SWCA
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TECHNICAL MEMORANDUM

To: Sean VonRoenn (East Rio Blanco County Metropolitan District) and Lisa Cook (Town of Meeker)

From: Noah Greenberg and Tony Somers, SWCA Environmental Consultants

Date: December 11, 2020

Re: **Basis of Design for Circle Park Landscape Design and Conceptual River Enhancement**

INTRODUCTION

SWCA Environmental Consultants (SWCA) has prepared this technical memorandum on behalf of the East Rio Blanco Metropolitan District (ERBMD) and the Town of Meeker (Town) to serve as a basis of design (BOD) for the landscape design of Circle Park (Park Landscape Design) and a conceptual fluvial enhancement design of the White River at Circle Park (River Design Concept).

Project Background

Meeker is in Rio Blanco County in northwest Colorado. With an economy that is driven in large part by ranching and hunting/fishing-based tourism, there is a strong connection to nature, and few places exist that can rival Meeker and its surrounding areas in this respect. The Flattop Mountains are southeast of Meeker and are known as a remote wilderness area with productive high mountain lake and stream fisheries and abundant big-game wildlife. Expansive tracts of open range surround Meeker and are used for hunting and off-road vehicle recreation, with solitude and views that are world-class. People who love Meeker (either as residents or visitors) speak of the area's natural beauty, isolation from the chaotic outside world, and the down-to-earth character of the people who spend time here.

The White River originates in the Flattop Mountains and then flows through Meeker, providing ample opportunities for fishing. During SWCA's site visit, numerous individuals and small groups were observed walking the Town Park trail along the river, and fishing from the riverbanks at Circle Park. The river provides an in-town connection to nature, a ribbon of greenspace, and recreational opportunity that is enjoyed by residents and visitors alike.

Circle Park is centrally located in the Town and underwent a capital improvement project in 2020, including the construction of an off-channel fishing pond. The Town and ERBMD are currently interested in implementing an overall landscape improvement to Circle Park to complement the new fishing pond. The landscape design project at Circle Park should include an interrelated river enhancement project to address ongoing bank erosion that is occurring in Circle Park.

While talking with the Town and ERBMD staff, the following design preferences and priorities were identified.

1. Meeker has an appetite to enhance access and use of the river but does not want to become Steamboat Springs or Aspen. River-enhancement projects should promote safe access to the river to facilitate fishing, wildlife viewing, and other non "thrill" activities.
2. An important component of any successful project will be the protection of private property from risks including flooding, ice dams, trespassing, and vandalism.
    a. Ice dams and associated flooding are especially problematic for the Town.
3. Design should focus on minimizing maintenance requirements.

Existing Conditions

Circle Park is located on the south side of the White River, accessed by a one-lane bridge. The existing amenities include a small tent campground, two covered picnic pavilions, a makeshift broken slab concrete boat ramp to the river, and roughly 250 feet of White River shoreline that is used for fishing and river access. A fishing pond was constructed in a central portion of Circle Park in 2020 and is fed by an irrigation canal.

A fluvial geomorphologic assessment of the White River through Circle Park was initiated during this site visit, including a survey of the channel thalweg, water line, banks, and representative cross sections. These data are being analyzed using hydraulic modeling software, but the initial observations of the channel indicate that many of the bank erosion and flood dam issues along this reach may be the result of a channel that is too wide for the hydrology of the system. This additional width reduces the hydraulic energy in the channel which contributes to two processes that are averse to the Town's interests.

1. Lateral bars are formed in channels with lower hydraulic energy during routine flow conditions. The lateral bars can modify the channel hydraulics, creating erosive forces on channel banks. This is occurring in Circle Park, where a mid-channel lateral bar is impeding flows through the central portions of the drainageway, which is promoting bank-eroding hydraulics on both sides of the channel.
2. Lower hydraulic energy and shallow water both contribute to the development of a specific type of ice, frazil ice, and this type of ice is especially prone to forming ice dams.

A summary of SWCA's observations of existing conditions is provided in the attached Technical Memorandum dated November 11, 2020.

Park Landscape Design Goals and Constraints

SWCA incorporated the following goals into the Park Landscape Design.

1. Develop the park to compliment Town Park—provide a natural park area that highlights the river.
2. Provide safe and controlled access to the river for fishing and water recreation.
3. Develop a handicap-accessible ramp to allow wheelchair access to the river.
4. Develop a trail network that connects the various park elements, including the parking lot, campground, fishing pond, river access, and adjoining property trails.
5. Redesign the existing, undersized parking lot and road to facilitate ingress, egress, parking, and pedestrian safety.
6. Enhance access to, and the aesthetic quality of, the designed fishing pond.

7. Incorporate a lighting plan (with power buried from the utility pole near the access bridge).
8. Include a conceptual irrigation plan layout, with the expectation that the irrigation system installer will use this information to guide a design-build process.

The constraints that apply to SWCA's Park Landscape Design include the following.

1. The Circle Park fishing pond layout, including fishing dock, are already designed and under construction in 2020. SWCA's landscape design should be consistent and supportive of these existing designed features.
2. The park does not have a sanitary sewer or potable water supply.
3. Access to the agricultural property to the east of the park must be maintained for the land user.

River Design Concept Goals and Constraints

SWCA incorporated the following design goals into the River Design Concept.

1. Promote stable bank conditions along the White River to protect and enhance the natural aesthetic quality of Circle Park.
2. Promote river conditions for environmental and recreational uses.

SWCA incorporated the following design constraints into the River Design Concept.

1. The project should cause no harm to existing resources, and hopefully improve flooding and ice dam conditions in the White River.
    a. Protection of Circle Park banks should not be at the expense of other properties along the drainageway.
    b. The project should qualify for a no-rise certification relative to the 100-year base flood elevation.
    c. The project should be designed to provide incremental improvements to the conditions that currently promote dangerous ice dam formation.

DEVELOPED DESIGN HIGHLIGHTS

SWCA developed the Park Landscape Design and River Design Concept in 2020. The design highlights and considerations are presented in the following sections.

Park Landscape Design

Based on the results of SWCA's initial site observations, and conversations with ERBMD and Town staff, the Circle Park landscape design was developed to include the following components (which are represented in the attached Park Landscape Design drawings).

1. Improved ingress/egress and parking.
    a. The parking area is designed to promote safe access to park amenities, including the new river access ramp, fishing pond, camping area, and trail network.
    b. The parking circle is designed to retain an existing mature spruce tree.
    c. Stormwater runoff from the road and parking surfaces is routed to a raingarden that will provide stormwater treatment prior to discharge to the White River.

2. A trail network that connects the bridge and parking lot to the planned fishing pond, river, campground, and existing trail that begins in the southwest corner of the park. The designed trail will be constructed of crusher fines and is conducive to wheelchair use.
3. A handicap-accessible ramp located just downstream of the access bridge, where a makeshift ramp is currently located. The ramp is designed for pedestrian use only (i.e., not vehicles), is accessed via foot traffic from the south (to avoid conflicts with vehicles), and takes advantage of the existing deep eddy at this location.
    a. The ramp has a 7.5% or flatter slope.
    b. As designed, the ramp's construction is contingent on the implementation of the river design concept and would be tied into the cross-channel weir structure.
4. An improved fence along the park's east perimeter that maintains property boundaries, prevents cattle from accessing riverbanks in Circle Park, and includes a gate to maintain property access.
5. A lighting plan that promotes safety along the park road and parking lot.
    a. The lighting plan is dark sky-compliant and will require coordination with the stakeholders to determine when lighting should go off.
6. An irrigation plan layout that pulls water from the existing water pump house and delivers it to the major lawn areas throughout the park.
    a. Based on the raw water supply for this system, special consideration for the irrigation pump and filtration system is required. These aspects of the irrigation system are not included in SWCA's design and are presumed to be under the purview of the contractor selected for the irrigation system construction.
7. A grading and planting plan that achieves the following.
    a. Introduces native planting areas to create a natural aesthetic.
    b. Uses native vegetation along the park perimeter, fishing pond, structures, and designated planting beds.
    c. Maintains views to the cemetery for 4th of July fireworks.

River Design Concept

SWCA developed a conceptual design for addressing ongoing bank erosion at Circle Park and the overly wide, undefined base flow channel of the White River at this location. This design is intended to protect Circle Park and adjacent properties while promoting environmental health of the river and floodplain areas. SWCA's conceptual design could be progressed through to final design for construction. Alternatively, the conceptual design could be used for bidding for a design-build contract. SWCA often recommends using a design-build contract to implement river enhancement projects to provide flexibility to the contractor during installation and because unique conditions encountered at the site often require field fitting. Key components of the developed conceptual design include the following.

1. A bank stabilization design that includes cross-channel j-hook weir structures downstream of the access bridge, concentrating flows into the channel center (toward the existing lateral bar).
    a. This design would help protect properties on both sides of the channel and would create better instream habitat for fish.
    b. Excavation of mid-channel material to create a define thalweg. Excavated material will be used for bank stabilization (as described below).

2. The existing Circle Park riverbanks will be enhanced and built out using material excavated from the channel. These banks will be built to create a low-floodplain terrace that will gradually become vegetated with riparian shrubs and forbs. The low-floodplain terrace will be predominantly dry, with the exception of high-flow events during spring runoff or significant precipitation events.

DESIGN CONSIDERATIONS

SWCA recommends consideration of the following during bidding and construction of the Circle Park Landscape Design and the River Design Concept.

Circle Park Landscape Design

Implementation of the Circle Park Landscape Design should include consideration of the following.

1. Permitting
    a. The designed landscape improvements are configured to largely avoid mapped wetland and non-wetland waters. However, if construction impacts are expected to encroach into previously mapped wetland or non-wetland waters, consultation and possible permitting with the U.S. Army Corps of Engineers (USACE) may be required.
        i. Construction of the river access ramp will require Clean Water Act Section 404 authorization from the USACE. The construction of this feature will likely be authorized under Nationwide Permit 42: Recreational Facilities (NWP 42). The use of NWP 42 requires pre-construction notification to the USACE.
    b. The activity will likely result in greater than 1 acre of earth disturbance. Accordingly, construction is expected to require authorization under Colorado's Construction Stormwater Permit. The development of a stormwater management plan and submittal of a Notice of Intent to the Colorado Department of Public Health and Environment should be included in the scope of work for the construction of this project.
    c. The project is designed to avoid fills that would result in a rise in the 100-year flood elevation. However, coordination with the local Federal Emergency Management Agency (FEMA) may be required.
2. Construction
    a. The selected contractor should have experience constructing natural park areas and associated improvements.
    b. Based on local availability, considerable cost savings may be achieved through the substitution of specified material. The acceptability of these substitutions should be evaluated to ensure that they will not result in unacceptable compromises regarding aesthetics, utility, or longevity.
3. Maintenance
    a. The planting plan is developed to minimize the amount of vegetation management required. However, in addition to regular mowing during the growing season, it likely will be necessary to periodically prune trees and shrubs, replace perennial plants following die-off, and manage weed infestations.
    b. The irrigation system will require annual maintenance including periodic pump and filter maintenance, winterization each fall, and spring start up.

c. The natural paths will require resurfacing/additional material every few years.

d. The road and parking surfaces will require maintenance and resurfacing periodically.

River Design Concept

Implementation or the River Design Concept should include consideration of the following.

1. Permitting
    a. The designed improvements will require USACE Clean Water Act Section 404 authorization. The project will likely be authorized by the USACE under Nationwide Permit 27: Aquatic Habitat Restoration, Establishment, and Enhancement Activities (NWP 27). The use of NWP 27 requires pre-construction notification to the USACE.
    b. Based on the work within the White River channel, coordination with the local FEMA administrator is encouraged. It may be necessary for a Professional Engineer to provide documentation to support a No-Rise certification.
2. Additional Design and Engineering
    a. SWCA recommends considering implementing the project as a design-build effort with a contractor that has a Professional Engineer on staff that can provide field engineering and field fitting services.
    b. Although the design concept is configured to avoid exacerbating frazil ice formation and ice jam development, these considerations should be evaluated by the engineer responsible for final design and or the design-build effort.
3. Construction
    a. SWCA recommends engaging a contractor with experience installing similar river and bank enhancement projects. This recommendation is especially important if this project is implemented as part of a design-build process.
4. Maintenance
    a. The natural channel design approach recommended in SWCA's design concept is intended to persist for many decades. However, inspection and repair during the initial high-runoff events is recommended. The ability to quickly address small modifications can help avoid structure failure and larger repairs.
    b. Infrequent extreme events, including floods over the 100-year flood level or ice-jam flooding, may cause damage to the proposed improvements which should be repaired as soon as conditions permit.

PROBABLE CONSTRUCTION COSTS

SWCA has developed probable costs of construction which are attached to this memorandum. These costs are projected based on standard costs of construction that apply nationwide. Local materials, labor, and equipment costs may require adjustment to the provided estimates. Additionally, there may be opportunities for Value Engineering based on specific project priorities and local materials availability, to name a few.

PROJECT COMPONENTS TO HIGHLIGHT FOR POTENTIAL GRANT FUNDING

SWCA recommends considering the following project components relative to their perceived value in pursuing grant funding for implementation of the Circle Park Landscape Design and River Design Concept.

1. Fishing access for all abilities
    a. Colorado Parks and Wildlife Grants Page: https://cpw.state.co.us/aboutus/Pages/GrantPrograms.aspx
    b. Bass Pro Shops Grant Page: https://about.basspro.com/community/support/

2. River corridor enhancement
    a. Colorado Water conservation Board Watershed Restoration Grants: https://cwcb.colorado.gov/colorado-watershed-restoration-grants
    b. National Fish and Wildlife Foundation Restore Colorado Grant: https://www.nfwf.org/programs/rocky-mountain-rangelands/restore-colorado-program

3. Natural spaces access for all abilities
    a. Great Outdoors Colorado Grants: https://goco.org/grants

4. Water quality improvements resulting from bank stabilization, drainageway enhancement, and stormwater treatment.
    a. CDPHE Water Quality Grants: https://www.colorado.gov/pacific/cdphe/water-quality-improvement-fund

ATTACHMENTS

1. Summary of Initial Site Visit and Planning Discussions for Circle Park and 3rd/10th Street Access, April 27, 2020
2. White River at Circle Park Fluvial Assessment, November 11, 2020
3. Circle Park Landscape Design
4. Circle Park Landscape and White River Enhancement Probable Costs
5. Conceptual Landscape Designs for 3rd Street White River Access
6. Conceptual Landscape Design for 10th Street White River Access

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TECHNICAL MEMORANDUM

To: Sean VonRoenn (East Rio Blanco County Metropolitan District) and Lisa Cook (Town of Meeker)

From: Noah Greenberg and Tony Somers, SWCA Environmental Consultants

Date: April 27, 2020

Re: **Summary of Initial Site Visit and Planning Discussions for Circle Park and 3rd/10th Street Access**

INTRODUCTION

SWCA Environmental Consultants (SWCA) has prepared this technical memorandum to summarize the observations and planning discussions which occurred during the April 10, 2020, site visit in Meeker, Colorado. The site visit was conducted by Noah Greenberg (SWCA) and David Bidelspach, P.E. (Five Smooth Stones Restoration, working as a sub-consultant to SWCA). Tony Somers, PLA (SWCA), was originally scheduled to participate in this site visit but was unable to join due to COVID-19 travel restrictions.

The site visit included the following specific activities.

1) Review the recently constructed Town Park to gain information regarding the design and amenities at that location, and to promote Circle Park and 3rd/10th Street designs that are consistent with Meeker's aesthetics and which provide new and supplementary amenities to those already present.

2) Conduct a fluvial geomorphological assessment of the White River at Circle Park (beginning just upstream of 3rd Street and extending downstream past Circle Park for roughly 100 yards).

3) Collect existing conditions information for Circle Park, 3rd Street, and 10th Street to facilitate the final design for Circle Park and conceptual planning for 3rd and 10th Streets.

4) Meet with Town of Meeker (Town) and East Rio Blanco County Metropolitan District (ERBM) Park and Recreation Department (PRD) staff to discuss big-picture goals for SWCA's design work; to discuss concerns and constraints with various project approaches; and to develop a better general understanding for how these projects can serve as an amenity to the community.

This technical memorandum summarizes SWCA's evaluation of existing conditions and conceptual design approaches for each of the three areas. General observations which apply to all three sites are provided as a stand-alone section.

GENERAL OBSERVATIONS AND INPUT FROM TOWN AND ERBM PRD

Meeker is in Rio Blanco County in northwest Colorado. With an economy that is driven in large part by ranching and hunting/fishing-based tourism, there is a strong connection to nature, and few places exist that can rival Meeker and its surrounding areas in this respect. The Flattop Mountains are located to the southeast of Meeker and are known as a remote wilderness area with productive high mountain lake and stream fisheries and abundant big-game wildlife. Expansive tracts of open range surround Meeker and are used for hunting and off-road vehicle recreation, with solitude and views that are world-class. People who love Meeker (either as residents or visitors) speak of the area's natural beauty, isolation from the chaotic outside world, and the down-to-earth character of the people who spend time here.

The White River originates in the Flattop Mountains and then flows through Meeker, providing ample opportunities for fishing. During SWCA's site visit, numerous individuals and small groups were observed walking the Town Park trail along the river, fishing from the riverbanks at Circle Park, and playing in the forest near 10th Street. The river provides an in-town connection to nature, a ribbon of greenspace, and recreational opportunity that is enjoyed by residents and visitors alike.

While talking with the Town and ERBM PRD staff, the following themes emerged.

1) Meeker has an appetite to enhance access and use of the river but does not want to become Steamboat Springs or Aspen. River-enhancement projects should promote safe access to the river to facilitate fishing, wildlife viewing, and other non "thrill" activities.

2) An important component of any successful project will be the protection of private property from risks including flooding, ice dams, trespassing, and vandalism.
    a. Ice dams and associated flooding are especially problematic for the Town.

3) Design should focus on minimizing maintenance requirements.

CIRCLE PARK

Existing Conditions

Circle Park is located on the south side of the White River, accessed by a one-lane bridge. The existing amenities include a small tent campground, two covered picnic pavilions, a concave-shaped area used as an ice rink, a make-shift broken slab concrete boat ramp to the river, and roughly 250 feet of White River shore line that is used for fishing and river access.

An existing ditch conveys water along the south side of Circle Park to a water pump station which provides irrigation water to the cemetery, located immediately to the south of the park and on a bluff that is roughly 100 feet higher in elevation than Circle Park. Water that is not pumped to the cemetery is released to the White River, either through an overflow weir or from an outlet which can be used to drain the ditch.

A fluvial geomorphologic assessment of the White River through Circle Park was initiated during this site visit, including a survey of the channel thalweg, water line, banks, and representative cross sections. These data are being analyzed using hydraulic modeling software, but the initial observations of the channel indicate that many of the bank erosion and flood dam issues along this reach may be the result of a channel that is too wide for the hydrology of the system. This additional width reduces the hydraulic energy in the channel which contributes to two processes that are averse to the Town's interests.

1) Lateral bars are formed in channels with lower hydraulic energy during routine flow conditions. The lateral bars can modify the channel hydraulics, creating erosive forces on channel banks. This is occurring at Circle Park, where a mid-channel lateral bar is impeding flows through the central portions of the drainageway, which is promoting bank eroding hydraulics on both sides of the channel.

2) Lower hydraulic energy and shallow water both contribute to the development of a specific type of ice formation that is especially prone to forming ice dams.

Developed Engineering Design for Circle Park

Prior to SWCA's engagement for the Circle Park landscape design, the Town developed an engineering design for the park that includes the burial of the existing ditch, excavation of a fishing pond in the location that is currently used for the seasonal ice rink, and a single pavilion structure that would replace the existing two structures.

Landscape Design Goals

SWCA understands that the goals for the Circle Park landscape design are as follows.

1) Develop the park to compliment Town Park—provide a natural park area that highlights the river.

2) Provide safe and controlled access to the river for fishing and water recreation.

3) Develop a handicap-accessible ramp to allow wheelchair access to the river.

4) Develop a trail network that connects the various park elements, including the parking lot, campground, fishing pond, river access, and adjoining property trails.

5) The existing parking lot and road are undersized and should be designed to facilitate ingress, egress, parking, and pedestrian safety.

6) Enhance access to, and the aesthetic quality of, the designed fishing pond.

7) Promote stable bank conditions along the White River to protect and enhance the natural aesthetic quality of the park.

8) The landscape design should include a lighting plan (with power buried from the utility pole near the access bridge).

9) The landscape design should include a conceptual irrigation plan layout, with the expectation that the irrigation system installer will use this information to guide a design-build process.

Landscape Design Constraints

The constraints which apply to SWCA's landscape design are understood to include the following.

1) The project should cause no harm to existing resources, and hopefully improve flooding and ice dam conditions in the White River.
    a. Protection of Circle Park banks should not be at the expense of other properties along the drainageway.

   b. The project should qualify for a no-rise certification relative to the 100-year base flood elevation.

   c. The project should be designed to provide incremental improvements to the conditions that currently promote dangerous ice dam formation.

2) The Circle Park fishing pond layout, including fishing dock, are already designed. SWCA's landscape design should be consistent and supportive of these existing designs.

3) The park does not have a sanitary sewer or potable water supply.

4) Access to the agricultural property to the east of the park must be maintained for the land user.

Conceptual Design Approaches

Based on the results of SWCA's initial site observations, conversations with ERBM PRD and Town staff, and the fluvial geomorphological assessment, the conceptual approach for the Circle Park landscape design includes the following components (some of which are represented, schematically, in the maps provided in Attachment 1).

1) Improved road quality and parking lot, with the road circle being shifted to the northeast, possibly centered on the existing conifer tree.

2) A trail network that connects the bridge and parking lot to the planned fishing pond, river, campground, and existing trail that begins in the southwest corner of the park. The trail would be constructed of crusher fines or other natural material that is conducive to wheelchair use.

   a. Educational signs/stations located at the fishing pond, along the banks of the White River, and/or on the handicap-accessible river access ramp.

   b. Boulder or log benches located along the trail to provide sitting/resting opportunities.

3) A bank stabilization design that would include a j-hook weir on either side of the river, just downstream of the access bridge, concentrating flows into the channel center (toward the existing lateral bar).

   a. This design would protect properties on both sides of the channel and would create better instream habitat for fish.

   b. Using material from the existing lateral bar, build up the eroded banks along Circle Park to develop a terraced floodplain. The banks would be revegetated with typical native riparian woody vegetation that would provide aesthetic and wildlife value to the corridor.

   c. A rustic fence (buck and rail or similar) or well placed vegetation could limit access between the trail and the White River. Access to the river would be provided at several fence (or vegetation) line breaks, with natural stonework providing safe footing to the river for recreation.

4) Develop design for a handicap-accessible ramp to be located just downstream of the access bridge, where the makeshift ramp is currently located. The ramp would be for pedestrian use only (i.e., not vehicles), should be designed to be accessed via foot traffic from the south (to avoid conflicts with vehicles), and should take advantage of the existing deep eddy that is located here.

   a. A major obstacle to achievement of an ADA-compliant ramp will be the length of ramp needed to attain a 7.5% or flatter slope.

5) An improved fence along the park's east perimeter (buck and rail or similar) that maintains property boundaries, prevents cattle from accessing Circle Park's riverbanks, and includes a gate to maintain property access.

6) Develop lighting plan that promotes safety along the park road and parking lot.

    a. Initially, bollard lighting is presumed to be the appropriate level of lighting. If more lighting is desired by the stakeholders, light poles could be incorporated.

    b. The lighting plan should be dark sky compliant and will require coordination with the stakeholders to determine when lighting should go off.

7) Develop a conceptual irrigation plan layout that pulls water from the existing water pump house and delivers it to the major lawn areas throughout the park.

8) Develop a micro-grading and planting plan that achieves the following.

    a. Introduces some minor topographic relief to break up spaces and create natural planting areas.

    b. Uses native vegetation along the park perimeter, fishing pond, structures, and designated planting beds.

    c. Conserves water by vegetating open lawn areas with low-water demand turf grass.

    d. Provides a wind break by planting evergreen trees to the west of the camping areas, which would also provide privacy from the higher use areas of the park.

        i. Maintain views to cemetery for 4th of July fireworks.

3RD STREET

SWCA is developing conceptual river access enhancement designs for 3rd Street.

Existing Conditions

The intersection of 3rd Street and the White River is presently a dead end of a street that is primarily lined with Town utility buildings and sheds. SWCA understands that the southeast-most building is scheduled for demolition but that most of the other buildings will remain for the foreseeable future. Where 3rd Street currently ends at the White River, there is A large pile of fine-grained sediment and debris is currently at the 3rd Street and White River intersection. A trailer park community is located along the river to the east of 3rd Street and Circle Park is located to the west. The White River flows in a primarily straight orientation by 3rd Street, with a small channel formed by a lateral bar near the riverbank and the main channel thalweg located near the opposite riverbank.

Design Goals

SWCA understands that the design goals for 3rd Street include the following.

1) Creating an alternative river access location that is less busy than Circle Park.

2) Converting an existing industrial area to be an amenity for the Town.

3) Protecting private property to the east, with controlled access for residents.

4) Providing a connection with Town Park.

5) The 3rd Street access area does not need to be a stand-alone park area. Town Park is adjacent to this area and provides many park amenities.

Design Constraints

The primary design constraints expected at the 3rd Street access area include the following.

1) Existing Town buildings will limit the area that can be incorporated into the design at this location.

2) The side channel immediately downstream (west) of 3rd Street needs to remain as it serves as a water intake from the channel.

3) A water transfer station is located roughly one block north of the White River on 3rd Street—parking and access will need to be designed to be compatible with this truck traffic.

Conceptual Design Approaches

The conceptual design approach is expected to include the following components, which are depicted schematically on the maps in Attachment 1.

1) Removal of the large sediment pile and development of a stepped-stone river access/sitting area that is enhanced by riparian planting along the path to the river access.

2) Creation of a "link" trail between Town Park and 3rd Street.

3) Construction of a fence along the private property line to the east, with a gate installed for resident access to 3rd Street.

4) Explore potential for a parking lot or turn around area at the end of 3rd Street.

    a. Managing the interface between pedestrians/cars at the river access area and the industrial truck traffic associated with Town facilities will be important.

10TH STREET

SWCA evaluated an area to the northeast of the 10th Street bridge for potential access improvement.

Existing Conditions

The area is currently an undeveloped riparian floodplain leading from a non-designated parking area to the river. Large trees create a canopy with a relatively open understory. The area is largely vegetated with hydrophytic plants and wetlands may be prevalent. SWCA understands that the public right-of-way remains fairly close to the 10th Street bridge. The private property is undeveloped and there was discussion about the landowner's potential willingness to allow the access project to encroach onto their land.

Design Goals

The design goals for the 10th Street access include the following.

1) Providing a safe opportunity to park and access the river.

2) Managing user traffic to protect private property and the riparian habitat.

3) Concentrating use in a controlled manner to prevent the ongoing use of the south side of the 10th Street bridge for river access.

Design Constraints

Design constraints that will need to be addressed at this location include the following.

1) The public right-of-way is relatively narrow; improvements at this location will need to be confined to this corridor unless an agreement with the adjacent property owner is pursued.

2) Managing foot traffic to remain on the trail will be important to protect the fragile riparian environment and to prevent trespassing onto the adjacent property.

3) The area is prone to seasonal flooding and the design should minimize post-flooding maintenance requirements.

Conceptual Design Approaches

SWCA anticipates developing a conceptual design for the 10th Street access that includes the following components (see maps in Attachment 1 for design component locations).

1) A designated parking lot with appropriate signage.
    a. Trash cans?

2) A trail that connects the parking lot to the river.
    a. Consider a boardwalk to limit wetland impacts, facilitate use during wet weather, and manage foot traffic.
    b. If not a boardwalk, consider using a low fence to manage traffic.

3) Depending on the level of coordination with the adjacent property owner, potential fence (with gate) to prevent trespassing but allow resident access to the 10th Street river access.

4) Construct a stepped-stone entry to river at the base of the 10th Street bridge abutment.
    a. If adjacent property owner is amenable, consider moving river access roughly 20 feet upstream to a natural eddy that would be ideal for entry/exit from the river.

INFORMATION REQUEST

If available, SWCA requests the following information to facilitate development of the conceptual designs for the 3rd and 10th Street access and landscape design at Circle Park.

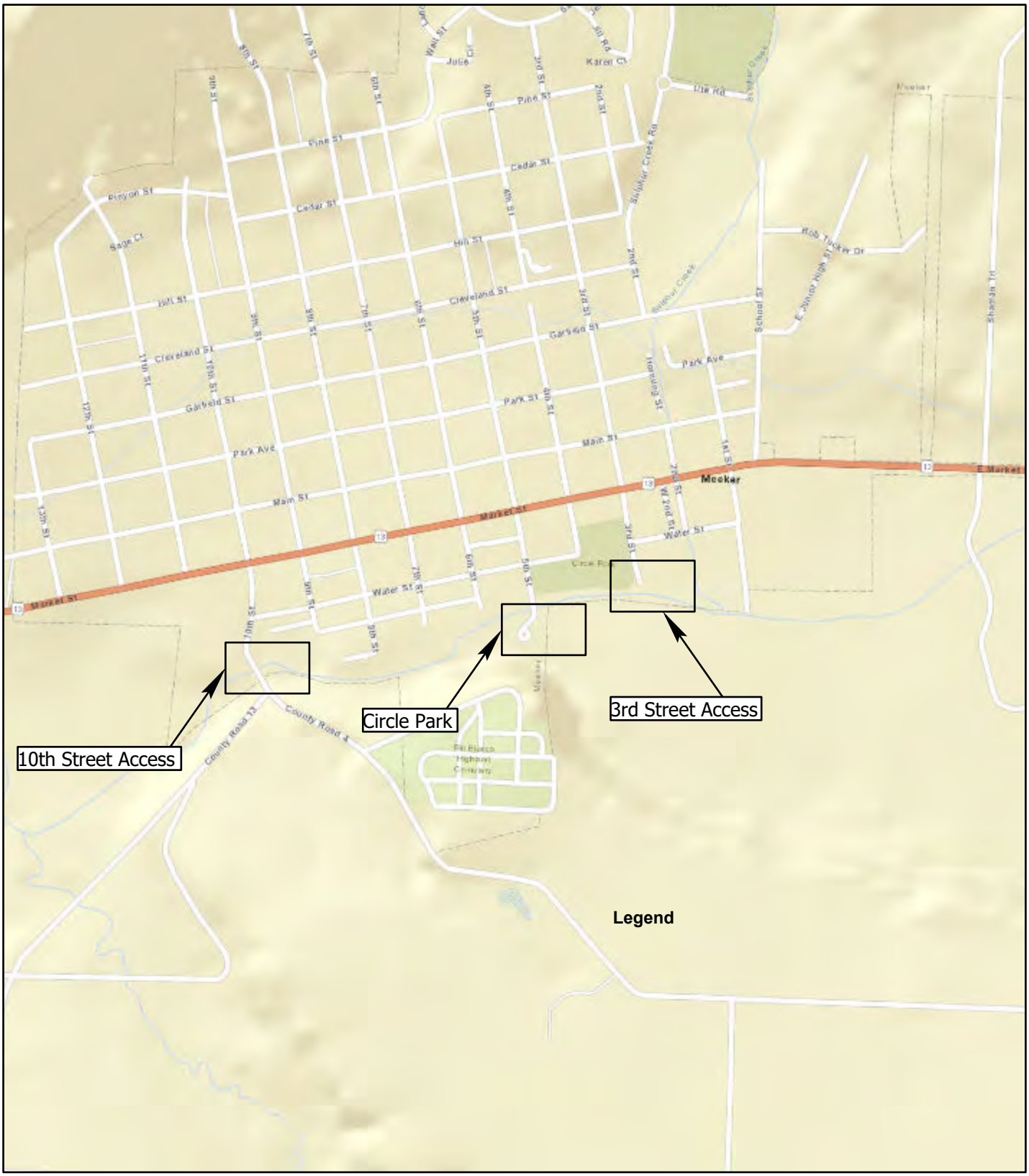
1) Landscape design for Town Park;

2) Bridge design (including survey, wetlands delineation, and hydraulic study) for 10th Street bridge; and

3) Parcel boundaries for Town.

ATTACHMENT 1

Circle Park, 3rd Street, and 10th Street Schematic Conceptual Design Maps



N

0 500 1,000 Feet

NAD 1983 UTM Zone 13N
4/27/2020

Meeker Circle Park Design and White River Access

Location Map

Town of Meeker, Rio Blanco County, Colorado

SWCA Project No. 480863

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4/27/2020

Meeker Circle Park Design and White River Access

Circle Park

Town of Meeker, Rio Blanco County, Colorado

SWCA Project No. 480863

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Meeker Circle Park Design and White River Access

3rd Street Access

Town of Meeker, Rio Blanco County, Colorado

SWCA Project No. 480863

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Meeker Circle Park Design and White River Access

10th Street River Access

Town of Meeker, Rio Blanco County, Colorado

SWCA Project No. 480863

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TECHNICAL MEMORANDUM

To: Sean VonRoenn
East Rio Blanco Metropolitan Parks and Recreation District
101 Ute Road
Meeker, Colorado 81641

From: David Bidelspach, P.E., and Noah Greenberg

Date: November 11, 2020

Re: **White River at Circle Park—Fluvial Assessment and Design Considerations (Revised Draft)**

SWCA Environmental Consultants (SWCA) has prepared this memorandum to summarize the results of a fluvial geomorphological assessment and conceptual river improvement design for the White River at Circle Park in the Town of Meeker. This work was directed and supervised by David Bidelspach, P.E., of 5 Smooth Stones Restoration (5SSR), working as a subconsultant to SWCA.

BACKGROUND AND OBJECTIVES

SWCA was engaged by the East Rio Blanco Metropolitan Parks and Recreation District (ERBM), with support from the Town of Meeker (Town), to develop a landscape design for Circle Park. The existing conditions at Circle Park include an approximately 290-linear-foot-long reach of instable river bank that consists of turf grass with incised banks that are prone to erosion. Preliminary observations of these banks indicated that the river bank instability is a result of a disequilibrium of the White River at this location—the channel is overly wide, resulting in deposition of sediment within the primary flow conveyance of the channel and displacement of erosive forces to the perimeter of the channel.

Because instable river banks will compromise the resilience of any landscape design for Circle Park, SWCA's scope of work includes a fluvial geomorphological assessment for this reach of the White River and development of a conceptual design to mitigate bank erosion and promote overall river health. It should be noted that additional engineering design and permitting will be required prior to the implementation of any in-channel improvements. The goal of the conceptual river improvement design is to provide ERBM and the Town with a recommended approach for mitigating bank instability and to facilitate development of a landscape design that is compatible (and hopefully synergistic) with the expected river improvements.

SWCA understands that the Town and ERBM goals and constraints for potential White River improvements at this location include the following:

- Ice dam formation and associated flooding is an ongoing issue along this reach of river, resulting in property damage.

- The river corridor includes other areas with instable banks that have the potential to damage property.
- While there is interest in promoting river health, there is not an appetite for projects that are focused on creating whitewater boating features (e.g., wave features).
- River improvements should be focused on achieving bank stability and healthy river function while minimizing construction impacts and costs.

Based on these goals and constraints, SWCA's assessment and design are focused on achieving the following objectives:

1. Using a combination of field and desktop methods, identify the river processes that are responsible for the existing bank instability.
2. Develop a river design that prioritizes the following attributes:
    a. Promotes stable channel conditions in the White River through Circle Park.
    b. Is compatible with Circle Park landscape design and intended uses.
    c. Has neutral or positive impacts on the 100-year flood elevation.
    d. Has neutral or positive impacts on the formation of ice dams and associated flooding.
    e. Uses bioengineering approaches to achieve the desired river condition with a minimal footprint.

The following sections of this memorandum provide additional details and considerations regarding this evaluation and design process.

FLUVIAL ASSESSMENT

The fluvial assessment of the White River through Circle Park consisted of desktop and field studies conducted February through May 2020. Throughout the remainder of this memorandum, reference will be made to various river features that are depicted in Figure 1.

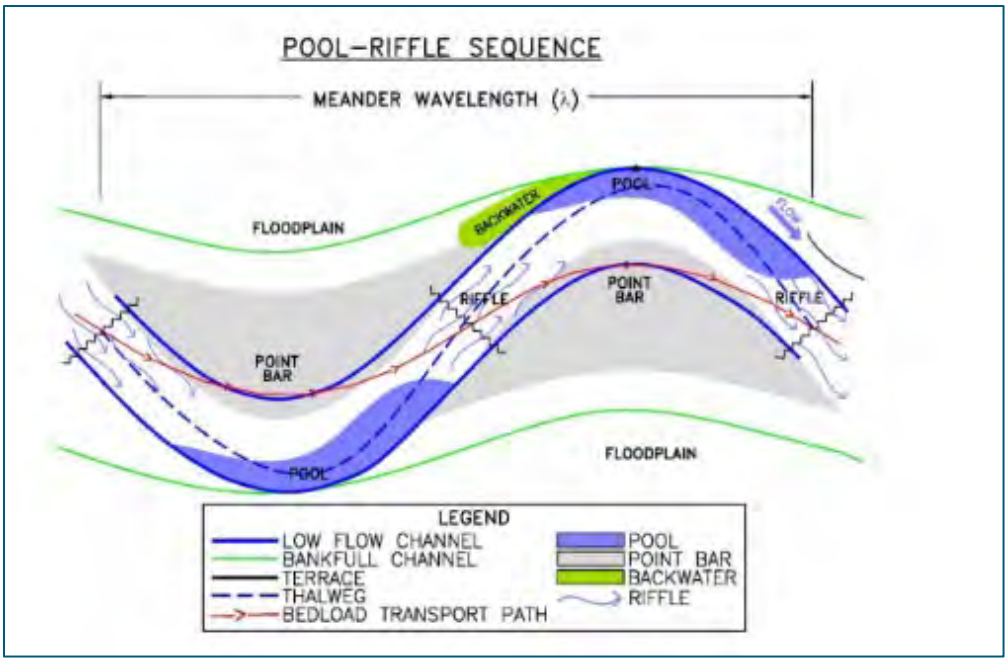

Figure 1. Typical riffle-pool sequence with common feature terms.

Desktop Assessment

The desktop assessment included an evaluation of the White River hydrology and planar geomorphic characteristics (e.g., sinuosity, channel width, etc.). Notable observations include the following:

Conditions in Upstream/Downstream Reaches that Provide Typical Reference Conditions

- The White River below Meeker is a pool-riffle system with a relatively uniform bed slope of about 0.0048ft/ft.
- Based on the distance between fresh sandy depositional bars on Google Earth aerial photography, an approximately 600-foot spacing currently exists between pools in the river upstream and downstream.
- Downstream of 10th Street, the low flow channel has widths of roughly 75 feet, with bankfull widths of roughly 100 feet.
- Based on 2014 aerial photography, the channel has widened by a minimum of 13 feet to a maximum of 20 feet over 20 years, indicating approximately 1foot of bank erosion per year. Although not overly concerning, the channel should be stabilized from a park and fishery standpoint.

Conditions Observed in White River at/near Circle Park

- When compared with downstream reference reaches, the river channel appears over-widened:
    - At 3rd Street, the bankfull width is approximately 125 feet based on aerial photography.
    - At Town/Circle Park, the bankfull width appears to be about 105 feet, with a mid-channel bar downstream of 5th street.
- Based on initial assessment and not survey, the river's natural condition is presumed to consist of a channel width of approximately 90 feet but has been over-widened to 125 feet. The existing

pool-to-pool spacing is appropriate for the smaller widths observed downstream of the Town but is not consistent with the channel widths observed at Circle Park.

Field Survey and Associated Assessment

The field survey and associated assessment included a focused topographic survey of the channel bottom and surrounding terrain, an analysis of the channel cross sectional area, calculation of channel width-to-depth ratios, and other field-based observations. Notable aspects of this evaluation, including methods and findings, include the following:

- Topographic field surveys were performed for:
    - Three channel cross sections (i.e., perpendicular to stream).
        - Two cross sections surveyed upstream of the Circle Park bridge.
        - One cross section surveyed downstream of the bridge closer to a run (transition from riffle before meeting a pool).
    - A 1,600-foot-long reach of the river beginning near 3rd Street and extending past Circle Park roughly 200 feet. Along this reach, the ground surface elevation of the thalweg (deepest parts of the river) was surveyed.
- Surveyed results show a pool-to-pool spacing of 460 to 630 feet, which was verified by aerial analysis.
- Cross section 2 (just upstream of the bridge) was the best riffle cross section identified. A clear bankfull stage could not be identified from this cross section because both banks had been manipulated. The other two channel cross sections showed bankfull cross-sectional areas of approximately 500 square feet.
    - The existing channel cross-sectional area (i.e., 500 square feet) provides a basis for design of a channel that will allow similar flow conveyance as is currently present.
- Current channel width-to-depth ratios on this reach range from 34 (near 3rd Street) to 38 (downstream of Circle Park).
    - Although smaller width-to-depth ratios would be preferred for this reach (e.g., a ratio of roughly 20), the transitions in the reach will not support smaller width-to-depth ratios.
- The overly wide channel is likely resulting in shallow water during winter months, which can result in adverse frazzle ice buildup.

FLUVIAL DESIGN

SWCA developed a conceptual fluvial geomorphologic design for the White River at Circle Park that is consistent with the assessment findings and our understanding of the goals for this effort. For graphical representations of the conceptual channel design, please refer to the landscape design for Circle Park. The following summarizes key aspects of this design concept.

- The basis of design includes a targeted 450-square-foot design cross-sectional area (90% of the existing cross-sectional area). The design focus is on pool-to-pool spacing and promoting development of a narrower and steeper channel.
    - A 450-square-foot cross-sectional area represents a design discharge of 2,800 cubic feet per second (cfs) and a flood return interval of 1.6 years, which is generally consistent with a typical bankfull channel capacity of 1.5- to 2.0-year recurrence.

  - In-channel structures would be designed to handle a 100-year discharge and the corresponding shear force applied at bankfull discharge and to the 100-year discharge.

- To promote the concentration of low flows (and associated desirable sediment flushing, a two-stage channel is proposed:
  - An inner berm channel (a low flow channel), and
  - A bankfull channel (occupied only during high flow) that is stabilized using revegetation transplants.
- The establishment of two deep pools and narrow riffles with an inner berm bench for low flow, totaling approximately 800 feet in length, are to be excavated to promote bank stability and fish habitat enhancement. This approach will help mitigate conditions that lead to frazzle ice formation and will promote conditions that are favorable for shelf ice formation, preventing water from freezing along the channel bed.
- Two boulder J-hook structures are proposed just downstream of the Circle Park bridge. The J-hook structures will tie into the river bank and extend across the channel. Note that much of these structures will be below water or buried in the alluvial sediment. These structures will help to centralize flows coming out from the bridge and create beneficial scour holes downstream of the hooks. Bridge piers constrict the channel to be to about 90 feet wide.
  - The upper J-hook arm on the south riverbank (i.e., at Circle Park) will be situated with the American with Disabilities Act (ADA) access ramp.
- Toe wood structures are proposed in the banks for fishery habitat improvements and taking transplants from the existing bar to build up the banks.
- The design would lower the existing bed slightly, and a bed slope of approximately 0.005 feet/feet would be achieved at tie-in. The bankfull maximum riffle depth would also increase slightly allowing for sediment to move through the reach more efficiently.
  - This narrower and steeper channel would have more specific energy to clear ice through the area than is provided by the current channel configuration.
- A large mid-channel bar downstream of the bridge is to be cut out, and a pool is to be created in the area.
  - A secondary benefit of this is the potential to lower the 100-year base flood elevation by as much as 0.05 feet downstream of the 5th Street bridge at Circle Park.

Figure 2 shows the design channel cross section (green) and the existing channel cross section (red). The bankfull area differences are roughly balanced.

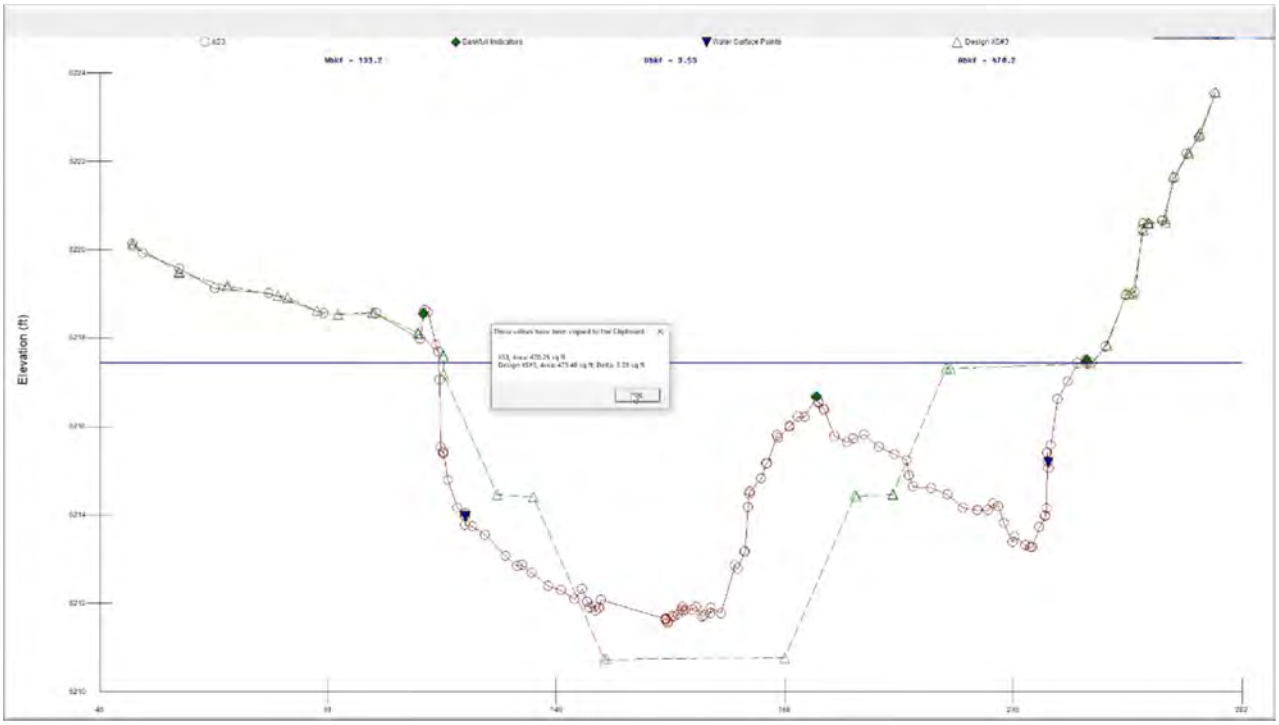

Figure 2. Existing and design channel cross sections.

Bank Stabilization Alternative—Avoidance of In-Channel Structures

Following the July Town Board meeting, SWCA was asked to develop an alternative to in-channel work in the White River. An approach that would provide bank stabilization without in-channel structures could include installation of soil-lifts that consist of a bioengineered approach to stabilize the channel banks without modifying fluvial geomorphologic processes in the channel. Figure 3 provides a typical diagram for this bank stabilization approach.

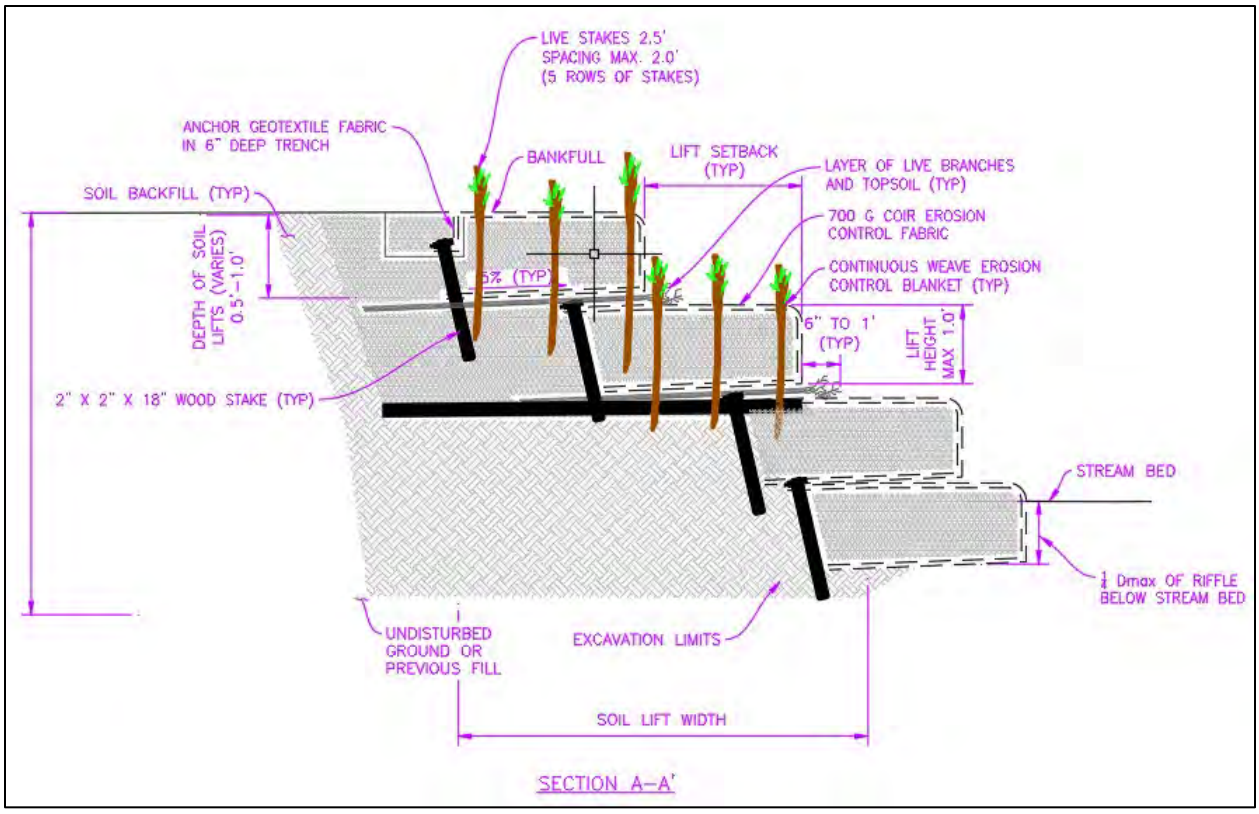

Figure 3. Soil lift bank stabilization.

Details Pertaining to Soil Lift Preparation and Installation

Soil lifts are constructed by placing soil on top of a portion of two horizontal geotextile fabrics. The reinforcement of the soil is provided by the outer geotextile fabric woven into a strong mesh of high tensile strength. After the soil is compacted, the remaining fabric is wrapped over the front and top of the soil mass and the lifts are staked in place and built on top of each other as shown in the diagram below. The lifts are about 1 foot thick. The live stakes from willows hold the soil lifts together. Furthermore, the soil lifts need to be lightly compacted and both neatly and tightly wrapped to prevent drag forces on loose fabric from high-flow events.

Recommended Changes from the Hydraulic Letter Soil Lift Detail at Town Park

SWCA reviewed the hydraulic analysis letter prepared by JVA Inc. (JVA) for Town Park and recommends considering changes as outlined below. For bank stabilization, JVA indicated that as the fabric wrapping the soil mass is permanent, there is low concern with needing vegetation establishment to help provide bank stabilization. The proposed change would include live willow stakes as the soil lifts are being put in place to help provide bank stabilization.

JVA also indicated the soil lifts will be set at a 1:1 slope, resulting in approximately 900 cubic yards of existing bank material removed for soil lift installation. The proposed change would be to have a side slope of 3:1 during installation, resulting in a safer, more sustainable river bank slope.

Costs per Linear Foot for Treatment Alternative

For a typical cross section at Circle Park (see Figure 4 below), the bank stabilization approach will require six soil lifts.

- The cost for this treatment is $25 per linear foot per lift (or a total of $150 per linear foot for the cross section depicted in Figure 4)
- The total length of the bank is 400 linear feet

The total estimated cost for installing bioengineering soil lifts at Circle Park is roughly $60,000, not including access ramps, fencing, permitting, or other appurtenant improvements.

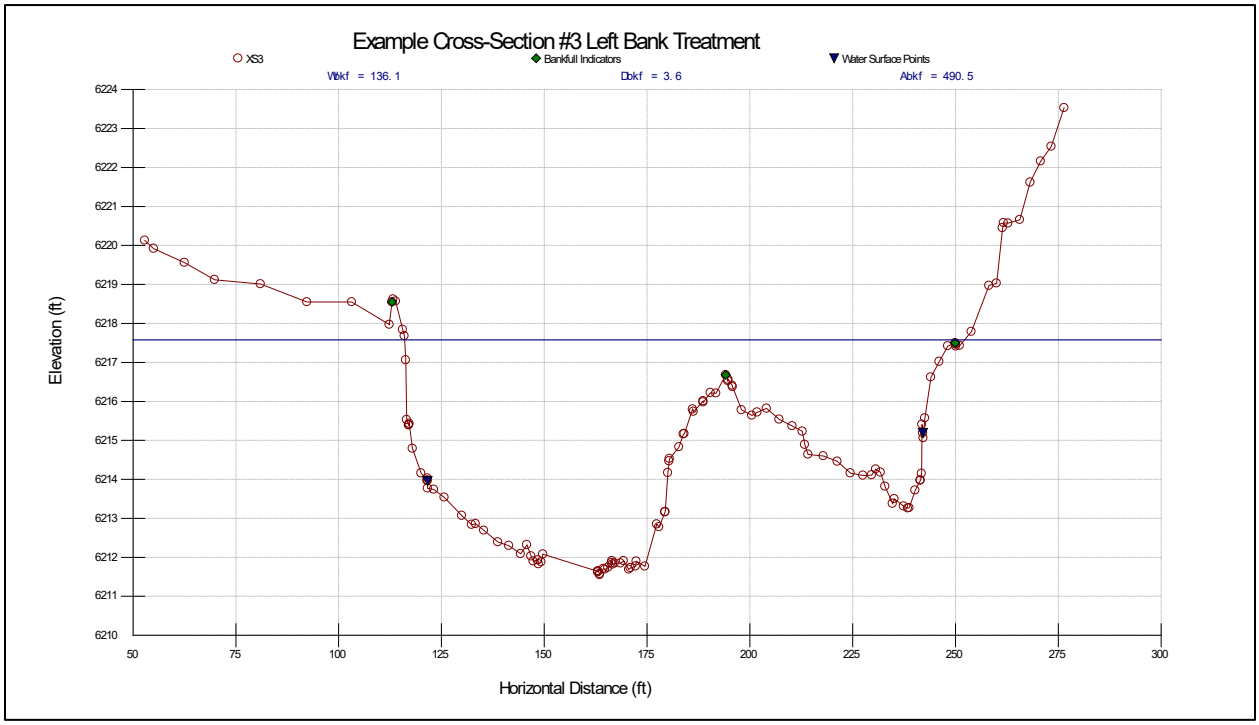

Figure 4. Typical cross-section at Circle Park where soil lifts would be installed.

Pros and Cons and Long-Term Stability of this Treatment Alternative

Pros associated with a soil-lift approach include likely lower cost (compared with channel work), easier permitting, and a lower risk of changing the floodplain (either favorably or adversely relative to other properties). In addition, the stair steps provide access and a good place for vegetation to establish.

Cons associated with a soil-lift approach include lower level of environmental enhancement, less resilience to flood damage, and less opportunity to mitigate the development of frazzle ice. Although long-term stability will be adequate on the southern left bank, as the mid-channel bar grows, faster water will be pushed toward both banks, and the potential for erosion and bank migration on the north bank will increase without the removal of the mid-channel bar.

An additional consideration is that there would be roughly 20 horizontal feet of park bank loss with the construction of 3:1 side slope because soil lifts cannot be used as fill in the active river channel. The soil-lift stabilization approach is expected to have an approximate life-span of 25 years, with maintenance expected following high-flow events and to manage vegetation.

Other Alternatives Considered

If the Town wanted to include toe boulders in combination with soil lifts, this approach would cost roughly $70,000 for Circle Park and would be more difficult to permit. Additionally, if erosion occurs behind a boulder toe, the boulders can encourage bank migration and instability.

SWCA also considered the potential to merely use riprap along this bank, with approximately 18- to 24-inch rock. This approach would not be visually appealing at the park and would require a minimum depth of 3 feet for stabilization. At a cost of roughly $125 per ton, a riprap stabilization approach would cost approximately $100,000 and be challenging from a Clean Water Act Section 404 permitting perspective.

ICE JAM ANALYSIS AND CONSIDERATIONS

Ice jam formation is known to cause flooding issues in the White River in Rio Blanco County. Based on anecdotal observations shared with SWCA, ice jams form downstream (near Rangely) and move upstream to Meeker. In addition to these personal accounts of ice jam issues on this reach of the White River, the report *Ice Considerations in the Design of Modern In-Stream Structures* (Tuthill et al. 2006) evaluated the potential for stream structures to contribute to ice jam formation, including a case study of a recently constructed diversion weir on the White River which resulted in ice jam formation.

SWCA conducted an initial evaluation of the White River relative to the observed ice jams in the White River drainageway through the Town. For the purposes of this evaluation and relative to our conceptual river enhancement design, ice jam formations are a result of two processes: 1) frazil ice formation, and 2) frazil ice deposition and ice jam formation. Our observations regarding these processes and the proposed river enhancement design concept are summarized in the following sections.

Frazil Ice Formation

The formation of frazil ice is a preliminary step in the development of an ice jam. This section provides a summary of existing and proposed design conditions relative to frazil ice formation. A report from the U.S. Bureau of Reclamation states that frazil ice formation is dependent on turbulence and suggests that frazil ice production is most evident in the vicinity of rapids (Hayes 1974. Rapids are places in the river where the bed slope is higher, causing significant rise in water velocity and turbulence. In pools, the bed slopes are flatter than in rapids and corresponding velocity is lower.

Existing Conditions

SWCA observed that this reach of the White River, including upstream segments, has significantly wider channel areas with greater surface area to volume ratios, which can promote formation of frazil ice during winter weather. A published investigation evaluated frazil ice formation in riffle-pool sequences as a result of supercooling of turbulent open water (Tuthill 2008). These observations suggest that potential river enhancement designs should strive to reduce the surface area to volume ratio in the project reach at base flow conditions.

Proposed Conceptual Enhancement Design

SWCA's proposed enhancement design, consisting of cross-channel J-hook weir structures, would result in a lower surface area to volume ratio under low- and baseflow conditions. This will be achieved by concentrating low flows into a central portion of the drainageway, thereby minimizing the amount of low-flow spreading that currently occurs.

SWCA's proposed enhancement design includes a typical drainageway cross sectional area of 500 square feet. At a design flow rate of 3,000 cfs, the resulting flow velocity in this reach will be 6 feet per second, significantly higher than the lower threshold for thermal ice growth. Furthermore, bankfull velocities through the channel in this area with the design are expected to be in the range of 4 to 5 feet per second, which is well above the threshold for thermal ice growth. During very low flow conditions, flow velocities below 1 foot per second may be observed, however these slow velocities will be mitigated using a low-flow inner-berm channel to increase low flow velocities. Of note is that the current low-flow channel width is about 4 times greater than the proposed low flow inner berm width.

Frazil Ice Deposition and Ice Jam Formation

The frazil ice may travel long distances downstream in the water column until surface concentration exceeds conveyance capacity of the channel or channel obstructions are encountered (including sharp bends, channel constrictions, or human-made structures), whereupon frazil ice sheets will deposit to form an ice jam cover. The ice jam cover can spread out of riverbanks to flood fields and other property (Tuthill 2008). Additionally, the ice jam can travel great distances upstream from the origination.

Existing Conditions

SWCA understands that ice jams are known to form downstream and then travel upriver to Meeker. Relative to ice jam formation downstream, it is unlikely that the proposed enhancement will have any effect (positive or negative) on formation frequency or duration. However, the construction of instream structures in the White River at Meeker does have the potential to promote or retard ice jam formation in this reach, to the extent that this is an issue (either presently or in the future). In particular, instream structures which create protuberances or shallow areas that are prone to frazil ice entrapment are discouraged. This concern is addressed by reviewed literature (Tuthill 2008; Tuthill et al. 2006) and is considered in SWCA's proposed design approach.

Proposed Conceptual Enhancement Design

SWCA's proposed enhancement design includes construction of cross-channel J-hook weir structures that would have a thalweg invert that is flush with the upstream channel bottom. As a result, when water flows downstream it should not encounter protrusion of the cross-channel structure above the bed of the channel. Additionally, the proposed locations avoid sharp river bends and channel expansion and contraction ratios are kept to 10:1, both of which should help the design pass frazil ice.

Frazil Ice Analysis Summary

In summary, SWCA expects to not have boulders with a high protrusion height above the channel bed, and the majority of the work is to be focused on modifying channel conditions for flows corresponding to bankfull and 2-year discharge. The corresponding modifications include producing a channel with a narrow width to depth ratio. The flows above the 5-year storm event are not expected to change significantly. As a result, ice formation would still be visible, but these conditions would not be worsened from SWCA's design. SWCA recommends that final design follow the preliminary guidance for river restoration structures provided by Tuthill (2008), namely focusing on providing critical water velocities and frazil ice passage. It should be noted that frazil ice formation and ice jam formation are subject to a wide range of variables, some of which may be outside the scope of our analysis or which are feasibly addressed by localized channel enhancement projects.

CITED REFERENCES

Hayes, R.B. 1974. *Design and Operation of Shallow River Diversion in Cold Regions*. Bureau of Reclamation, Report REC-ERC-74-19. Available at: https://www.usbr.gov/tsc/techreferences/hydraulics_lab/pubs/REC/REC-ERC-74-19.pdf. Accessed October 2020.

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