster signs to minimize poles.
- Informational and interpretive displays are encouraged along the trail. Themes to be addressed include maps, history, geology, natural sciences, fitness, and ecology. Displays could include waysides, sculptural elements and artifacts.
- Consider high tech signage/touch screens at trailheads that post information about City events, destinations, and tourist information.
- Coordinate signage fonts and character with the Look Deeper Montrose Graphic Brand Standards.

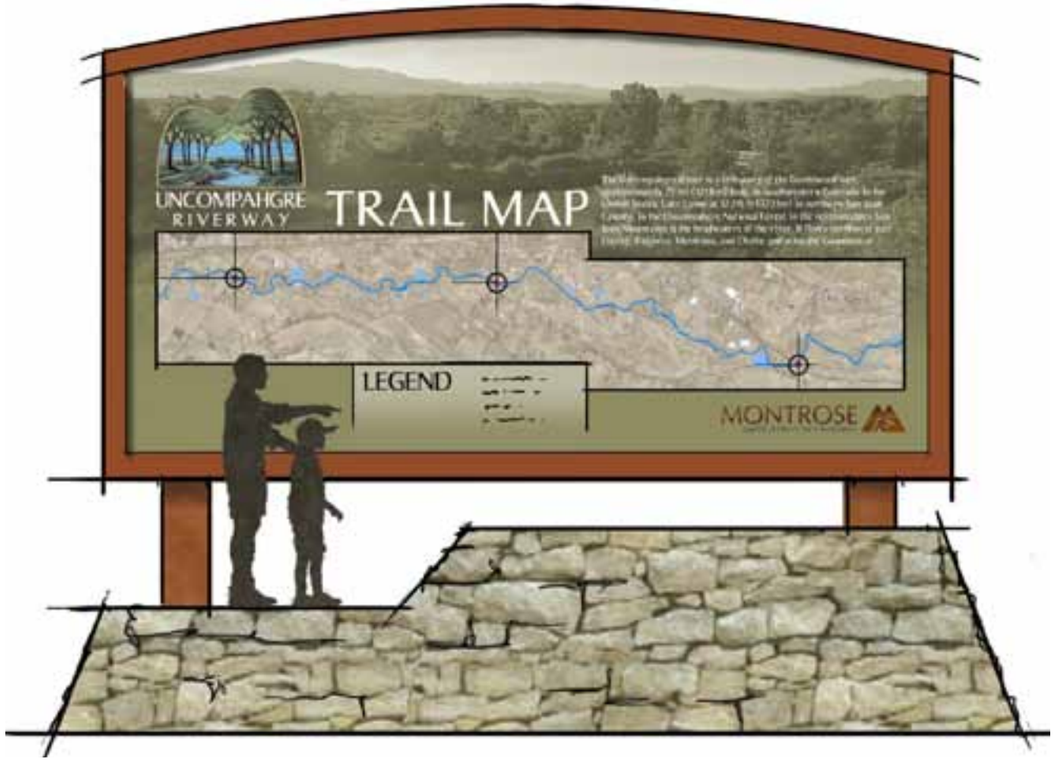
**Design Character**

The Uncompahgre River Corridor offers a unique natural setting within the developed surroundings. The nature of the corridor is a meandering stream with a shady overstory of cottonwoods. Adjacent to the stream a variety of riparian vegetation exists with pockets of wetlands, wet meadow grasses, willows, and a variety of stream bank vegetation. Visitors to the corridor seek connection to the natural environment, recreation, exercise, wildlife viewing, and a rest area. Research indicates that regular exposure to natural areas improves mental health and supports interest in the environment.

The intent of the corridor plan is to protect and enhance the natural qualities by minimizing the visual impacts of constructed improvements. New elements should be designed with consideration to views from within and into the river corridor. Sustainable site design strategies and techniques should be incorporated with an emphasis on education.

- Natural materials are preferred, such as stacked boulder walls rather than concrete.
- Provide informal seating through use of boulders set at approximately 18" - 24" height. Design walls to provide seating opportunities. Logs can be cut to provide seating.
- Metal railings, lights, and bollards to be corten steel or matching dark brown color.
- Use neutral colors that blend into the surroundings.
- Use bioengineering or biotechnical stabilization techniques where appropriate such as brush layering, willow staking, native seed, biodegradable erosion control fabrics/blankets, and vegetated swales in place of rock-lined or hardened structures where feasible.
- De-emphasize and buffer views of built structures within the river corridor.
- Ornamental structures such as pavilions, sculpture and plazas are an exception that can be featured within the corridor, however, they should be designed to be complementary to landscape views.



These in-stream structures, pool-riffle sequences and riparian and wetland habitat (overhead cover) were designed and created to produce a world-class trout fishery at the Roaring Fork Club in Basalt.

# Section 2.3 River Corridor Ecology

The ecology of the river corridor as addressed in this master plan encompasses the river channel, adjacent riparian vegetation, and extended edge conditions. Riparian zones and their associated vegetation are an oasis of important wildlife habitats in western Colorado because of the semi-desert climate. The presence of water and high water tables adjacent to streams allows for the growth of taller, denser, and more diverse species and structure of plant communities. This vegetative and structural diversity in turn provides more habitat for a great diversity and number of animals to flourish, from microbes to insects to birds and mammals, the flora and fauna provide sources of food, shelter, cover, nesting and breeding habitat for riparian-dwelling wildlife. Riparian ecosystems provide a transition area and buffer between upland and aquatic habitats and are directly affected by the surface and subsurface water of the stream and adjacent drainages.

**Methodology**

The inventory and analysis prepared for the master plan were completed at a macro level by a team from Walsh Environmental which included a river ecologist, a water resource engineer, and landscape architect performing a qualitative field assessment of the 10-mile corridor along with an overview analysis of existing GIS mapping data. The analysis was also informed by previous reports including the 2000 Montrose Greenway Feasibility Study and input from local agency review and focused specifically on the aquatic, wetland, riparian and terrestrial habitat conditions within and adjacent to the river.

The Walsh team divided the 10-mile master plan study into 16 reaches (A through P) based on predominant characteristics regarding land use/land cover, stream bed, stream bank, and overbank habitat conditions and qualities. Data collected included the grading (i.e., a score of A through F) of existing conditions. The data sheets are available in the appendix. Ideas for restoration are included.

Habitat Assessment Mapping is a second tool used to supplement the Riparian Corridor Assessment data and grading to show the geographical inter-relationships and landscape patterns of the adjacent urban environment that affect and influence the riparian corridor. The assessment map includes colored polygons defining the dominant habitat types and disturbance conditions. Habitat patterns combined with a Riparian Report Card that grades the habitat condition provide indication and rating of quality, potential opportunities and constraints for preservation and restoration areas, recreational access, and waterfront adjacent development. The Riparian Report is provided in the Appendix.

**Existing Condition Summary**

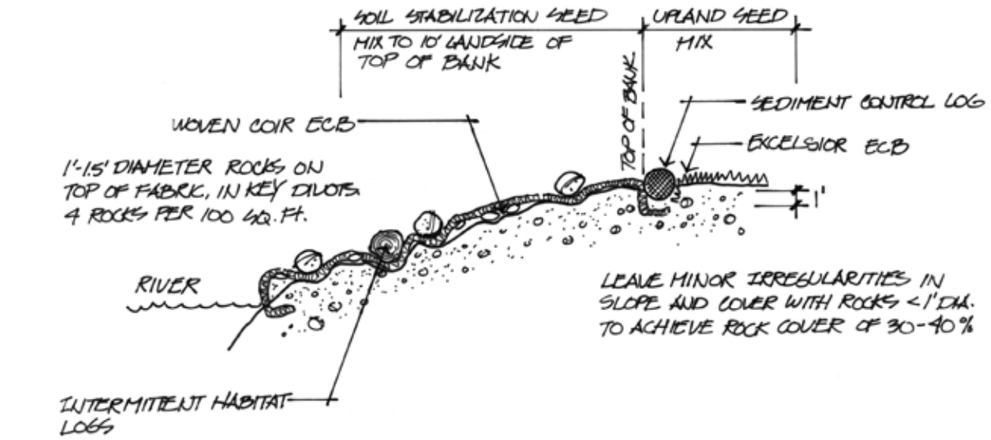
The history of Montrose is connected to the Uncompahgre River Corridor. Camps and ranches settled in the area to support area mining operations. With the construction of the Gunnison Tunnel in 1908-09, the valley supported extensive agriculture. The current condition of the river varies in response to historic and current land uses. Regarding ecological system health, a wider cross section of riparian, wetland and upland habitat in the floodplain is desirable, providing for a greater diversity of vegetation, infiltration of flood water and ground water recharge, water quality treatment, wildlife habitat and shading of the stream. Natural functioning river corridors are dynamic systems that move across the floodplain in response to flood flows, obstructions, soils, and gradient. Development within the valley and floodplain constrictions along the river have affected the river by altering flows, flood elevations and patterns, changed the mineral content, impacted the channel structure, and reduced the permeability and vegetated cover of the drainages within the watershed.

The Uncompahgre Valley Water Users Association completed the Gunnison Tunnel in 1904 which supports 575 miles of irrigation canals and laterals that irrigate agricultural lands in the Uncompahgre Valley. The effect of the agricultural system irrigating the Mancos shale soils is increased pH, salinity and specifically selenium levels in water bodies, creeks, ditches and the River. The Bureau of Reclamation and NRCS are increasing programs targeting improvements to selenium levels. Improvements targeting selenium reduction can potentially be located along the river corridor at the confluence of tributary drainages from the agricultural areas.

Additionally, Ridgway Reservoir, completed in 1987, regulates flows from the Uncompahgre headwaters. The regulation removes some flooding that could affect the adjacent vegetation and sediment/nutrient loading. The reservoir potentially settles out heavy metals and other contaminants leached from mining operations upstream and releases significantly cooler water, which is a benefit to native fish offsetting the warming effect caused by loss of much of the canopy along the corridor that shaded the river.

This sketch illustrates potential riparian vegetation restoration possible in Cerise Park that can be supported by adjusting the alignment of the existing drainage channel to support higher soil moisture levels in larger areas within the river corridor. Species that would be targeted for restoration include wet meadow grasses and forbs and understory woody plants.

This example shows a bank stabilized with boulders, logs and vegetation on the Eagle River in Edwards, Colorado.




Type D Treatment: Bank Enhancement Section

Bioengineering example: Live willow stakes rolled into biodegradable fabric with topsoil sprout and reinforce channel edges at Three Springs, Durango at installation, (left) and one year of growth, (above).

**Significant Ecological Reaches**

*Reach A: Braided Agricultural*

Gravel mining has been a thriving industry and a significant part of the Montrose economy. The areas of previous and adjacent gravel mining are in various conditions. Reach A is highly unstable. Both banks and the bed are actively eroding in response to a recent event that has altered the equilibrium. Further, the riparian overstory is threatened because water levels are falling with the incising invert (channel bed elevation). The riparian vegetation is becoming disconnected from the sustaining water table as the river channel bed elevation and water levels fall due to channel incision. Braiding occurs when deposits form from upstream disturbance. Entrained sediments are carried by the tributary drainages that enter the Uncompahgre and are likely one of the sources causing the deposition and braiding. Reductions in sediment loads from gravel mining, soil erosion, and bed and bank disturbance would assist in stabilizing this area. A range of restoration alternatives with a wide range of cost are possible to further restore the riparian corridor. Detailed studies need to be done to analyze and restore specific areas.

*Reach K: Ogden Road*

While impacted by previous gravel mining, has areas of intact habitat on both sides of the river. Acquisition of this area would allow a wider corridor for habitat and allow space for enhancements that improve water quality.

*Reach D and E: Happy Canyon and North 9th*

The riparian habitat and adjacent, undisturbed open land and floodplain in Reaches D and E between Taviwach Park (Reach C) and Main Street (Reach F) rate as one of the most significant habitat areas within the City and warrants serious consideration for greater protection via acquisition and preservation. This area remains largely intact without major fragments and development incursion, and is high quality, functioning habitat that has not been gravel mined. This area has mature, expansive, and structurally diverse native riparian cottonwood forest, understory shrub, wetland and grassland habitat provide a refuge for a suite of large and small wildlife, song birds, birds of prey and waterfowl that local residents enjoy observing on a daily basis. This area would provide a significant open space linkage, functional habitat, and educational/ interpretive opportunities between the City's growing network of parks and open space from Cerise Park, to North 9th and Grand Park to Taviwach Park and downstream to La Salle Road.

*Reaches O and P: Loutsenhizer and Upstream Agricultural*

The broad, open grasslands, ponds, wetlands, and ribbons of riparian forests along the southern reaches of the river corridor provide a critical mass of land area for wildlife to move, hunt, breed and find refuge. While these reaches currently lie within the regulatory purview of the County, as the City expands, annexes, and begins to develop, these agricultural lands warrant greater preservation than the Uncompahgre River Buffer Zone Ordinance will provide. Preservation of a broader riparian corridor and floodplain in this relatively uninhabited area will protect and maintain the natural functions, and recreational and scenic values that this area currently provides.

Habitat Functions:

- The river itself provides habitat for fish.
- The river provides feeding areas and travel corridors for waterfowl and other birds such as Great Blue Heron, and mammals such as otter, muskrat, mink, and beaver.
- The river is a source of water for wildlife consumption.
- Riparian vegetation (terrestrial, wetland and aquatic) provides food, shelter, hiding cover, nesting cover, and nesting sites (cavity nesting birds, for example).
- Riparian corridors provide important pathways for daily and seasonal movement of wildlife.

The following factors affect the quality of the aquatic, wetland and riparian habitat and therefore the associated quality of Uncompahgre River wildlife and fishery habitat in the Montrose area:

- Water quality impacts
- Sediment loading from erosion and urban runoff in the watershed
- Bank erosion along river
- Lack of natural pool-riffle sequence

- Loss or down-cutting of intact stream bed
- Removal and/or narrowing of the riparian forest
- Fragmenting and constriction of migration/movement corridors up and down the corridor caused by built structures, bridges, roadways
- Lack of food base due to gaps in adjacent vegetative cover

Wildlife concerns in river corridors in urban/suburban areas:
- Restricted wildlife movement as corridor narrows or man-made structures impede
- Loss and alteration of vegetation communities
- Loss of solitude/hiding cover
- Changes in hydrology (floodplain loss, constriction, channelization)
- Disturbance to feeding/nesting/resting from increasing human activity; various species have very different tolerances for disturbance.
- Timing and type of disturbances: continuous, intermittent, regular/irregular)
- Proximity of disturbances (tolerance varies by species)
- Potential increase in runoff, siltation, pollution to streams

Species of particular concern in or near the river corridor (list does not include all Montrose County Threatened, Endangered, or Special Concern Species):
- Yellow-billed Cuckoo (Federal Candidate, known to nest along the Uncompahgre River between Delta and Montrose);
- Bald Eagle (State Threatened, migration & wintering)
- Western Burrowing Owl (State Threatened, could be located in prairie dog towns near river corridor)
- Greater Sandhill Crane (State Special Concern, migration, nesting in western Montrose County)
- Peregrine Falcon (State Threatened)
- Northern Leopard Frog (State Special Concern)
- Midget Faded Rattlesnake (State Special Concern)
- Northern River Otter (State Threatened)

**Restoration and Enhancement Concepts and Guidelines**
Aquatic habitat features can be installed to enhance the fishery, including both instream and bankside treatments. Instream treatments improve deepwater habitat, create flow separation and concentration zones, increase flow sinuosity, provide instream cover, improve adult fish habitat, create nursery areas, and enhance spawning opportunities. Bankside treatments include creation or enhancement of protective, overhead cover; provide shading to enhance and maintain temperature and pH; provide nutrient input for the aquatic food chain; and stabilize streambanks.

Of particular importance in riparian zones is the cottonwood-willow vegetation community. These plant communities make up a very small percentage of the land area of the western U.S. but are utilized by over three quarters of wildlife species for some portion of their annual life cycle. Perhaps half of the wildlife species found along the Uncompahgre River would not be present without the river and its associated vegetation.

Strive to maintain acreages of habitat that are:
- Relatively intact ecologically
- Of larger size
- Unique or rare
- Provide buffers to key habitats or sensitive wildlife activity areas

When locating high-use facilities (picnic areas, sport facilities or courses, parking lots), strive to:
- Locate them in areas already disturbed by human activity (former building sites, farm fields, junkyards)
- Locate generally farther from the river itself
- Avoid removal of existing quality, high density vegetation (such as cottonwood, willow, three-leaf sumac and other native trees and shrubs)

When locating trails:
- Minimize or reduce the length of trail immediately adjacent to the river
- Avoid cutting through the middle of natural vegetation patches; keeping trails along edges between different vegetation types will usually have less overall impact because species that thrive in edge areas are generally more tolerant of disturbance.

**Bank Improvements with Bioengineering and Biotechnical Treatments**
The distinction between these bank treatment methods is that vegetation is the primary stabilization component in bioengineered treatments, and only natural materials are used. Biotechnical methods incorporate vegetation into the treatment, thereby maintaining the benefits and natural look and function of "softer" treatments; however, they rely on non-natural materials in addition to the vegetation for stabilization.

Stabilization of eroding banks improves downstream water quality by reducing a significant source of fine sediment and nutrient loading. A broad range of treatments is possible including willow and pole cuttings, willow wattles and log toes, brush layering and brush revetments, and reinforcement lifts. Biotechnical treatments are well suited to areas with higher scour potential and in areas where known impacts will continue and include geocellular confinement systems that are topsoil-loaded and vegetated and rock/log deflectors to redirect flows off of the banks. Bank treatments are intended to restore the natural variability and function of unimpacted streambanks. Steep banks are laid back to milder slopes, with minor irregularities and variations to work around existing features including mature trees and large boulders. The banks may receive interim protection with degradable erosion control fabric during revegetation. The fabric is overlain with cobbles and logs in natural groupings to achieve 30 to 40 percent coverage. Woody debris also contributes to instream shading and cover; and serves as a food source and substrate for aquatic invertebrates.

**General Habitat Enhancement Measures**
- Instream aquatic habitat for fisheries, including low flow concentration and pool development
- Bioengineered and biotechnical bank stabilization should be the approach emphasized throughout the corridor to provide added benefits to aquatic and terrestrial habitat.
- Planting and seeding riparian buffers
- Noxious weed control and removal
- Control of spontaneous foot trails in preservation and restoration areas

The following recommended studies would help provide additional data for restoration projects:
- Inventory existing wildlife and wildlife habitat values
- Identify which species have critical needs for specific existing habitats (and conversely, identify opportunities for restoring or replacing necessary habitats for species currently missing but of great conservation interest)
- Assess level of species tolerance to proposed activities/actions; use this information to integrate human facilities/activities in the river corridor

Mitigation wetlands constructed for River Landing.

# Section 2.4 Stormwater Management

The City of Montrose Storm Drain Master Plan, adopted in 2009, provides a comprehensive description of the drain system needs along with prioritizing recommended improvements. The Uncompahgre River is the major natural drainage feature and receiving stream for six major drainage basins mapped in the area. The City maintains the drainage infrastructure within the urbanized area. The Bureau of Reclamation owns a significant portion of the regional irrigation distribution system, which is operated by the Uncompahgre Valley Water Users Association.

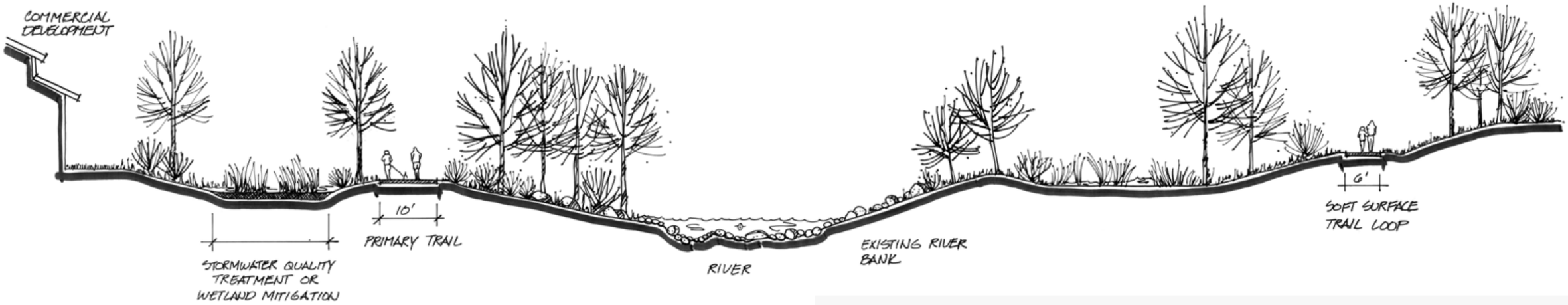
As noted in the Storm Drain Master Plan, the City is included in the Phase II regulations of the Colorado Stormwater Program propagated from the NPDES (National Pollutant Discharge Elimination System) part of the Clean Water Act. Any development in or adjacent to the river corridor must follow these regulations, and additionally meet requirements of FEMA (Flood Emergency Management Act) and the US. Army Corps of Engineers.

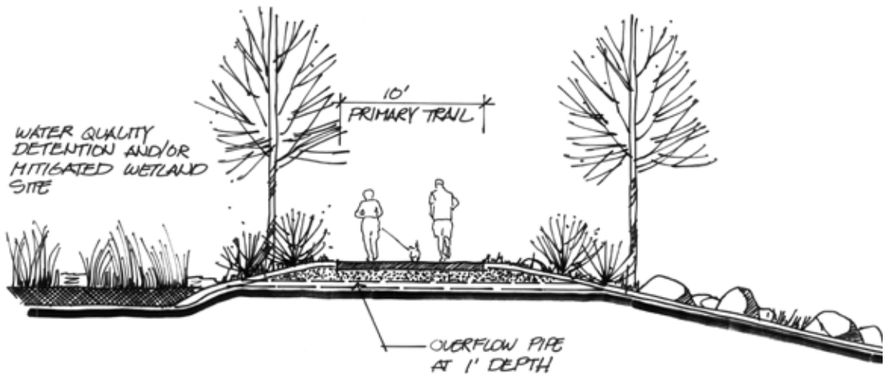
The Stormwater Master Plan is an important tool used to identify opportunities for improvements with multiple benefits. All projects can explore opportunities to incorporate stormwater management elements into proposed improvements. The application of surface elements has the potential to benefit the overall ecological health and open space quality of the river corridor while also performing important stormwater management functions.

Further, opportunities exist for partnering with agencies and private land owners to provide for stormwater management elements that meet development requirements with regional systems that offer reduced development costs by offering an economy of scale and consolidation of features, easing long term maintenance. Such features offer the opportunity to provide examples of progressive solutions and educate the public on the importance of constructed stormwater management elements as part of the City infrastructure.

All improvements and adjacent development should apply Low Impact Development (LID) techniques: refer to http://lid-stormwater.net and http://www.lowimpactdevelopment.org.

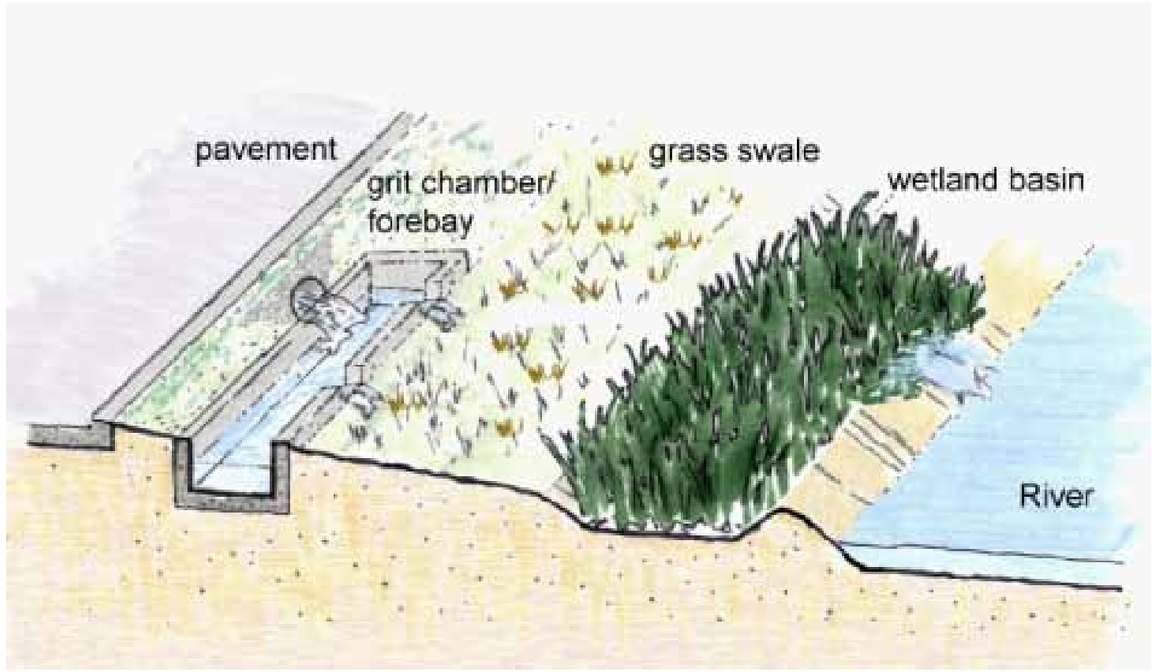
- Direct runoff through landscape swales
- Maintain a vegetated buffer from impervious areas
- Disperse drainage to multiple landscape locations versus concentrating flows to single outfall as much as possible.
- Integrate treatment areas into the site plan
- Provide landscaping that is complimentary to the river corridor, emphasizing native and adapted plant selections, minimizing the need for application of fertilizers.
- Utilize passive and active water quality enhancement measures via vegetated buffers, filter strips, bio-swales, and natural treatment systems.
- Incorporate natural treatment systems at point source discharge



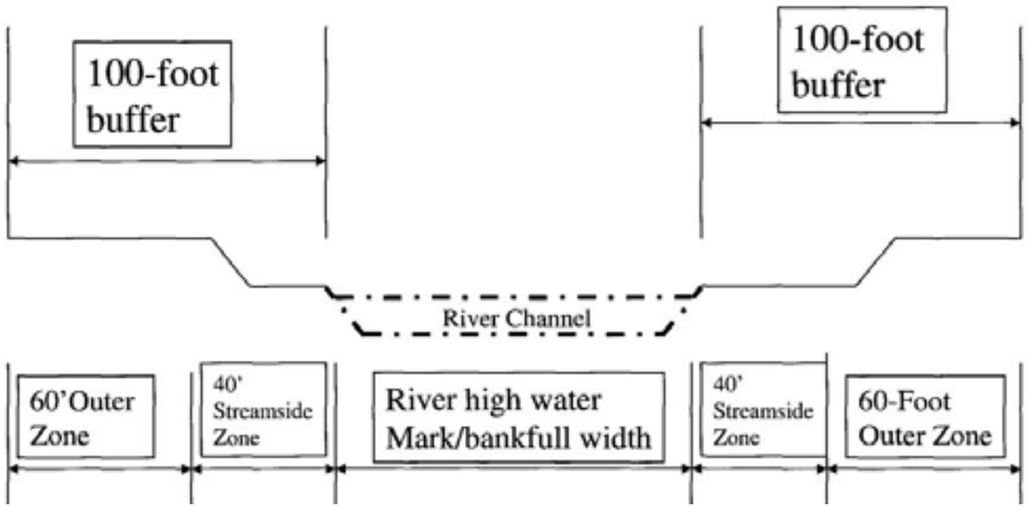




The path can provide a grade separation between a constructed surface stormwater element and the river.

A constructed water quality basin removes sediment and pollutants from urban runoff before it enters the Roaring Fork River in Jenny Adair Park.




The diagram illustrates the concept of a "treatment train" where a series of surface basins target the removal of runoff pollutants. The grit chamber targets sediment and gravel within a basin that is easily accessed for maintenance and removal of materials. The subsequent vegetated treatment areas remove finer particles and uptake nutrients such as phosphorous and nitrogen that occur naturally, but damage the river when present in high amounts. Sources of these pollutants are chemical fertilizers washed off landscape areas, animal droppings, and concentrations of organic materials. The vegetated elements of the system are well suited to the outer zones of the river corridor and can meet stormwater management requirements for river adjacent development while benefitting the river corridor by supporting higher soil moisture levels and areas of riparian vegetation.




From the City of Montrose Municipal Code – Section 4-4-8.3: Uncompahgre River Buffer Overlay Zone

# Section 2.5 River Adjacent Development

River adjacent property has an opportunity to benefit from expansion of the river corridor by linking to the trail network, providing access to open space, recreational amenities, and featuring views. River adjacent commercial areas have the potential to offer a unique setting for retail and restaurants as well as offering a quality worksetting for offices. Commercial, civic and residential uses can benefit from increased access through connection to the trail network.

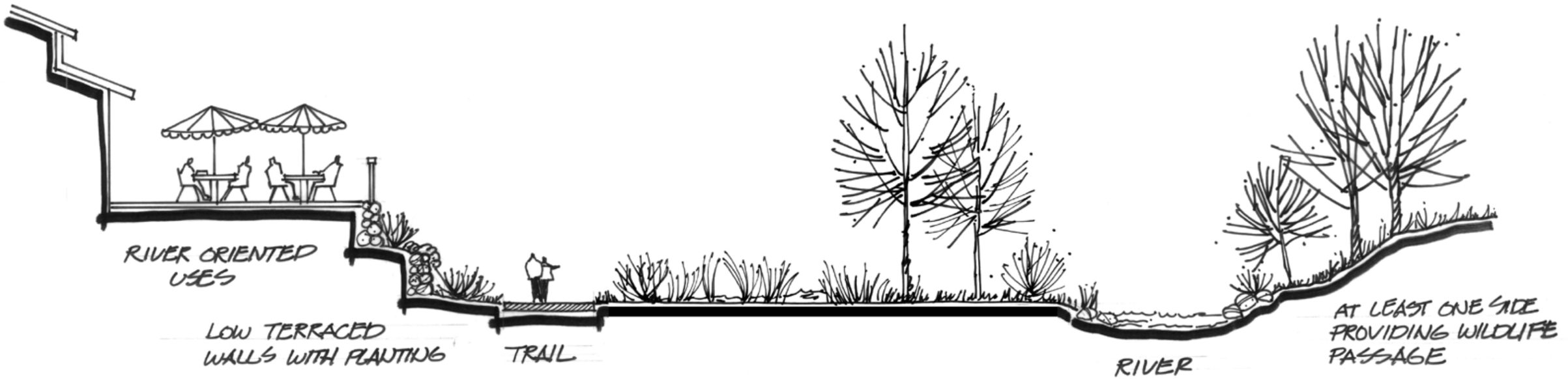
The following considerations will improve the quality of the river corridor edge:

- Orient buildings to include entrances, patios and windows facing the river corridor
- Provide trail connections and easements providing access to the primary trail
- Screen dumpsters, outdoor storage yards, large blank walls and parking from the river corridor
- Provide native and adapted landscaping along the river corridor edge
- Use wildlife friendly fencing
- Soft surface to river at key points as social trail develop

**The Uncompahgre River Buffer Zone (URBZ)**
URBZ ordinance was approved by Montrose City Council in April 2010 prior to the commencement of this Master Plan. As noted in the Ordinance: The buffer zone includes two zones. The "Streamside Zone," preserves the corridor in a natural state within 40 feet of the river high water mark. The 60 foot "Outer Zone" allows more flexibility regarding river oriented development. Applications for construction in the URBZ are processed through the City of Montrose Community Development Department.

The intent of the ordinance is to provide protection to stream bank areas and achieve a vegetative buffer between development and the stream. The outer zone can accommodate river compatible uses by varying preservation and restoration requirements relative to the existing conditions and proposed adjacent land use intensity.

As a recent City ordinance, the URBZ needs to have flexibility to be refined in the future to respond to specific site conditions and opportunities. Variances to the URBZ may be appropriate to accommodate limited higher intensity activity at retail nodes. This would allow for café patios and hard surface trail connections within physically constricted areas.




Example of more intense river oriented commercial adjacent to the river corridor.

Salida, CO

Durango, CO

Durango, CO

Durango, CO

Taken Ca. 1890, first bridge over the Uncompahgre near Montrose.

Taken 1884, horse drawn wagon on Dave Wood Road, near bridge over the river. Stereoscopic image.


# Section 2.6 Education

There are a number of historic and cultural resources along the river corridor. Regional history can be interpreted through signs, featuring of key views, providing information in museums, design interpretation, and featuring in website materials.

The Denver and Rio Grande Railway was built in the 1880s and abandoned in the 1970s. The railroad grade generally followed the river. The historic depot still exists in town and houses the local history museum. The abandoned railroad grade is now a bike path and part of the national Rails to Trails program, attracting visitors. This section provides an important segment of trail that should be expanded to the full major trail cross section width in time as other trail extensions are added and use of the trail increases. Numbers of historic buildings listed on the National Register are located not far from the river and could be linked to the river corridor with signs and improved walkway connections.

Chief Ouray and his wife, Chipeta, significant in Colorado history and Ute leaders, lived on a ranch within a sizable Indian and Mexican settlement on the west bank of the river near the museum. No structures remain. Chipeta and Chief McCook are interred on the museum property.

The Dominguez-Escalante expedition (1776) and Juan Rivera expedition (1765) parties came through the area and followed the river. There is a monument to the Dominguez-Escalante expedition on the museum property. Both Spanish parties left written descriptions of this area, and in particular described large springs and wetlands along the river. These have been named the Silver Plume Springs, or Springs of San Francisco. The springs feed Chipeta Lake and although the wetlands were partially drained in the 19th century, they are still clearly visible in some locations. These historic springs were mentioned in the first written descriptions of Colorado in 1765.

Additionally, the river provides a great resource for nature studies. Interpretive signage can provide education regarding natural systems, biology, aquatic life cycles, bird migration or other environmental topics. In addition to signs, the open space areas provide places to experience and learn about the rich riparian landscape firsthand. School programs, group activities, tours and other programs would be able to see natural systems along with learning about restoration efforts, mitigation, and water systems. Also, consider adding stations where wildlife could be viewed without being a disturbance.

With increased trails and park systems, additional learning can be enhanced related to fitness and public health. Mile markers allow recreationalists to measure distances traveled. Expanded trails and recreational opportunities allow for events such as races, fundraising walks, and participation and observation in variety of health enhancing outdoor activities.