WARM SPRINGS PRESERVE

Vision Plan
April 2023

Photo credit: Cooper Morton

Vision Statement

Warm Springs Preserve offers a unique opportunity for large-scale, community-supported creek restoration and passive recreation near the confluence of the Big Wood River and Warm Springs Creek.

Proposed design vision to include a preserved fairway lawn, enhanced floodplain and restored landscape.

WARM SPRINGS PRESERVE

This report is a summary of the community engagement process and vision plan developed for the future of Warm Springs Preserve.

Existing studies, new analysis and extensive public meetings led to the development of this vision plan, focusing on the connectivity, accessibility, and ecological restoration of the Preserve.

To stay involved and find out more:
www.WarmSpringsPreserve.org

PROJECT PARTNERS

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FRIENDS OF WARM SPRINGS PRESERVE

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Introduction

Warm Springs Preserve is an essential community gathering space for the City of Ketchum and the Wood River Valley.

At the base of Bald Mountain, along the confluence of the Big Wood River and Warm Springs Creek, is a cherished community gathering space: Warm Springs Preserve. This preserve provides opportunities to exercise and play all year long for locals, their furry companions, and local wildlife.

Thanks to overwhelming community support, the City of Ketchum purchased Warm Springs Preserve in 2022, now a 65-acre protected open space for residents and visitors of Ketchum, Idaho in perpetuity. The Preserve, a former golf course, was slated for development and used informally as a dog park. To ensure that the Preserve remained available for community use, the City of Ketchum launched a national campaign with the support of the Wood River Land Trust and Spur Community Foundation.

Over 950 community members donated funds to purchase the property. The acquisition will also allow access to an additional 15 acres of beautiful riparian woodlands along the southern floodplain of Warm Springs Creek to the Ketchum community.

The Preserve is enjoyed by a variety of users, from dog walkers, disc golfers, Nordic skiers and others. Due to the historic use of the property, the City committed to the community to restore the environment where possible, diversify access and enhance basic facilities. To improve this beloved landscape, this vision plan takes careful consideration of the community's dreams for the Preserve, and synthesizes those ideas into an inclusive, accessible and restorative place to gather.

How will we measure success?

Stream Restoration

Increased acres of floodplain connectivity, #/size/depth of pools, observed species richness (wildlife + vegetation)

Water Efficiency

Reduced water consumption (target reduction % or gal/acre)

Hazard + Flood Safety

Reduced frequency and extent of flooding in residential areas; reduced water speed and bank erosion

Visitor Experience

Increased access, usage, and activity types (access for all)

Aerial Image Source: Google Maps 2023

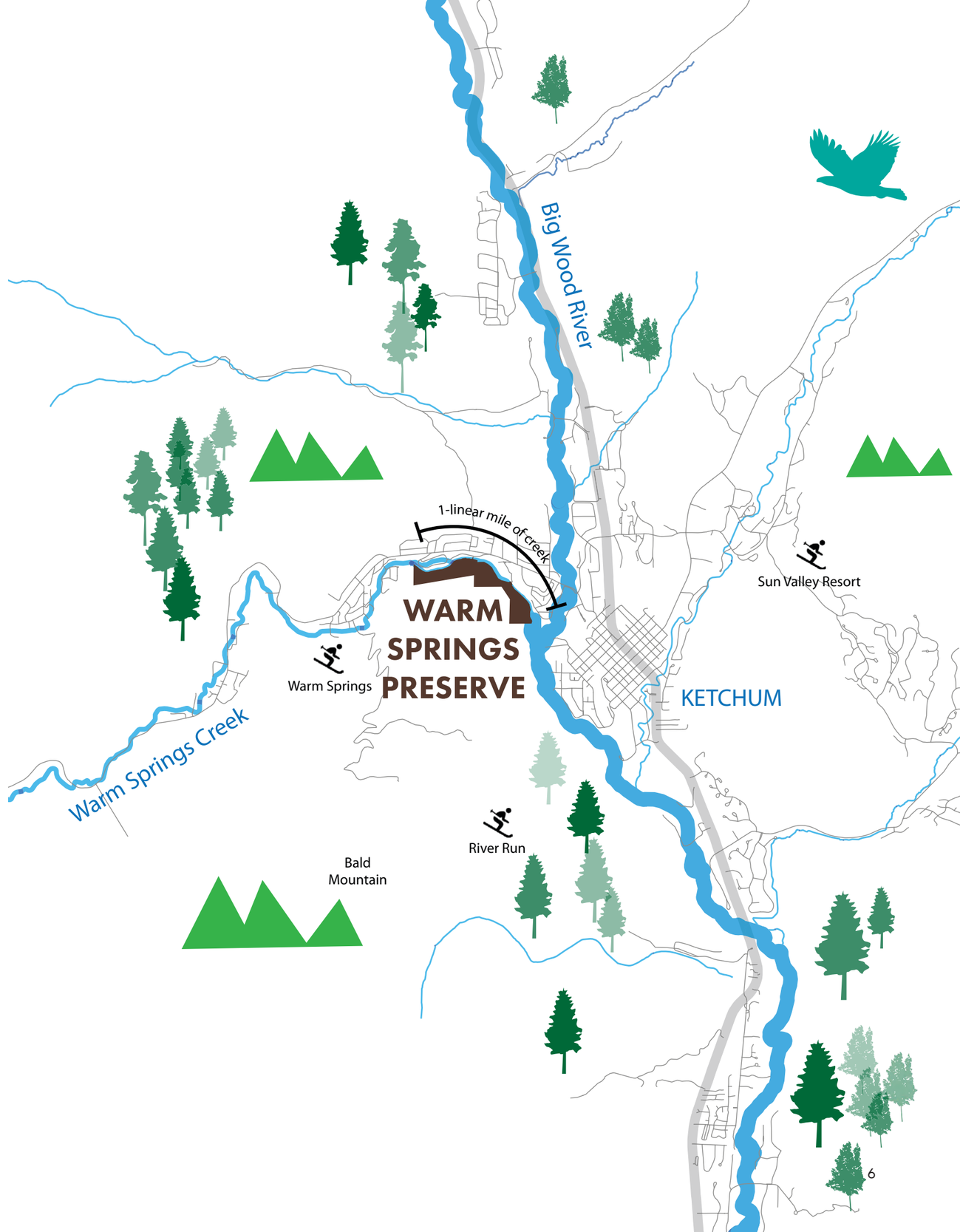
The Story of Warm Springs Preserve

Ecological Context

The Preserve is located near the mouth of Warm Springs Canyon and Creek, halfway between downtown and the base of the Warm Springs ski lifts. The creek is a major tributary of the Big Wood River, which flows into the Snake River within the Columbia Basin. Flowing from the Smoky Mountain Range, it is part of a transitional zone that separates the northern Rocky Mountains from the Basin and Range physiographic provinces. Elevations within the Preserve range from 5,800 to 6,200 feet above sea level.

Warm Springs Creek has long meandered through the narrow, high-elevation river valley. Over the years, its course has changed due to flooding and past waterway developments. It has been stabilized into its present channel with rock riprap and fill against residential development areas. In the southeast portion of the ranch, the old stream channel meanders through developed land, including the old golf course, where the floodplain has been reshaped and filled. The southeast portion of the ranch also contains topsoil and gravel that have been removed from the stream channel by past landowners. The golf course was built against a steep, forested, north-facing side of Bald Mountain, on formerly forested ground. The densely forested hillsides are populated by Douglas fir trees and a dense understory of shrubs. Opening onto the terraces between the mountain slope and the floodplain are areas of sagebrush and grasses, many of which have been replaced by turf grass or overrun by invasive weeds.

** Text adapted from the Warm Springs Historic Context Narrative*
Claudia T. Walsworth | Walsworth and Associates, 2009



Historic Timeline

Timeline

Alluvial Floodplain
Pre-1800

In this condition, the area where Warm Springs Preserve currently exists acted as an active floodplain containing multiple meandering streams and floodable areas.

Farm + Restaurant
1800 - 1950s

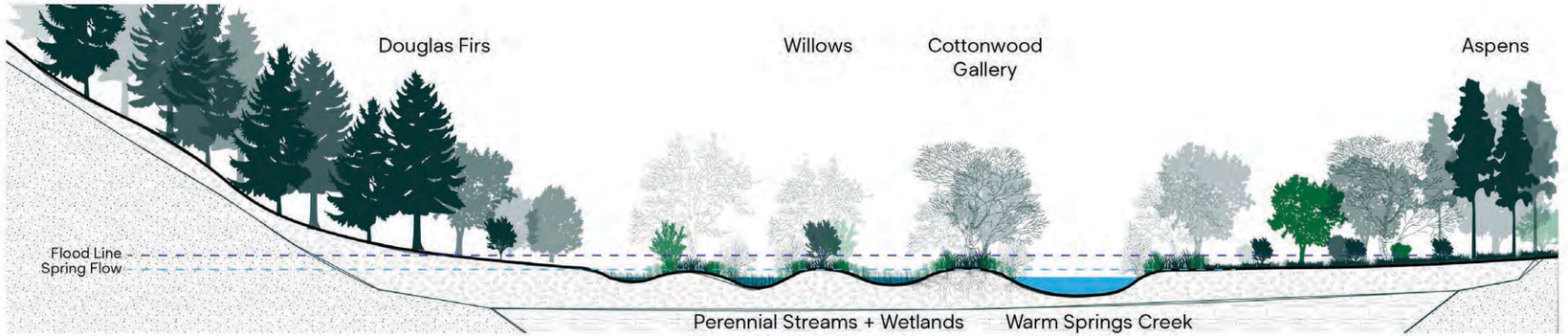
As people moved to the area and used the land for other purposes such as farming and recreation, the channel was confined and the floodplain was largely filled in.

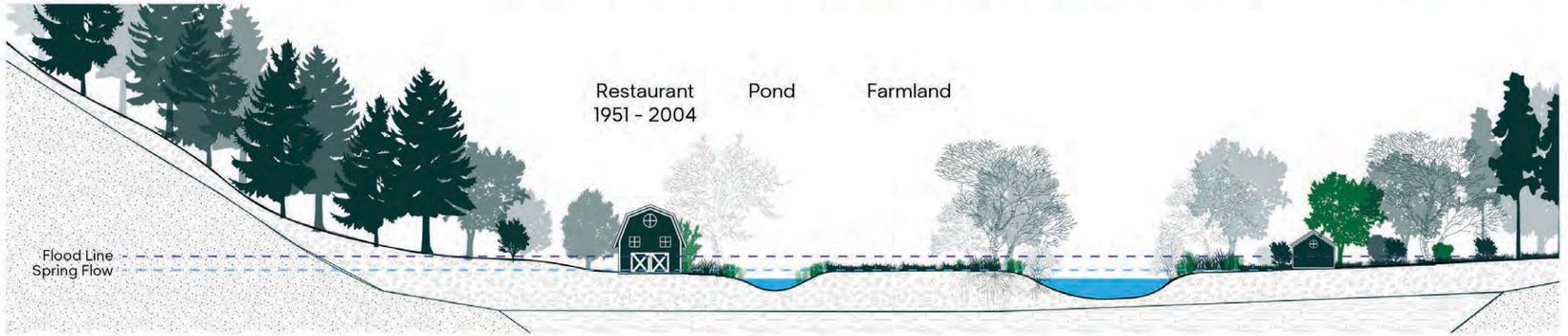
Golf Course
1960 - 2009

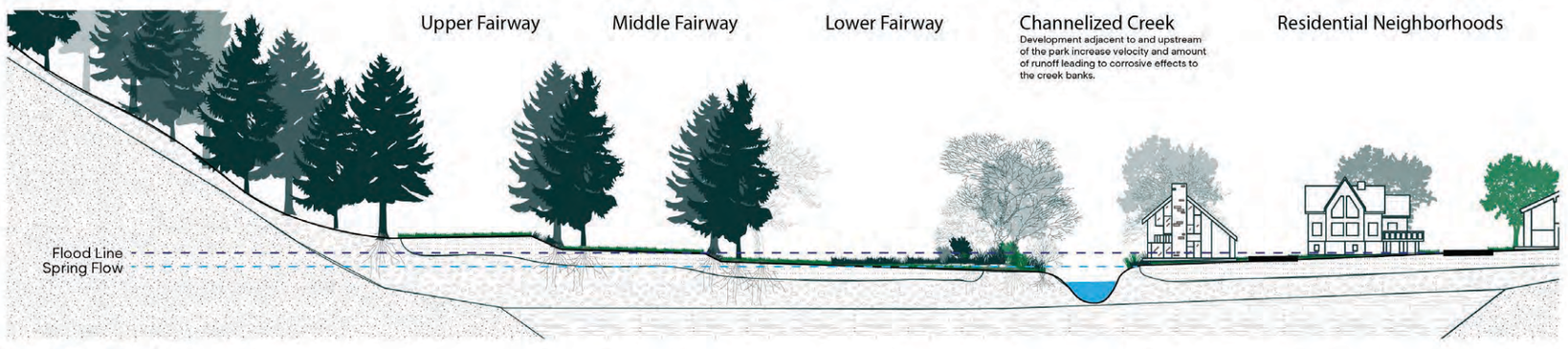
Intensive development on the floodplain has limited the creek's natural ability to move and flood. During flood events, the now confined creek is at high risk of stream bank erosion, channel incision and downstream flooding.

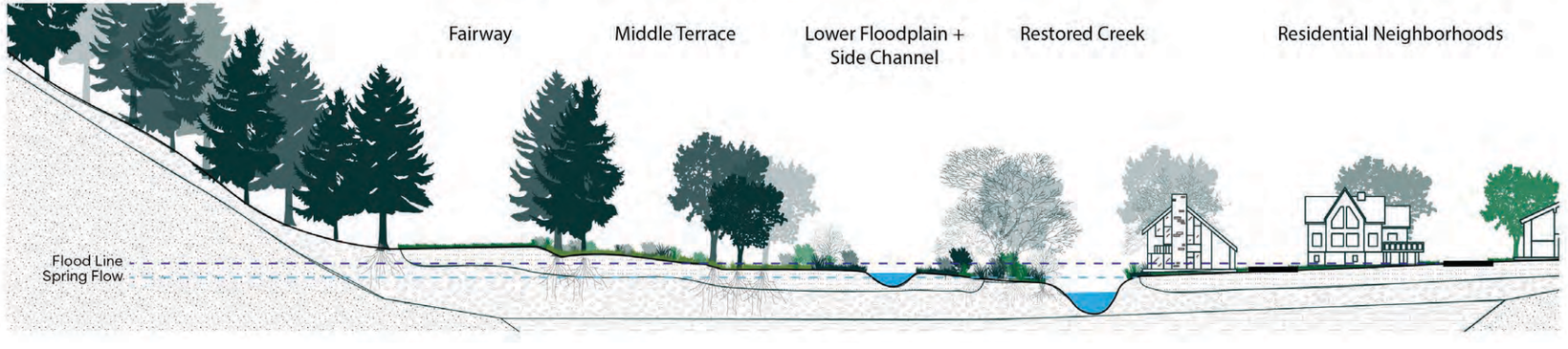
Future / Post-Restoration

The project would address many of the past impacts by restoring a natural stream and floodplain, while maintaining access for people and their pets primarily in the upland areas. Creek restoration would add in-stream complexity and create side channels for aquatic habitat and riparian function. The middle terrace would be outside of the new floodplain with native meadow plant species. The fairway would remain largely turf grass.







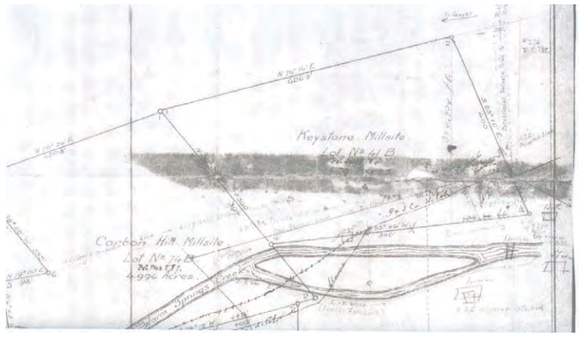


Warm Springs Preserve History

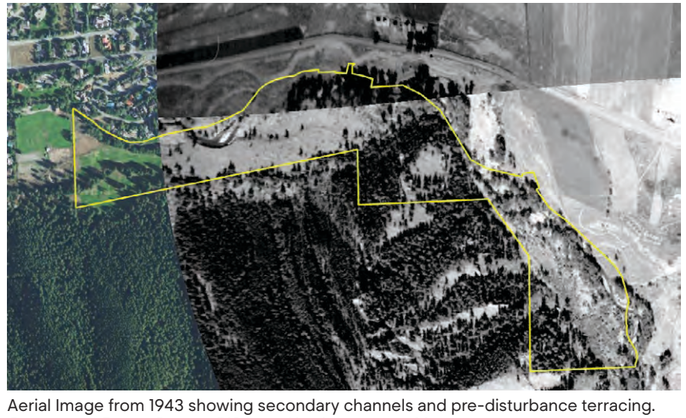
The story of Warm Springs Ranch is embedded in Western frontier development. The property, originally part of a desert land entry and homestead, was part of a historic working ranch that evolved into a resort. The history of the ranch coincides with the socio-economic growth of the upper Wood River Valley that began during the 1880s. Although it was not documented through archaeological field finds, it is highly likely that the Warm Springs Canyon was inhabited by the native people. The Wood River region is part of the Great Basin culture area that was the ancestral homeland of the Northern Shoshone for thousands of years. The travel corridor that is now state Highway 75 was originally a migration route for both game animals and humans.

** Text from the Warm Springs Historic Context Narrative*
Claudia T. Walsworth | Walsworth and Associates, 2009

Oscar Smith Farnlun's Warm Springs ranch circa 1920, courtesy of Petra Morrison



Properties of H.C. Lewis and Mary Guyer, hand-drawn by Isaac Lewis courtesy Fuller 1908. Map Source: Palmer Lewis Collection, Ketchum-Sun Valley Historical Society.



Aerial Image from 1943 showing secondary channels and pre-disturbance terracing. Courtesy of Blaine County GIS Land Use Information Map

The August Farnlund Home on Warm Springs Wagon Road. Source: Blaine County Historical Museum and Photo #F-05391 The Community Library, Ketchum.

The Guyer Hot Springs Hotel May 1891. Photograph # 66-74-30 Idaho State Historical Society.

Warm Springs Ranch Inn, 1956. Photograph #F-05875 Simpson Collection. The Community Library's Regional History Department, Ketchum.

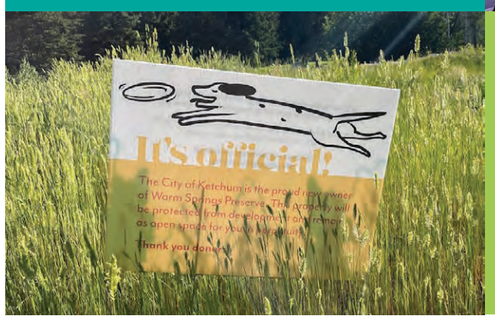
Advertisement in a 1973 Ketchum Tomorrow for the Warm Springs Ranch Inn. Ketchum Tomorrow newspaper files. The Community Library's Regional History Department, Ketchum.

Saving the Preserve

The purchase of Warm Springs Preserve was the culmination of community and City fundraising efforts, spearheaded by the Friends of Warm Springs Preserve Committee. Over 950 donors contributed between $7 and $1 million to raise a total of $9.5 million for the Preserve. In April 2022, the City paid $8 million to purchase the property from Bob Brennan and put $1 million in reserve for repairs to the extremely outdated irrigation system.

950+
donors

$9.5M+
donations raised thus far



$7–$1M+
donation value range

Celebration event photos courtesy of the City of Ketchum, June 2022.

Announcement Signage Posted on site

Commitments made during the funding and acquisition of the Preserve:

Warranty Deed Requirements:
- (1) or more 10-ft wide pedestrian trail for walking/skiing
- (1) pump house
- (1) public restroom
- (1) storage and maintenance building (1,000 SF)
- Floodplain restoration
- (24) parking stalls

Community Commitments:
- New irrigation system that reduces water use
- Flood mitigation
- Restoration of riparian zone & floodplain
- Creek & habitat restoration
- Passive park for open space in perpetuity
- Off-leash dog access
- Informal activities (disc golf, dog walking, etc.)
- Informal gathering space (picnic tables, etc.)
- Nordic trails
- Public restroom

Fundraising

Donations to Date:
- Land acquisition
- Master plan vision
- Improved irrigation system

Continued Donations:
- New, enhanced parking lot
- Restroom Facility
- Flood mitigation
- Restoration (riparian zone, floodplain)
- Amenity improvements
- Construction costs
- Ongoing maintenance

Support the Preserve:

To learn more or make a gift, visit:
www.WarmSpringsPreserve.org

Existing Site Observations

A

There are many opportunities to protect and enhance existing ecosystems, especially in the southern floodplain. This area of the site is currently difficult to access.

B

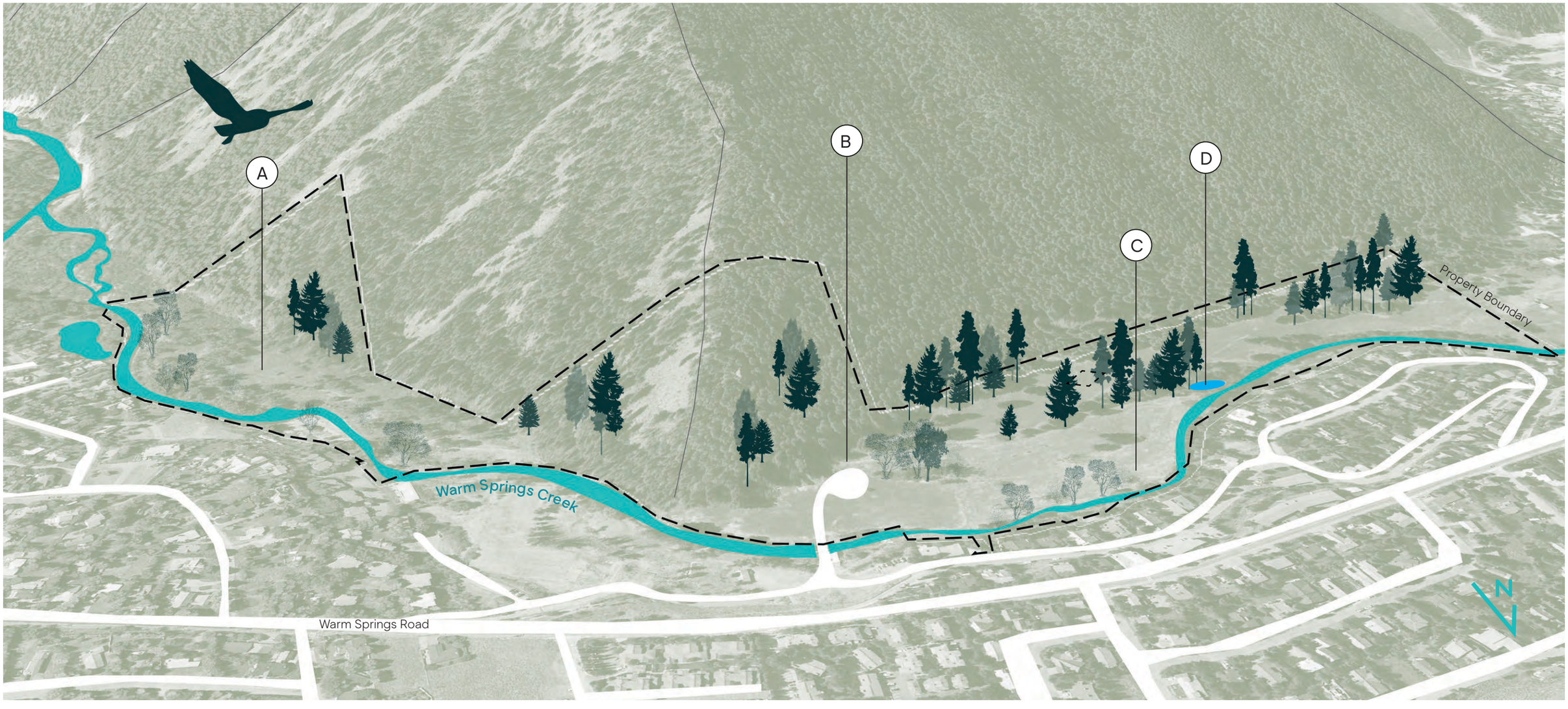
The gravel drive requires expensive annual maintenance. Increased use of the Preserve demands visitor amenities such as toilets, bike racks and new seating.

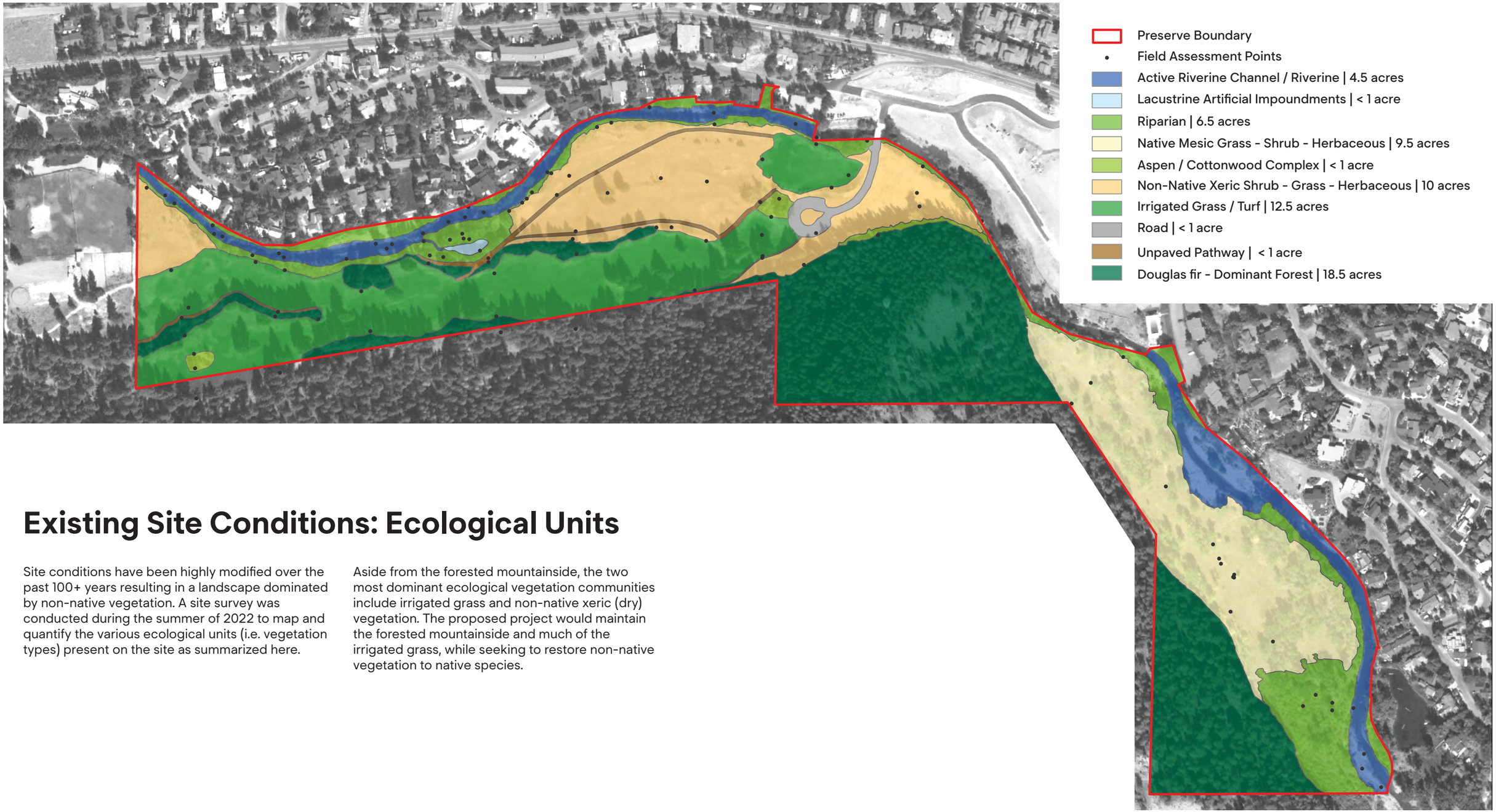
C

With a mile of continuous stream frontage along Warm Springs Creek, a major opportunity exists for stream, floodplain, and riparian restoration that would improve habitat and biodiversity.

D

A major issue for the Preserve and its maintenance is an inefficient and outdated irrigation system that uses significant amounts of water. The existing pond creates an opportunity to add a an adjacent pump house that would tie into a new irrigation system.





Existing Site Conditions: Ecological Units

Site conditions have been highly modified over the past 100+ years resulting in a landscape dominated by non-native vegetation. A site survey was conducted during the summer of 2022 to map and quantify the various ecological units (i.e. vegetation types) present on the site as summarized here.

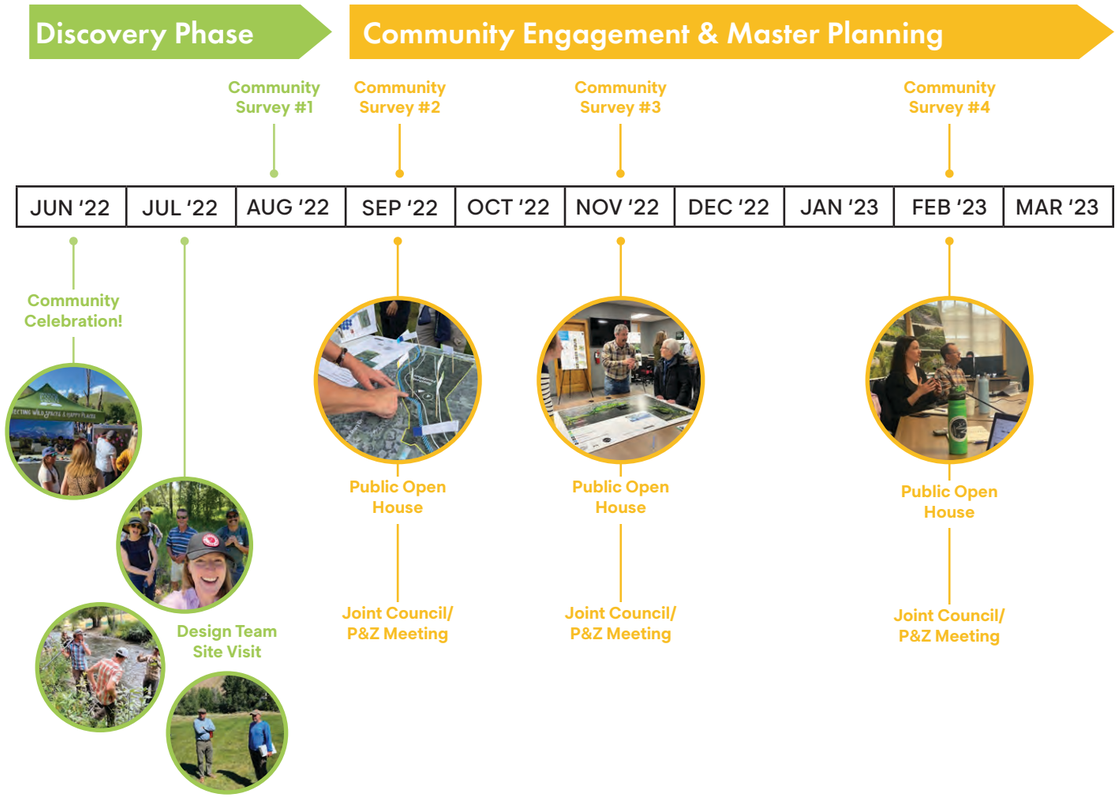
Aside from the forested mountainside, the two most dominant ecological vegetation communities include irrigated grass and non-native xeric (dry) vegetation. The proposed project would maintain the forested mountainside and much of the irrigated grass, while seeking to restore non-native vegetation to native species.

Community Engagement

A deep understanding of the connections between ecological systems and human communities guided the development of the master plan vision. Between July 2022 and February 2023, the community participated in a range of virtual and in-person events and workshops to discuss and give input on the future of the Preserve.

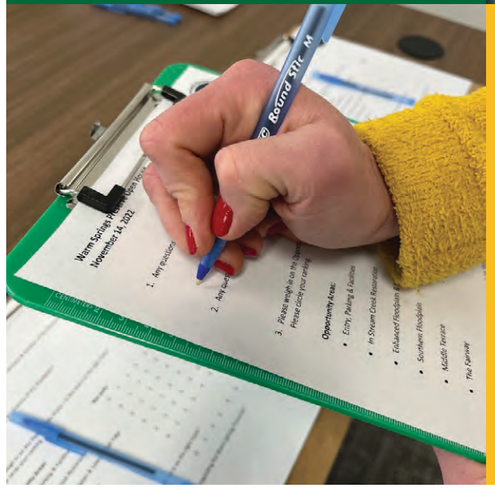
A unified design concept was synthesized from two primary perspectives:

1. A scientific analysis to determine appropriate site uses.
2. Stakeholder outreach to determine the community desires for the site.



10
public meetings
(September 2022
– February 2023)

200+
average daily
visitors as of 2023
estimates



400+
online + in-person
survey results
collected

Public Meeting Photos

Dot-ocracy Poster at Public Open House, September 2022

Public Open House, September 2022

Public Open House, November 2022

Public Open House, February 2023

Public Open House, November 2022

Public Open House, February 2023

Public Open House, September 2022

Public Open House, September 2022

Public Open House, September 2022

The relocated pond is fed from a new side channel and provides a safer source of irrigation water, as well as recreation, away from the habitat areas along the main creek.

Design Vision

A space that enhances both the natural habitat of the Preserve and experience for visitors and their furry companions.

The proposed vision for Warm Springs Preserve builds upon the substantial community comments, feedback and support. The conceptual design envisions a rich matrix of experiential spaces and dynamic ecologies that span the unique topographies and micro-climates throughout the Preserve. The project partners and design team developed six principles that describe the goals, values and themes universally important to the community and against which we tested design scenarios.

The final design includes ample off-leash dog access, creek and habitat restoration, new water-conscious irrigation system, walking trails, space for informal gatherings and activities, Nordic ski and snowshoe trails, and public restrooms. Development, organized sports and reserved private or commercial events will forever be restricted.

Project Principles

Create a Preserve that is Connected and Accessible to All.

Design for Success over Time

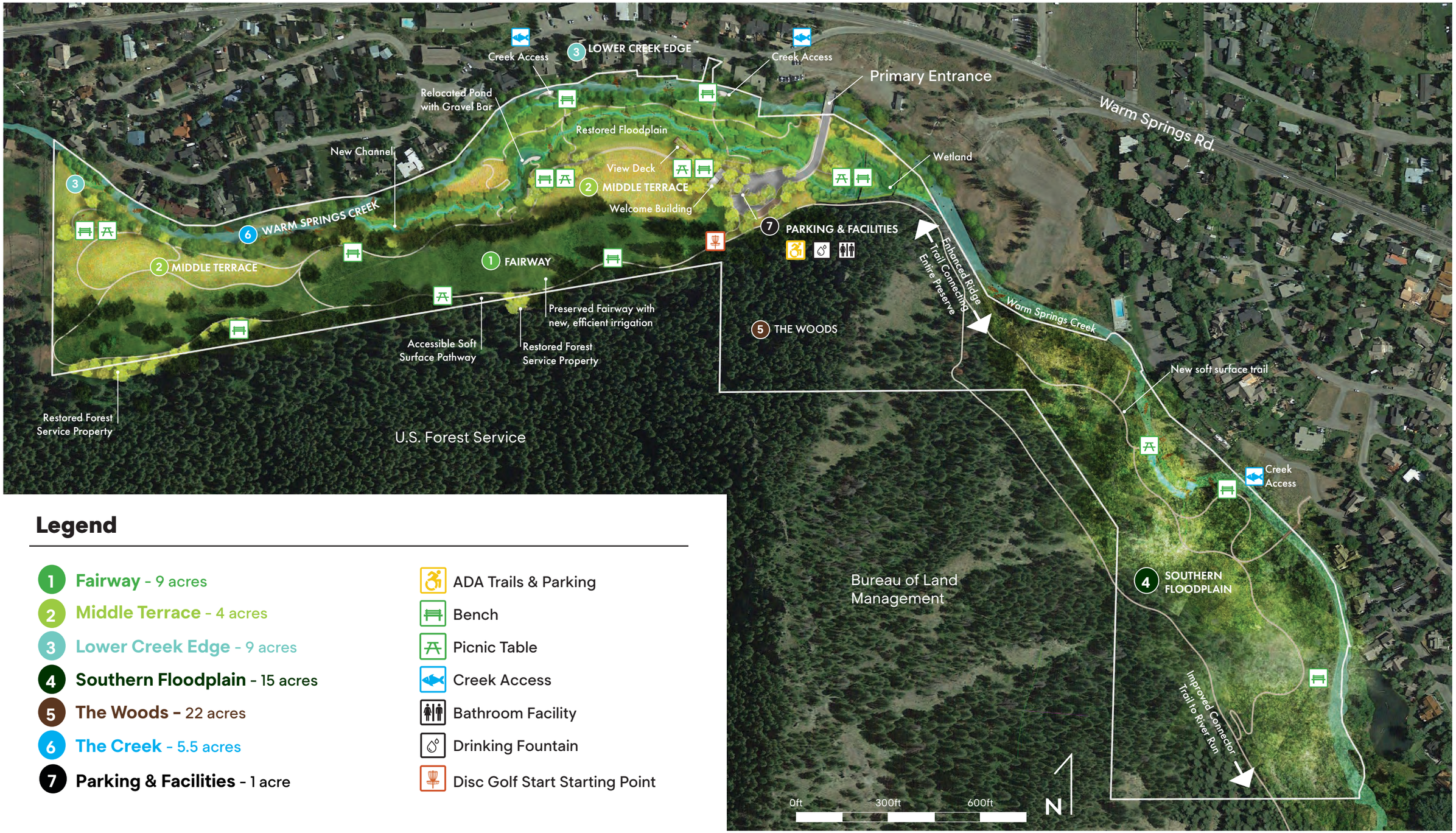
Support All-Season Multi-Functional Use

Demonstrate Leadership through Regeneration of Healthy Ecosystems for People, Plants & Animals

Restore the Creek and Floodplain

Celebrate & Educate about the Past, Present and Future of the Preserve

Overall Plan

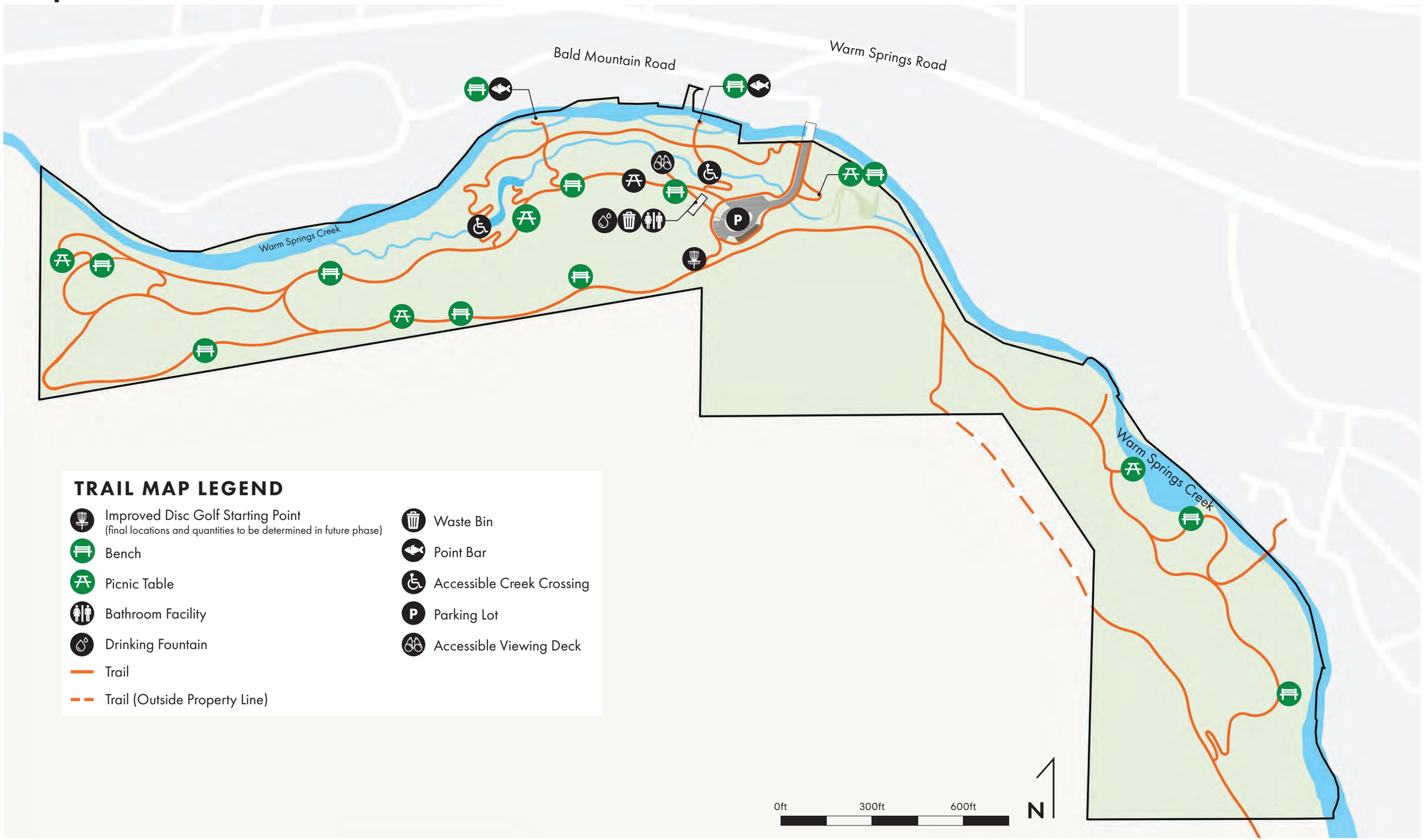


Legend

1. **Fairway** - 9 acres
2. **Middle Terrace** - 4 acres
3. **Lower Creek Edge** - 9 acres
4. **Southern Floodplain** - 15 acres
5. **The Woods** – 22 acres
6. **The Creek** - 5.5 acres
7. **Parking & Facilities** - 1 acre

- ADA Trails & Parking
- Bench
- Picnic Table
- Creek Access
- Bathroom Facility
- Drinking Fountain
- Disc Golf Start Starting Point

Proposed Trail Network



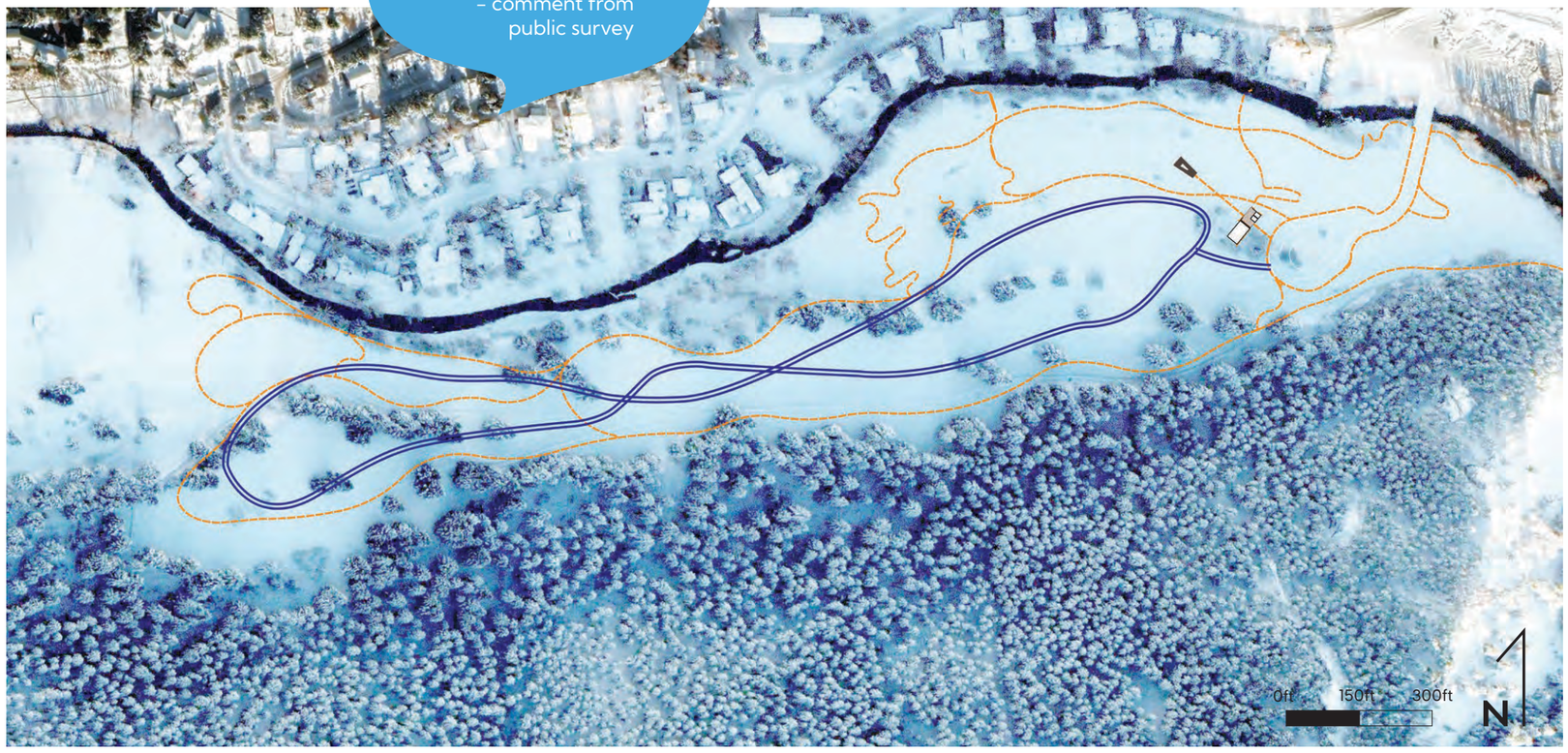
TRAIL MAP LEGEND

- Improved Disc Golf Starting Point (final locations and quantities to be determined in future phase)
- Bench
- Picnic Table
- Bathroom Facility
- Drinking Fountain
- Trail
- Trail (Outside Property Line)
- Waste Bin
- Point Bar
- Accessible Creek Crossing
- Parking Lot
- Accessible Viewing Deck

Proposed Winter Trail Network

"Excited about Nordic skiing trails in the winter!"

– comment from public survey



Multi-Use Winter Trails

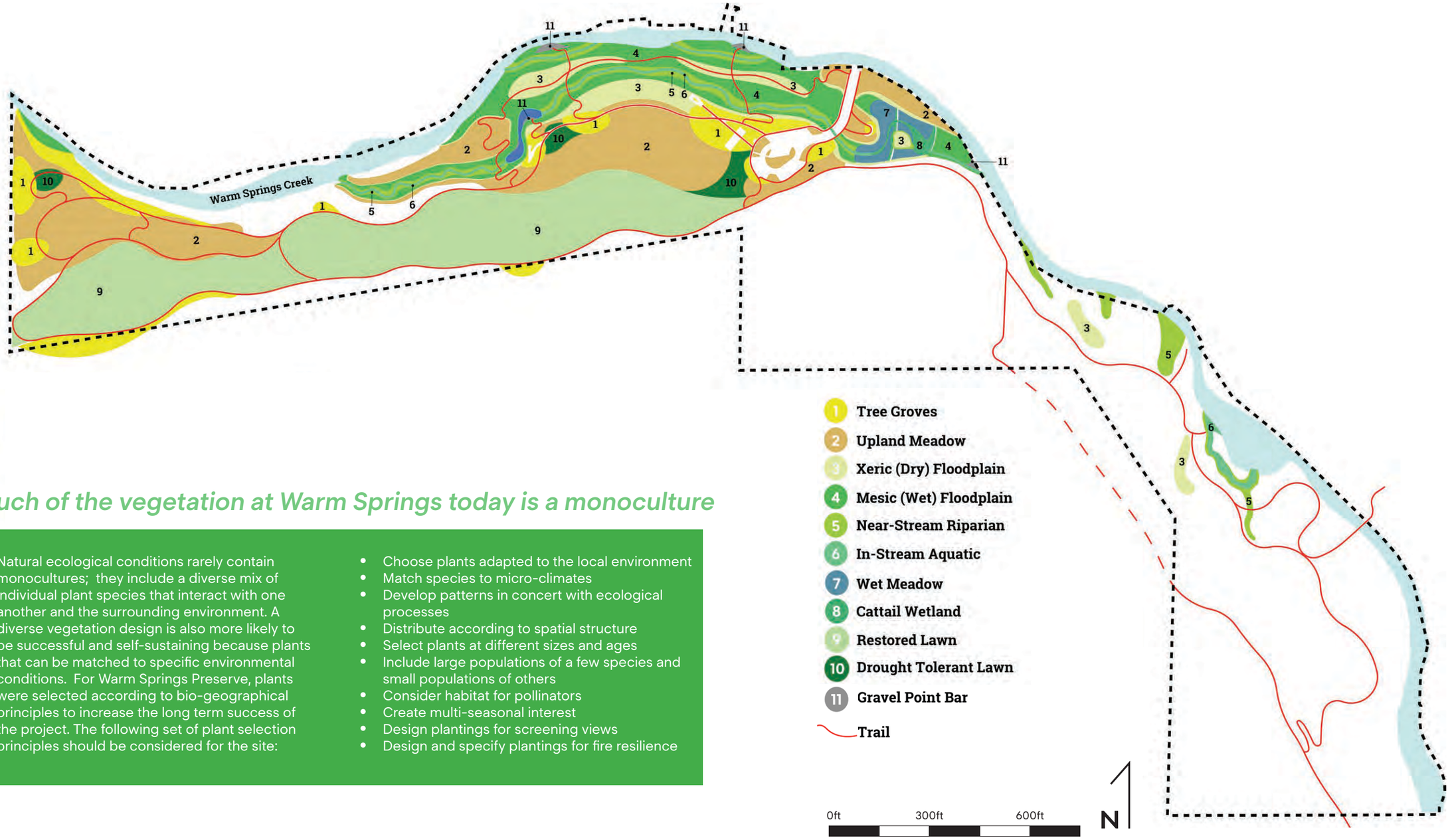
Nordic Skiing Track

Cross Country Trails, 2023

Cross Country Trails, 2023

Planting Character Zones: Plan

The proposed planting design would introduce a variety of native plant communities, especially in the restored areas along the creek.



Much of the vegetation at Warm Springs today is a monoculture

Natural ecological conditions rarely contain monocultures; they include a diverse mix of individual plant species that interact with one another and the surrounding environment. A diverse vegetation design is also more likely to be successful and self-sustaining because plants that can be matched to specific environmental conditions. For Warm Springs Preserve, plants were selected according to bio-geographical principles to increase the long term success of the project. The following set of plant selection principles should be considered for the site:

- Choose plants adapted to the local environment
- Match species to micro-climates
- Develop patterns in concert with ecological processes
- Distribute according to spatial structure
- Select plants at different sizes and ages
- Include large populations of a few species and small populations of others
- Consider habitat for pollinators
- Create multi-seasonal interest
- Design plantings for screening views
- Design and specify plantings for fire resilience

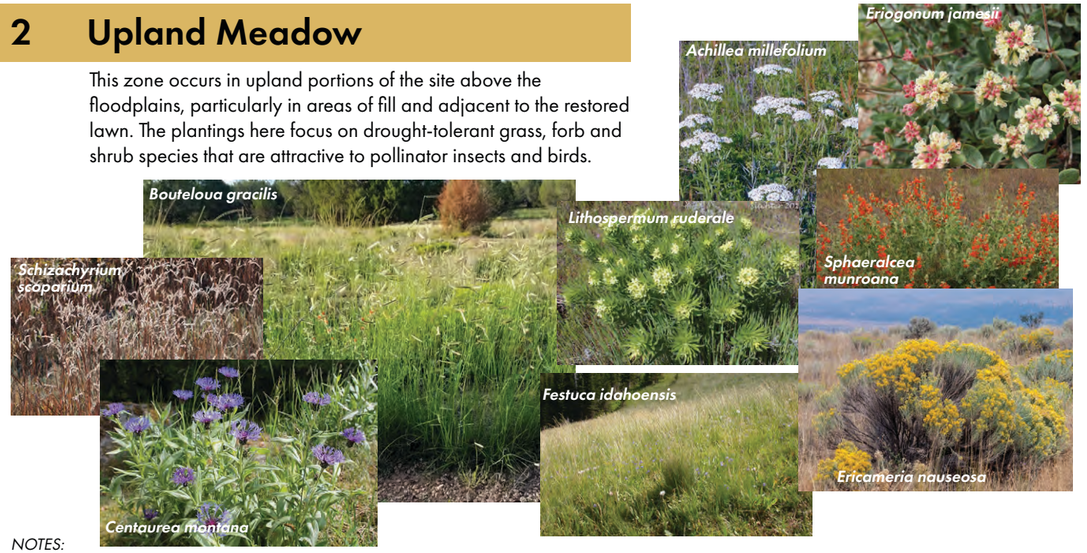
Planting Character Zones: Palettes

1 Tree Groves

The tree groves connect to existing evergreen planted areas on the site and are positioned as islands throughout the upland areas. In time, the shade created by the deciduous and evergreen trees in this zone will create a micro-climate for unique native shrub and perennials that provides diversity and greater sustainability within the landscape.

2 Upland Meadow

This zone occurs in upland portions of the site above the floodplains, particularly in areas of fill and adjacent to the restored lawn. The plantings here focus on drought-tolerant grass, forb and shrub species that are attractive to pollinator insects and birds.

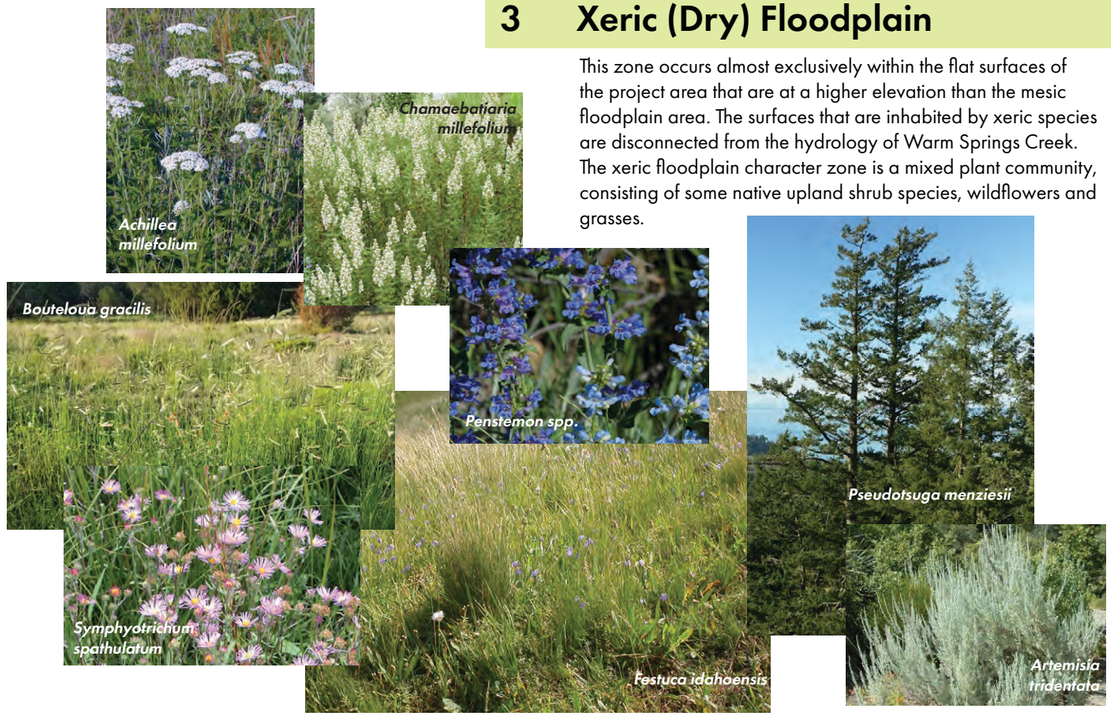


NOTES:

1. *These are images of example plant species of which these plant communities may be comprised.*
2. *Because the Preserve is frequented by dogs and wildlife, the final plan will carefully examine the safety of all chosen plant species.*

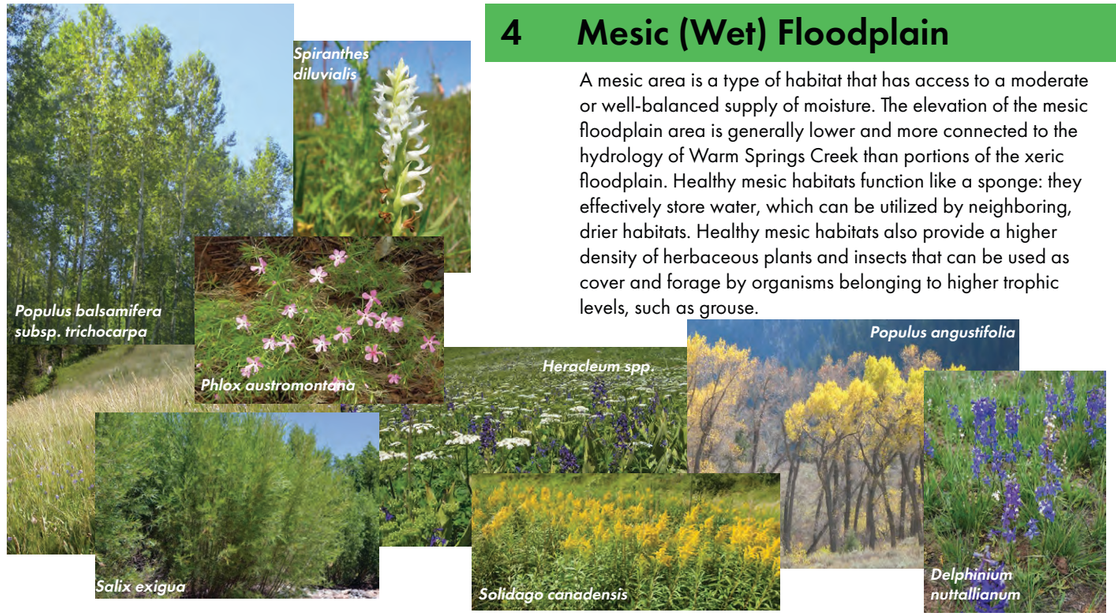
3 Xeric (Dry) Floodplain

This zone occurs almost exclusively within the flat surfaces of the project area that are at a higher elevation than the mesic floodplain area. The surfaces that are inhabited by xeric species are disconnected from the hydrology of Warm Springs Creek. The xeric floodplain character zone is a mixed plant community, consisting of some native upland shrub species, wildflowers and grasses.



4 Mesic (Wet) Floodplain

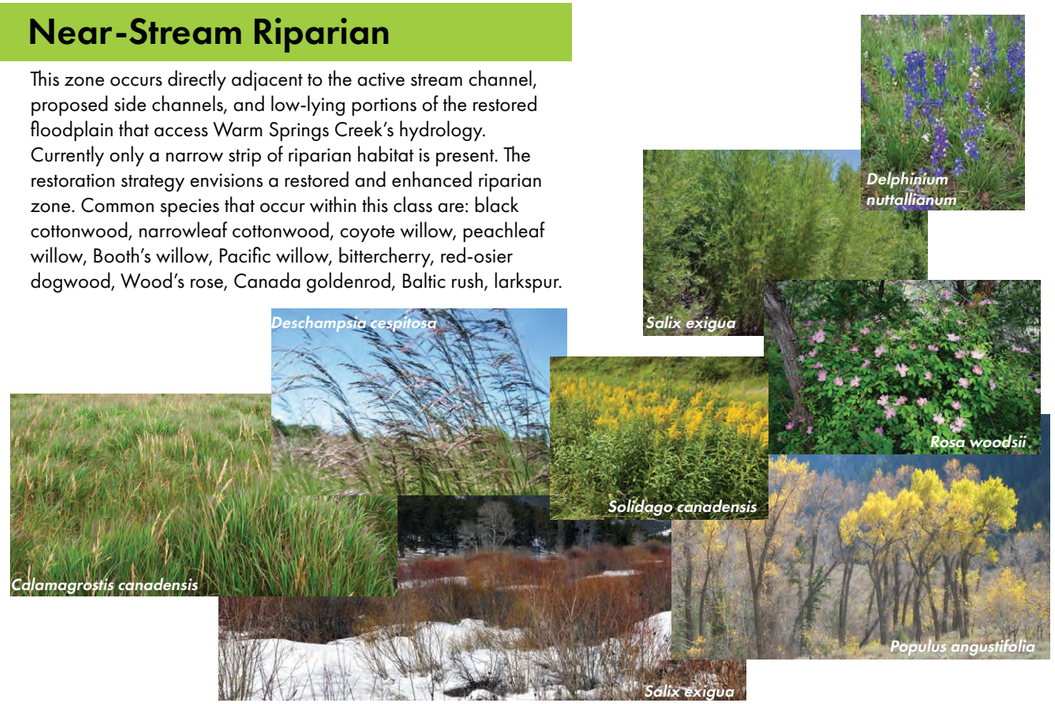
A mesic area is a type of habitat that has access to a moderate or well-balanced supply of moisture. The elevation of the mesic floodplain area is generally lower and more connected to the hydrology of Warm Springs Creek than portions of the xeric floodplain. Healthy mesic habitats function like a sponge: they effectively store water, which can be utilized by neighboring, drier habitats. Healthy mesic habitats also provide a higher density of herbaceous plants and insects that can be used as cover and forage by organisms belonging to higher trophic levels, such as grouse.



Planting Character Zones: Palettes

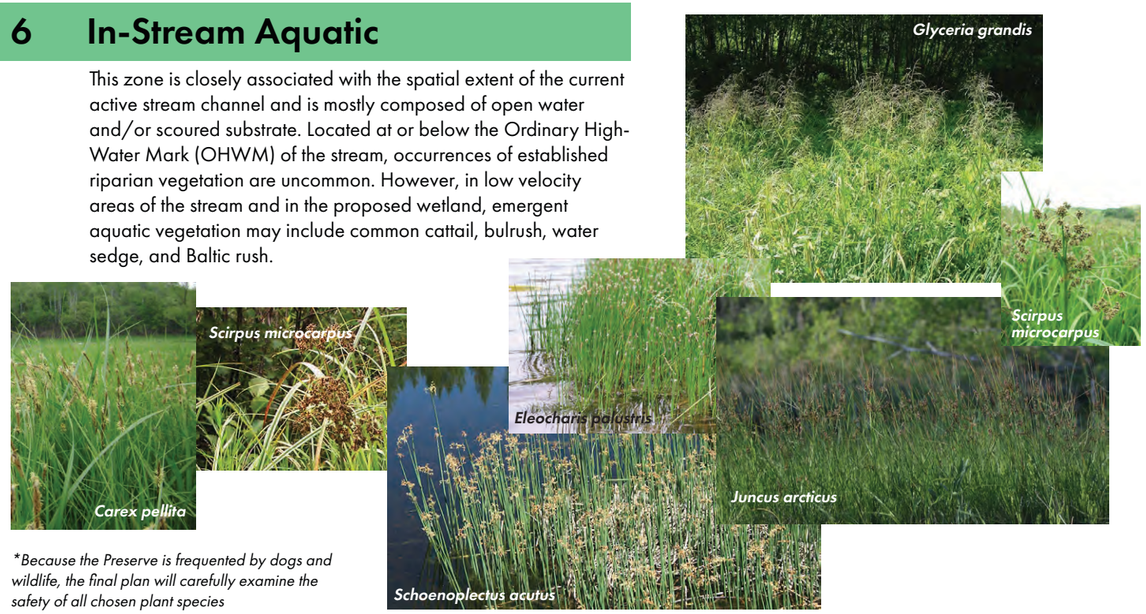
5 Near-Stream Riparian

This zone occurs directly adjacent to the active stream channel, proposed side channels, and low-lying portions of the restored floodplain that access Warm Springs Creek's hydrology. Currently only a narrow strip of riparian habitat is present. The restoration strategy envisions a restored and enhanced riparian zone. Common species that occur within this class are: black cottonwood, narrowleaf cottonwood, coyote willow, peachleaf willow, Booth's willow, Pacific willow, bittercherry, red-osier dogwood, Wood's rose, Canada goldenrod, Baltic rush, larkspur.



6 In-Stream Aquatic

This zone is closely associated with the spatial extent of the current active stream channel and is mostly composed of open water and/or scoured substrate. Located at or below the Ordinary High-Water Mark (OHWM) of the stream, occurrences of established riparian vegetation are uncommon. However, in low velocity areas of the stream and in the proposed wetland, emergent aquatic vegetation may include common cattail, bulrush, water sedge, and Baltic rush.

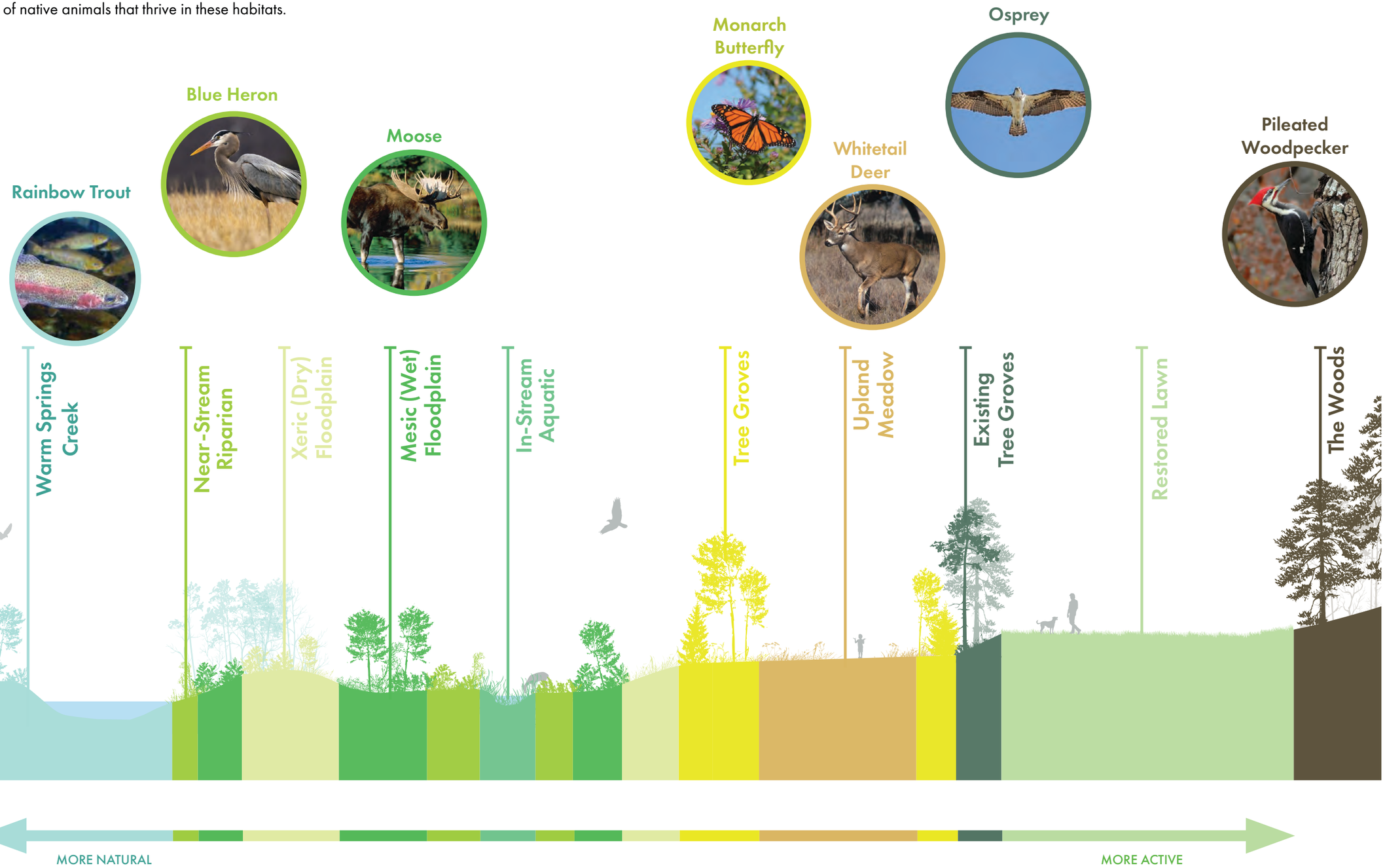


*Because the Preserve is frequented by dogs and wildlife, the final plan will carefully examine the safety of all chosen plant species

Careful plant selection and harvesting of native seed from the site itself will provide optimal conditions for success in a dynamic landscape and changing world.

Planting Character Zones Section

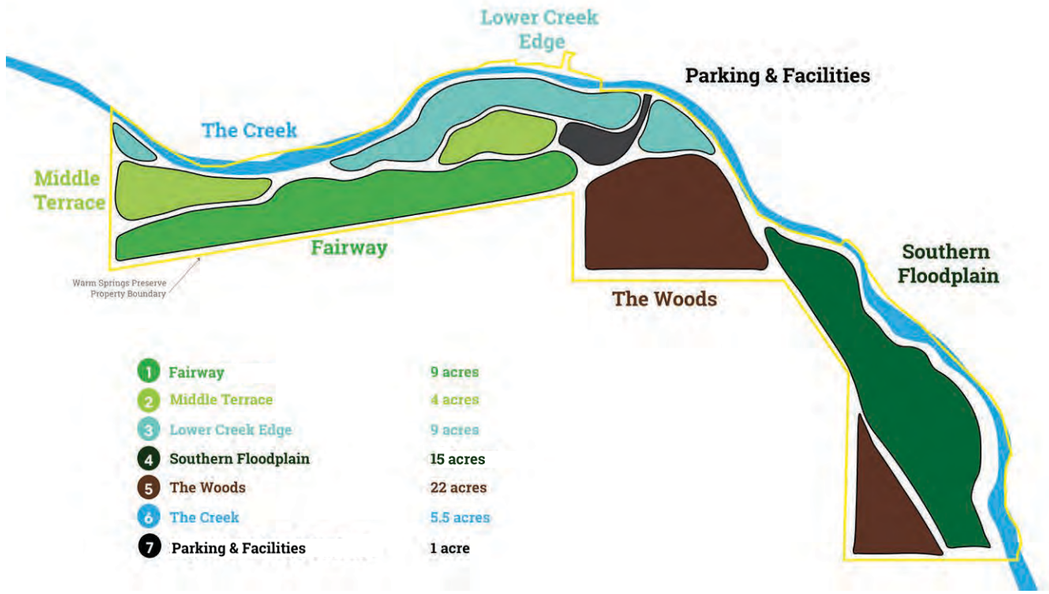
This is a conceptual section cut through of the different proposed plant character zones, and some examples of native animals that thrive in these habitats.

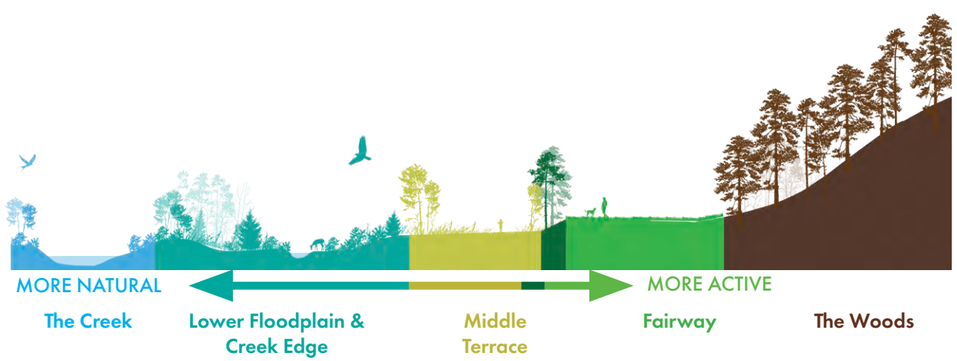


Zones

7 distinct zones cultivate a rich open space experience from the river's edge to the woodland.

Warm Springs Preserve includes a variety of different landscape conditions, each separated by distinct topography and vegetative characteristics. The master vision plan considers each of these areas as different opportunities for future-forward improvements, from preserving the fairway lawn and improving the irrigation system to more extensive restoration in the lower floodplain along Warm Springs Creek.





Improvements, by zone

Fairway

Preserved Upper Terrace Fairway with replaced irrigation system, new donor benches and picnic tables.

Middle Terrace

Earthworks and grading to receive the soil from the excavated floodplain. Planted with native meadow species and pockets of aspen groves.

Lower Creek Edge

Restored floodplain ecosystem with new side channels and irrigation pond.

Southern Floodplain

Minimally touched floodplain zone with minor grading updates, floodplain connections, soft surface pathways, invasive species removal, and in-stream fish habitat (wood & boulders).

The Woods

Forest within the property, which is a major connection for visitors.

The Creek

New gravel point bars for people and dog access. Install in-stream fish habitat (wood and boulders).

Parking + Facilities

Year-round public restrooms, storage building for maintenance equipment, donor recognition wall, history and preserve map, bike racks, leash hook board.

Parking & Facilities

The existing entry sequence and parking lot pose substantial maintenance challenges, particularly during the long winter season. To improve the existing parking area and reduce maintenance, the design proposes paving the parking lot, adjusting its shape to increase efficiency, and providing designated accessible parking spaces. A clearly delineated path provides safe pedestrian access around the parking lot and a designated snow storage location will reduce the "walling in" of the parking lot in times of heavy snow.

What's planned:

- (2) year-round public toilets
- 1,000 sq. ft. (max) storage building for maintenance equipment
- Donor recognition wall ($1,000+ donors)
- History and Preserve map
- Bike racks
- Leash hook board
- (24) parking spaces, including 2 handicap accessible spaces (asphalt paving)

Accessible Viewing Deck

Restored Floodplain
(non-irrigated with native riparian plantings)

Channel

Soft Surface Trails

Expanded Aspen Grove

Culvert

Asphalt Paved Drive

Wetland Overlook

Bike Racks

Welcome Building

ADA

ADA

Snow Storage

Channel

Fairway Lawn
(preserved w/updated irrigation)

Avalanche Zone

Improved Connector Trail to Southern Property

N

Illustrative view of welcome building from parking lot

Welcome Building

The proposed restroom and storage building will be compact and efficient while providing needed services and facilities to support the Preserve. It will include two (2) toilets for year-round use, storage for maintenance, water fountains for people and dogs, waste bins, donor wall to recognize community supporters, a trail map, historical information, bike racks, and sheltered seating. An enhanced grove of trees will provide ample screening from within the Preserve.

Parking Lot

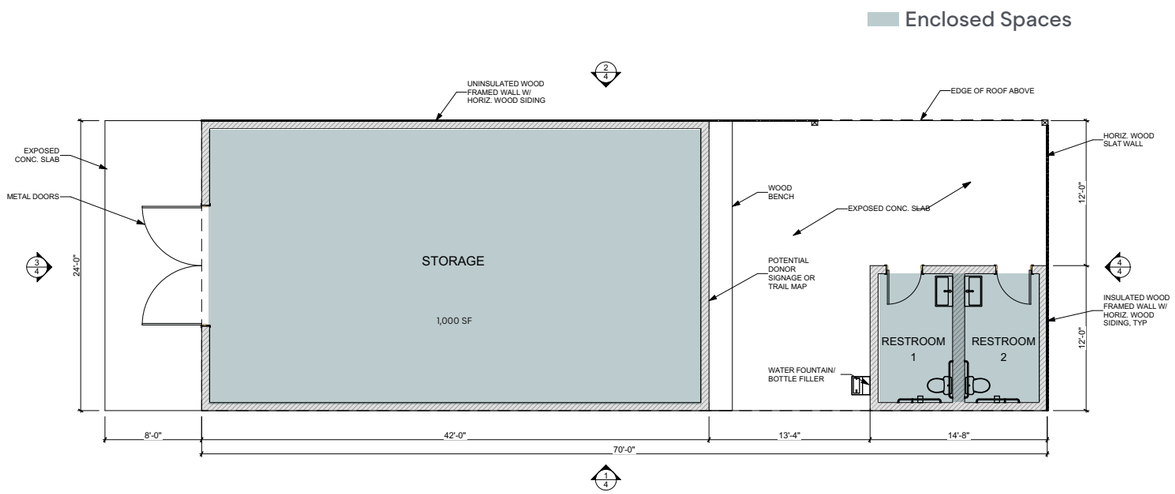
The proposed parking lot will have 24 stalls total per the warranty deed, with 2 handicap parking spaces included. The parking lot design considers stormwater runoff and snow storage.

Birds eye illustrative view of parking lot from welcome building

Welcome Building

Illustrative view of welcome building and side channel

Illustrative view of east elevation from parking lot



Building floor plan

Illustrative view of welcome building from parking lot

Lower Creek Edge

The proposed design for the lower creek edge expands and enhances the floodplain to restore ecological services and wildlife habitat. Excavated materials are relocated to the middle terrace and revegetated with native plants.

What's planned:

- Extensive grading & earthworks
- New side channel and pond
- Gravel bars
- Low water crossings for side channels
- Expanded riparian zone, including native trees and shrubs
- New beaver wetland

New Floodplain Channel

Restored Floodplain

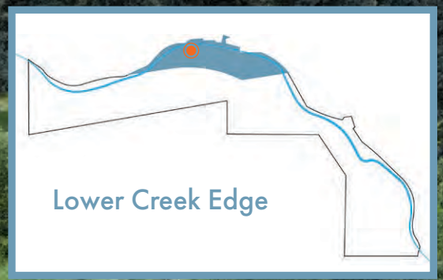
Interpretive Sign

Xeric (Dry) Floodplain

Accessible Viewing Deck

"Warm Springs Preserve is the last opportunity for large-scale habitat restoration in lower Warm Springs Creek"

– Wood River Land Trust



FUN FACT

Reconnecting the creek to the floodplain will reduce potential flood damage to neighbors, reduce irrigation needs, and benefit fish and wildlife.

Stepping Stones

New Floodplain Channel

Mesic (Wet) Floodplain

Mesic (Wet) Floodplain

Footbridge

Soft Surface Trail

Screened Pump House

Picnic Area

Irrigation Pond

"Very excited for flood mitigation and restoration facets of the project. And of course, the off-leash dog access and open space for everyone."

– comment from public survey

Warm Springs Creek

New Floodplain Channel

Aspen Groves

Woody Debris for Restoration

FUN FACT

Trout love a healthy riparian zone. Densities are 8–10 times higher in healthy creek habitats that include large woody debris and a healthy riparian zone.

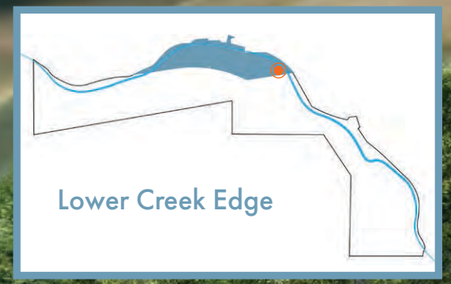
Restored Floodplain

Footbridge

Interpretive Sign

Log and Boulder Seating

Creek Access at Gravel Point Bar



New Channel Culvert

Wetland Overlook

Ridge Trail to Southern Floodplain

Side Channel

Beaver Dam Relic

Wet Meadow

Cattail Marsh

Interpretive Sign

Constructed Beaver Dam Relic

Picnic Area

Potential Location
for Existing Public Art

Middle Terrace

To reduce costs and keep all excavated earth on site, the middle terrace will receive the fill excavated from the restoration. This will be replanted with native grasses and wildflowers, as well as expanded aspen groves for shaded seating areas.

What's planned:

- Seasonal native wildflower meadow
- Enhanced biodiversity & pollinator species
- Minimal irrigation
- Mown pathways

Areas to receive fill from excavated floodplain to be revegetated with native wildflower meadow.

N

Floodplain View Deck

Existing Aspen Grove

Soft Surface Trails

Fairway

Upland Meadow

Upland Meadow

Upland Meadow

Donor Bench

JANE SMITH

Existing Tree Grove

Welcome Building

Native Wildflower Understory

Accessible Soft Surface Pathways

"A winding walking path around the circumference of the park is important as a way of providing access for the elderly, disabled, or injured."

– comment from public survey

Fairway

Ketchum residents and dogs alike cherish the existing fairway. The fairway provides an incredible experience for off-leash dogs, outings, trail hiking and cross country skiing. The concept design retains the integrity of the existing landscape, while making it more sustainable. The design proposes test plot opportunities to transition the existing Kentucky bluegrass lawn to a drought-tolerant species. Amenities such as new benches, picnic tables and waste bins will improve visitors' comfort. The existing path will be updated to ensure universal ADA access.

What's planned:

- Maintain fairway with some restored edges
- Replace inefficient irrigation system
- Opportunities for benches & picnic tables
- Potential for wildlife-proof waste bins
- Update existing path to ensure ADA access

"Strategize how to manage relationships between people, dogs and wildlife."

– comment from public survey

Restoration on U.S. Forest Service land

Updated ADA Trail

Restoration on U.S. Forest Service land

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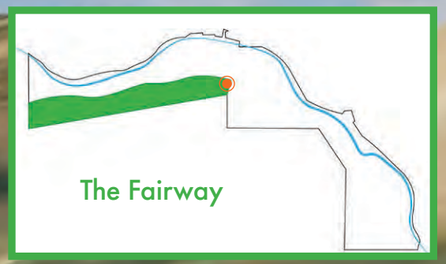


Middle Terrace

Open Lawn

Welcome Building

Parking Lot

Irrigation

Why is the new irrigation system important?

Currently, Warm Springs Preserve
uses 80% more water per acre
than the ballfields at Atkinson Park.

current water use
at Warm Springs Preserve

current water use
at Atkins Park

In July 2022

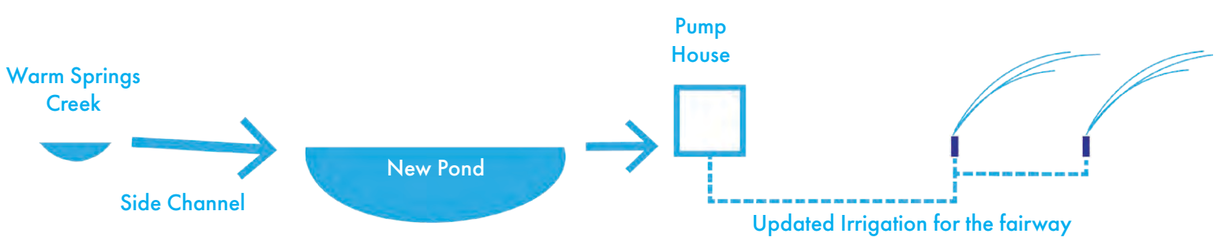
Warm Springs Preserve:
10.5 acres @ 2.5 mil gal
238,000 gal/acre

>

Atkinson Park:
9.5 acres @ 1.25 mil gal
131,500 gal/acre

How the new irrigation system will work:

The new irrigation system will be much more efficient and will only run at night!



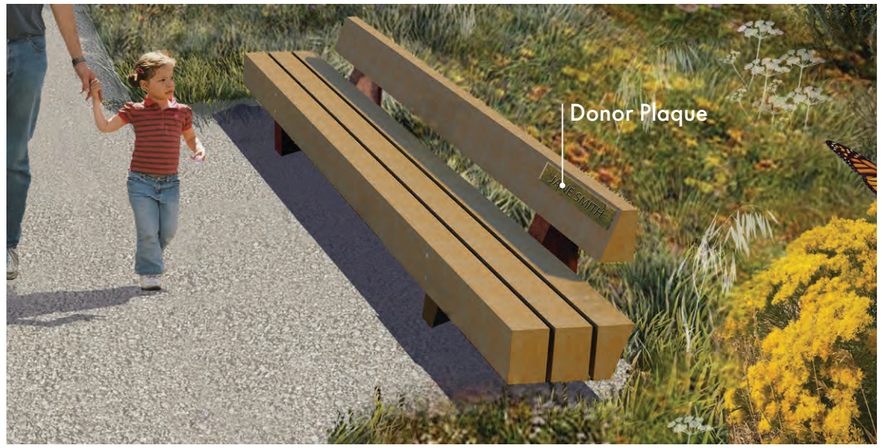
Amenities

Wildlife-Resistant
Waste Bin

Dog
Station

Disc Golf
Basket

Donor recognition elements embody inclusive values by providing a variety of accessible options for all members of the community.



Southern Floodplain

The intent for this area is to celebrate and preserve the existing floodplain along the creek while improving access and floodplain connectivity. On the southern property, minimal human influence has allowed much of the native ecosystems to thrive. However, a few minor improvements can substantially influence floodplain connectivity. The current creek alignment lacks pools and habitat complexity while the floodplain is poorly connected and features a growing weed population. Minor soil excavations, selective weed removal and overseeding of native plant material will reconnect the creek to the floodplain and allow for the recolonization of native riparian species.

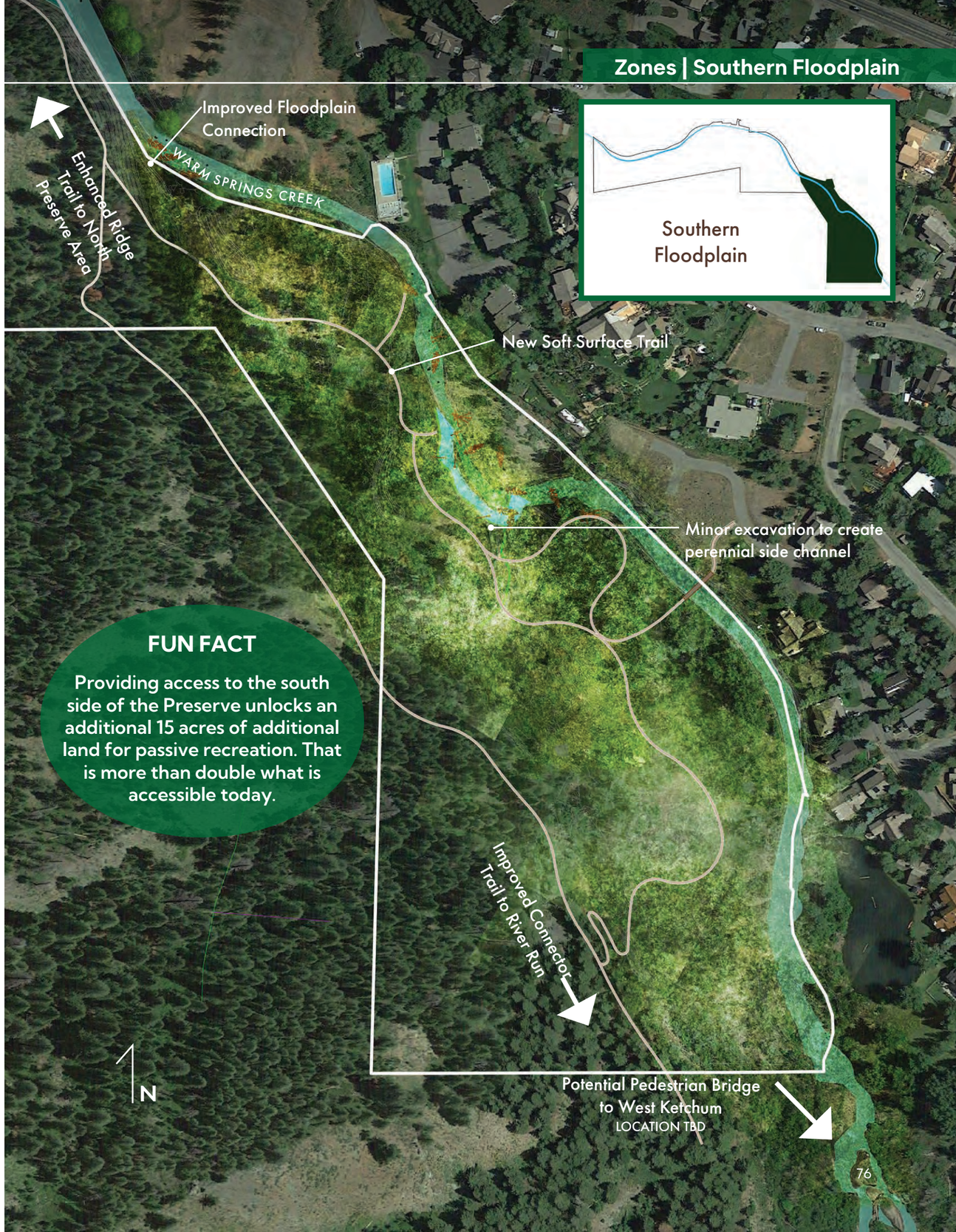
What's planned:

- Light touch, minor enhancements
- Minor grading
- Strategic floodplain connections
- One minimal soft surface pathway to connect at key access points
- Removal of invasive species
- In-stream fish habitat (wood & boulders)

Accessible Soft Surface Trail

Riparian Forest

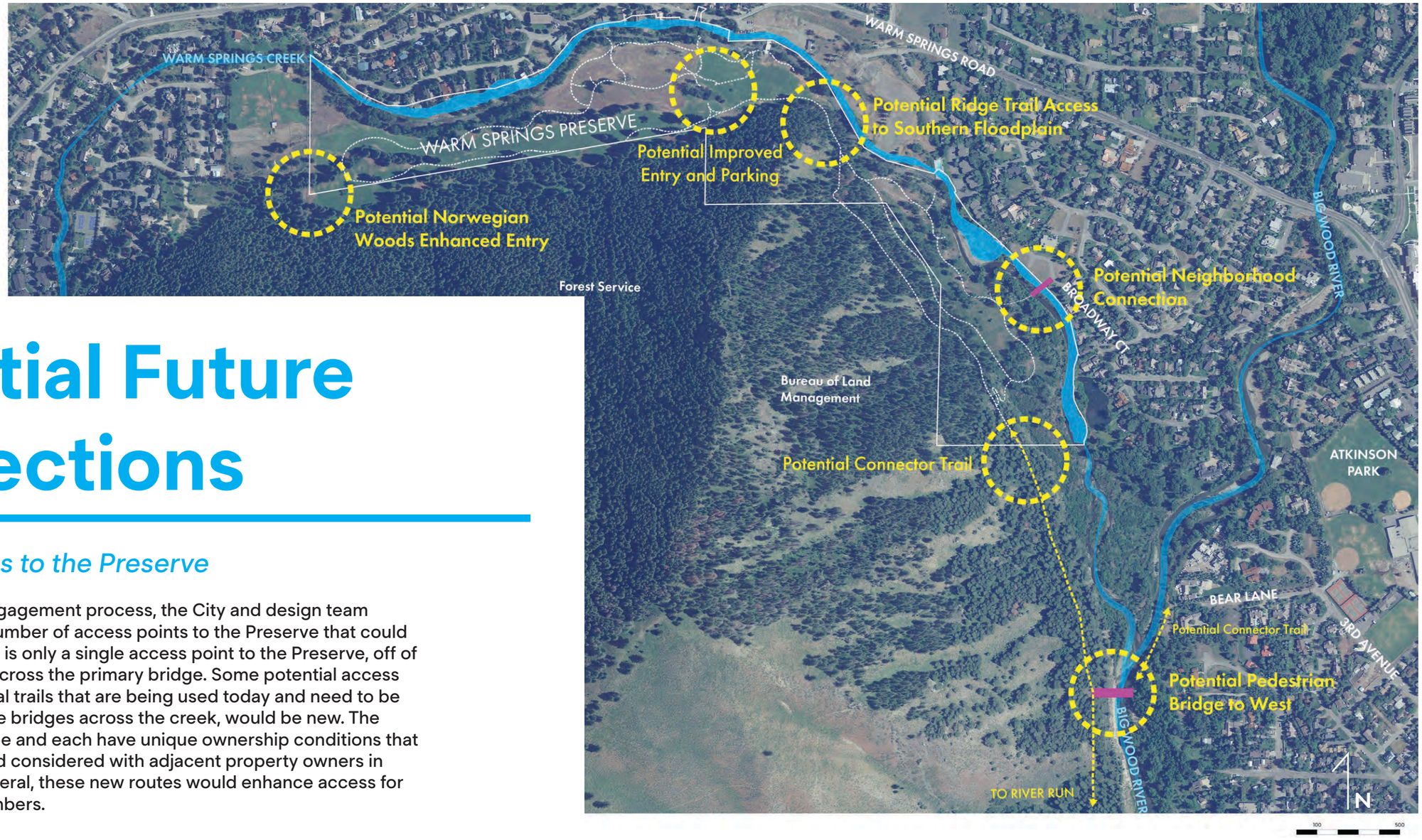
Illustration of Proposed Soft Surface Path through Existing Native Landscape

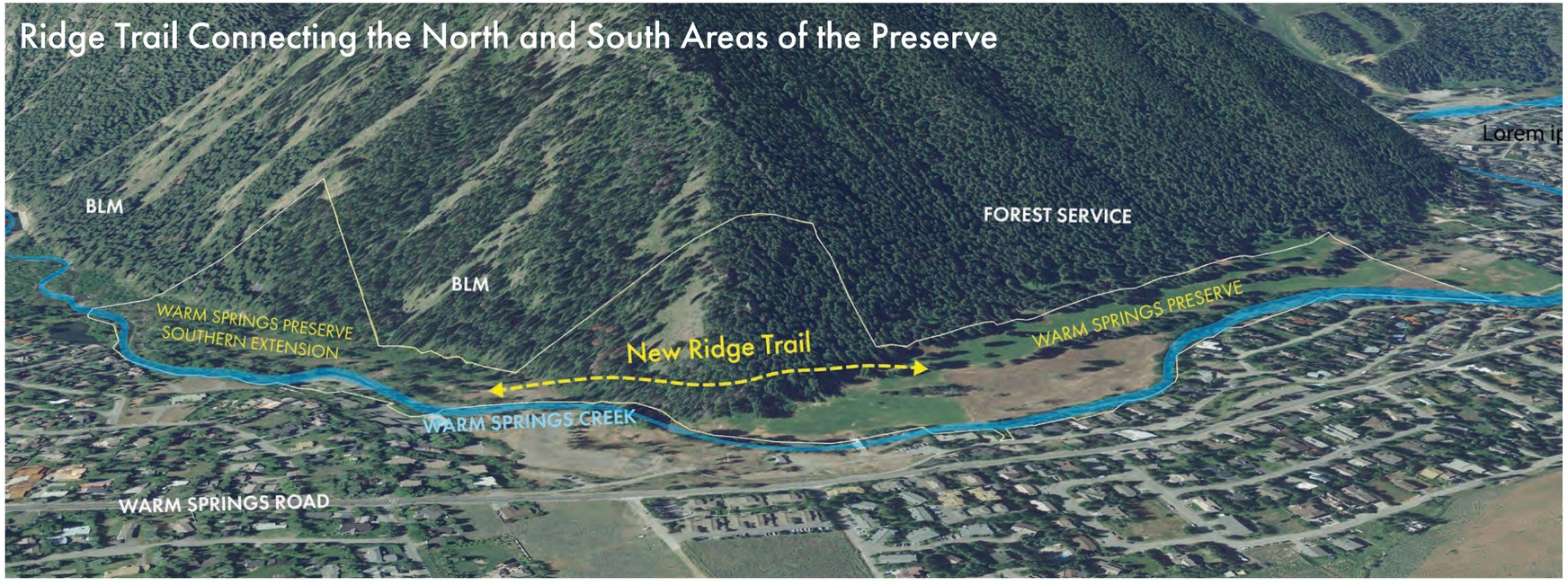


Potential Future Connections

Expanding access to the Preserve

During the community engagement process, the City and design team heard that there were a number of access points to the Preserve that could be improved. Today, there is only a single access point to the Preserve, off of Warm Springs Road and across the primary bridge. Some potential access points are existing informal trails that are being used today and need to be formalized. Others, like the bridges across the creek, would be new. The opportunities range in type and each have unique ownership conditions that need to be negotiated and considered with adjacent property owners in concert with costs. In general, these new routes would enhance access for Ketchum community members.



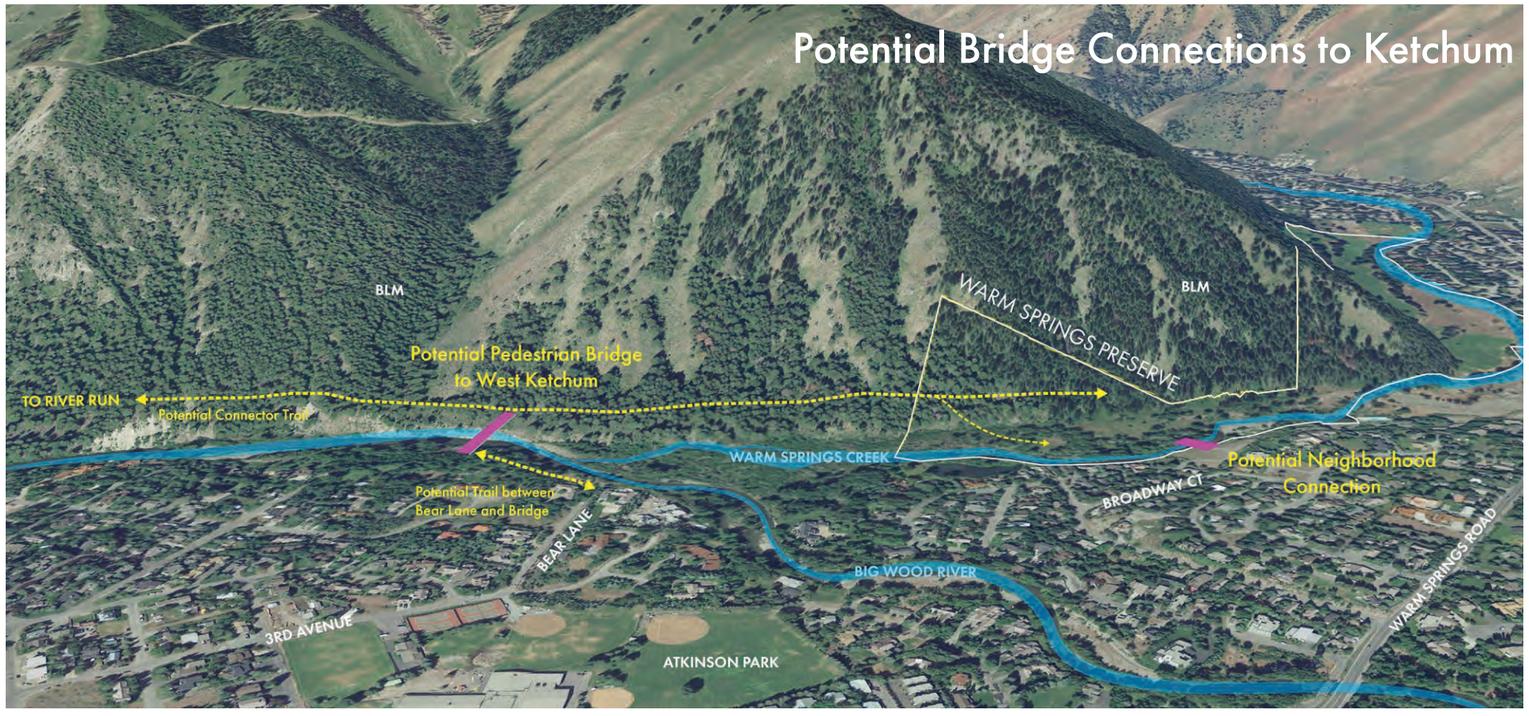


The Ridge Trail

While the City's purchase of the Preserve opened access to the southern floodplain's 15-acres, the area is nearly inaccessible. A very steep dirt trail rounds the ridge above Warm Springs Creek. Some residents indicate that during low creek flows they can cross the creek. The Vision Plan includes a new and improved hiking trail that would allow visitors to connect from the north to the south of the Preserve from the parking area, as shown in the map to the left.

West Ketchum Bridges

Many community members expressed excitement about creating one or two access points that would cross Warm Springs Creek or the Big Wood River to connect to trails in the Preserve. The City and design team studied various options and, based on feasibility, determined that the two locations shown in the map to the right would be potential access locations. A potential West Ketchum connection below the confluence would be on Bureau of Land Management land and would require approval. The second neighborhood connection shown requires additional study and community support. Access could range from simply improving the safety of the existing public access point or installing a year-round footbridge.



Existing Warm Springs Creek Conditions

- Poor flood conveyance and high risk of flood impacts
- Limited juvenile rearing habitat
- Low quality spawning habitat
- Poor groundwater recharge
- High rates of sediment transport
- Low biodiversity
- Greater risk of bank erosion

Existing Warm Springs Creek

Healthy Stream System

- Improved flood management
- Resilient to wildfire
- High biodiversity
- Extensive range of habitat types and areas of high-quality habitat for fish
- Lower risk of erosion
- Increased groundwater recharge

Example Restored Creek and Floodplain

Restoration

Why Restoration?

From past work on this site and in the area, we know that Warm Springs Creek is highly confined, armored, and incised. Floodplain connectivity is much less frequent than historically, not activating until over a 100-year flood for most of the project site. Fish habitat is generally degraded, with few pools and cover in the stream channel, and very limited off-channel habitat, particularly for juvenile fish. The riparian area has also been largely cleared, reducing shade and nutrient cycling, as well as potential fire buffering for neighboring communities. The existing stream and floodplain are poorly connected to the groundwater table, necessitating special consideration when working in and around the stream bed but also when considering riparian and wetland restoration on the floodplain.

Logistical Benefits

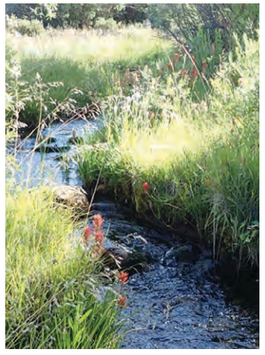
- Project principles based on stakeholder feedback
- City of Ketchum commitments
- Improve funding opportunities

Ecological Benefits

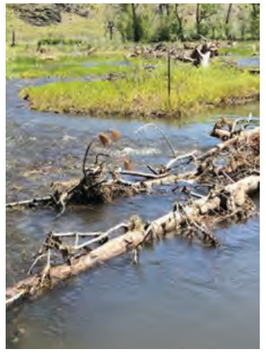
- Improve stream function
- Improve fish and wildlife habitat
- Dissipate flood risk
- Reduce stream energy
- Potential water savings
- Improve riparian shade and aesthetics

Restoration Outcomes

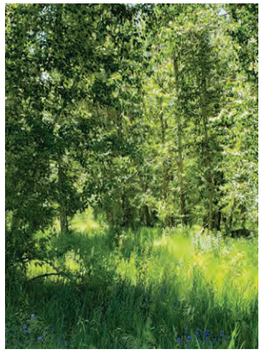
Active Sediment Bars



Side Channels



Active Floodplain



Dense Riparian Corridor

Proposed In-Stream Restoration

Several improvements are proposed within the creek edge to enhance the hydrological and ecological health of the creek.

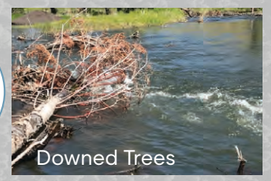
What's planned:

- Improved fish habitat
- Modifications will create more pools and off-channel areas for juvenile fish
- Greater floodplain connection
- Native riparian vegetation

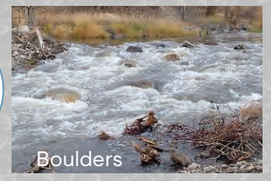

New Pond


Constructed Riffle


Downed Logs


Downed Trees

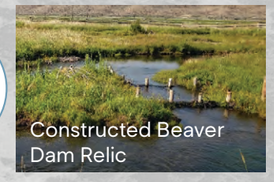

Gravel Point Bar


Boulders


Pools


Side Channel

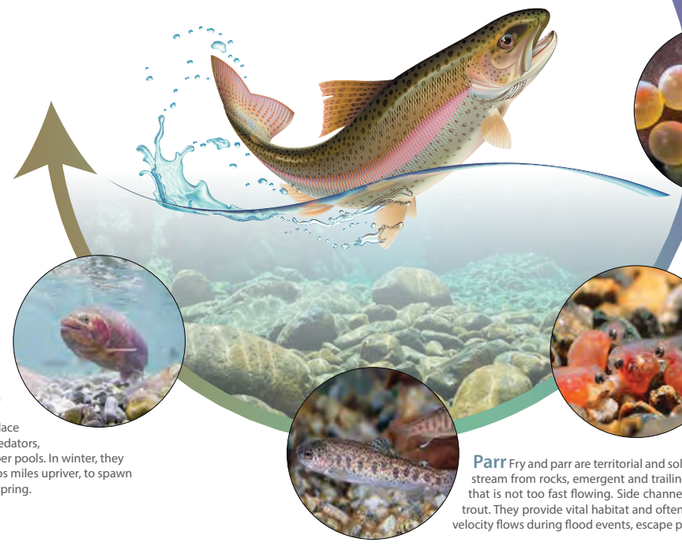

Log Jam


Constructed Beaver Dam Relic

Appendix

Trout Life Stages and Preferred Habitat

Trout need cool, clear water and plenty of food to eat. They also need cover from predators and room to travel upstream and down at different times of the year when feeding, overwintering and spawning.



Spawning Female trout dig a nest or redd in clean gravel shallows. As she releases her eggs, they are fertilized by the male and then covered with gravel. The gravels must be 10-40mm in size, loose and free of silt with plenty of oxygen rich water flowing through them. Spawning occurs in the spring.

Eggs At 2-5mm in diameter, eggs incubate in clean gravels and hatch into alevins. Female rainbow trout usually produce 2000 to 3000 eggs. The eggs usually hatch in about four to seven weeks, depending on stream temperature.

Alevins Newly hatched trout are called sac fry or alevin. Alevins stay in the gravel, living off the yolk sac. In approximately two weeks, the yolk sac is completely consumed, and fry commence feeding mainly on zooplankton. They then emerge as fry, set up territories and grow into parr. Alevins develop into parr in early summer, depnding on stream conditions.

Adults
Adult trout have a territory that gives them a good supply of food and a place to hide from predators, preferring deeper pools. In winter, they migrate, perhaps miles upriver, to spawn in early to late spring.

Parr Fry and parr are territorial and solitary. They need plenty of cover in the stream from rocks, emergent and trailing bankside plants, and shallow water that is not too fast flowing. Side channels are incredibly important for native trout. They provide vital habitat and often allow these juveniles to escape high velocity flows during flood events, escape predators and offer a food resource.

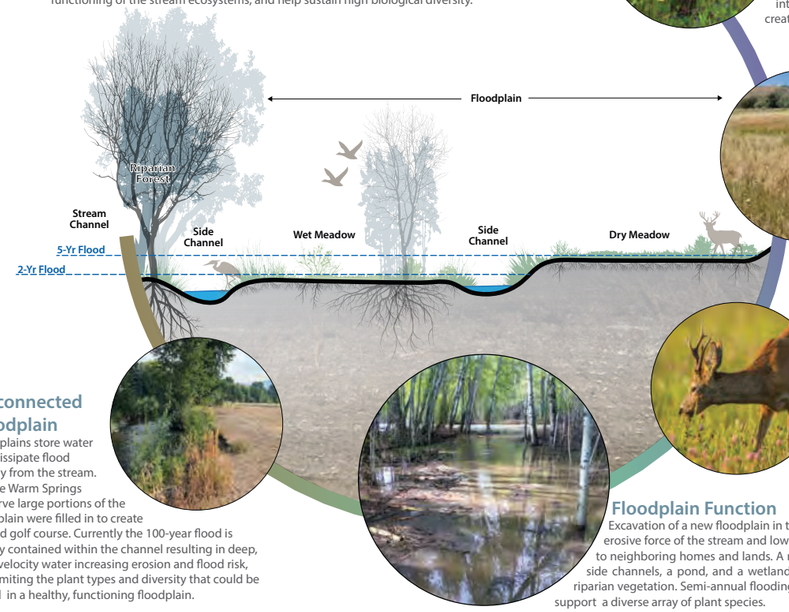
Insects + Plants = Fish Food
Aquatic invertebrates like insects, are integral to the trout food web. Insects feed on aquatic plants, decaying matter and microscopic animals. In turn, they become food for fish.

Riparian Vegetation
Riparian vegetation helps stabilize banks while providing shade and cover for fish. Juvenile fish need slow water and cover generally near the bank and in side channels.

Deep Pools and Cover
Adult fish need deep pools and cover often associated with in-stream wood and boulders.

Floodplain

Streams and rivers are much wider than the channels we associate them with. The areas next to streams, which are only covered by water during floods, are also part of the river system. Known as floodplains, in their natural condition they are an important ecological part of the landscape. The floodplain in the Preserve comprises mesic (wet) and xeric (dry) meadows. Floodplains filter and store water, secure both natural flood protection and the healthy functioning of the stream ecosystems, and help sustain high biological diversity.



Wet Meadow/Wetland
The elevation of the wet meadow or wetland is generally lower and more connected to the hydrology of Warm Springs Creek than portions of the dry meadow. Wet meadow habitats effectively provide drought insurance as land at higher elevations warms due to seasonal or other changes. Wet meadows may include some trees and larger shrubs. The Warm Springs Preserve wet meadow is intended to emulate a beaver wetland; beaver often create or influence wet meadows.

Dry Meadow Dry meadows occur almost exclusively within the flat surfaces of the project area that are at a higher elevation then the wet meadow and are disconnected from the annual hydrology of Warm Springs Creek. The dry meadow character zone is arid and mixed with some native upland shrub species, wildflowers, and grasses and relatively few trees.

Wildlife Resources
Floodplains provide essential habitat for wildlife. Floodplains are an important source of nutrients and provide multiple habitat niches. A new floodplain will provide off-channel habitat for aquatic species and riparian habitat for terrestrial species.

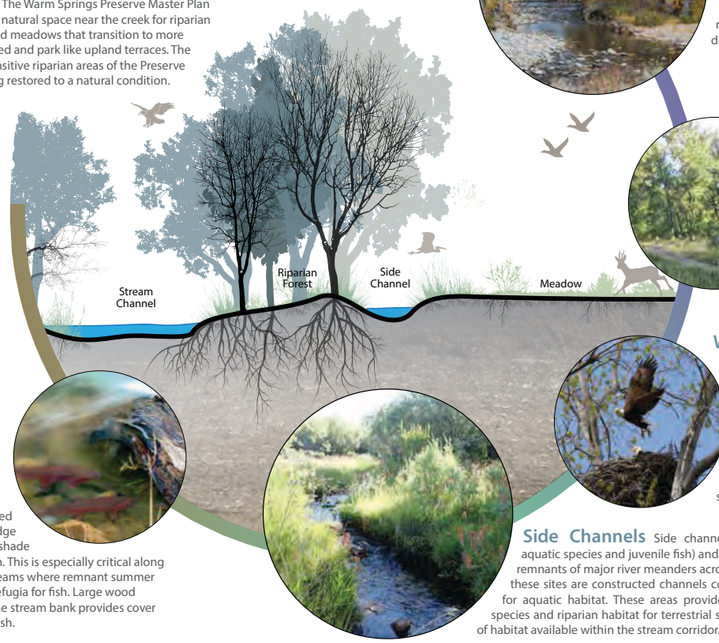
Disconnected Floodplain
Floodplains store water and dissipate flood energy from the stream. On the Warm Springs Preserve large portions of the floodplain were filled in to create the old golf course. Currently the 100-year flood is largely contained within the channel resulting in deep, high-velocity water increasing erosion and flood risk, and limiting the plant types and diversity that could be found in a healthy, functioning floodplain.

Floodplain Function
Excavation of a new floodplain in the Preserve will reduce the erosive force of the stream and lower the risk of flood damage to neighboring homes and lands. A new floodplain will include side channels, a pond, and a wetland, all surrounded by native riparian vegetation. Semi-annual flooding of the land areas helps to support a diverse array of plant species.

Connected Stream Floodplains
The importance of the hydrologic and ecological functions of floodplains is well understood, and there are many benefits to restoring connectivity of floodplains so that they actively flood. This not only supports native riparian and aquatic species, but it also accommodates floodwaters, thereby reducing flood peaks downstream. The Warms Spring Preserve plan recognizes the ecological benefits of floodplain inundation and is planned in a way to provide multiple benefits, such as combining flood risk reduction, ecosystem restoration, and adaptability to climate change. The plan highlights the challenges, opportunities and the many benefits of a reconnected floodplain that include habitat for fish and wildlife, groundwater recharge, carbon sequestration, open space and recreation.

Riparian Stream Edge

Riparian zones are the areas bordering the stream channel and provide many environmental and recreational benefits. The Warm Springs Preserve Master Plan includes natural space near the creek for riparian forest and meadows that transition to more manicured and park like upland terraces. The most sensitive riparian areas of the Preserve are being restored to a natural condition.



Cottonwood - Willow Riparian Forest This community occurs at low elevations, along the stream channel, where the water table is high and/or there is year-round water flow. Frequent spring flows provide areas of scour and sedimentation within the channel; this dynamic hydrologic regime contributes to the habitat's structural diversity and high wildlife value.

Botanical Resources Vegetation within this community is predominantly composed of deciduous species. The tall riparian trees and dense understory result in almost full canopy cover. Typical tree species include cottonwood, willow, bittercherry, rosewood, dogwood, herbaceous shrubs and grasses.

Wildlife Resources This habitat type is noted for its very high bird species diversity and abundance. Deciduous trees and shrubs are used by nesting migrants for foraging during migration. Mature trees provide numerous cavities for cavity-dependent wildlife such as woodpeckers. Tall trees are used by nesting raptors; stream banks provide nesting for belted kingfishers. A variety of mammals utilize the dense forest for cover, shade and food.

Fisheries Resources

Vegetation rooted at the water's edge provides cover, shade and food for fish. This is especially critical along intermittent streams where remnant summer pools provide refugia for fish. Large wood embedded in the stream bank provides cover and refuge for fish.

Side Channels Side channel habitats (built specifically for aquatic species and juvenile fish) and riparian habitat are small watered remnants of major river meanders across the floodplain. On the Preserve these sites are constructed channels connecting ponds built specifically for aquatic habitat. These areas provide off-channel habitat for aquatic species and riparian habitat for terrestrial species and increases the diversity of habitat available within the stream corridor.

Dynamic + Continually Changing

Riparian forests grow within an alluvial environment that is continually changing due to the ebb and flow of the stream. Riparian vegetation is constantly being reset by flooding disturbance.

Mature cottonwood stands do not regenerate in place, but regenerate by "moving" up and down a river reach. Over time, a healthy riparian area supports all stages of cottonwood communities.

Periodic flooding events are needed for cottonwood seedlings to germinate and become established on newly-deposited, moist sand and gravel bars. This cottonwood community can grow into a mature riparian forest.

Ecosystem Sciences

Ecosystem Sciences | 202 N 9th Street, Suite 400 Boise, ID 83702 | Phone 208.383.0226 | Fax 208.368.0184 | ecosystemsciences.com

MEMORANDUM

TO: Rob Richardson, Rio ASE

FROM: Zach Hill, Ecosystem Sciences

DATE: October 3, 2022

SUBJECT: **Warm Springs Preserve**: Task 1: Touch Point #1
Vegetation Communities, Ecological Units, Mapping, and Transverse Sections

Ecosystem Sciences conducted site surveys of the Warm Springs Preserve on September 12th and 13th 2022, in coordination with Rio ASE and Superbloom. Field investigations included site inspection, data collection and site survey to map vegetation community types and prepare transverse section sketches of the site to inform transition areas and zonal concepts for design development. Vegetation community mapping, ecological units and site transects are provided in the memorandum to the design team for use in concept refinement.

Ecosystem Sciences worked with the team to define existing ecological units and design vision based on refined concept. The mapping included in this memorandum are GIS outputs and will be provided in requested format for final maps or drawings prepared by Superbloom.

Warm Springs Preserve Land Cover/Ecological Unit Descriptions

The proposed Warm Springs Preserve project intends to redevelop and restore the 65-acre parcel that lies adjacent to Warm Springs Creek in Ketchum, ID (Figure 1). An analysis of the existing land cover/ecological conditions within the project area is required as part of the design process. This narrative provides a description of the methods and classifications that were used to delineate the existing land cover types and ecological units that occur within the project area. Accompanying this description of the land cover/ecological unit classifications is a series of maps that show their respective spatial distributions within the project area. In addition, five cross-sectional illustrations were created to show the elevation/ecological condition profiles within different portions of the project area (Figures 5-9). In all, the map set includes nine figures, which are referenced below.

Landcover

In 2019, prior to the Warm Springs Preserve project, Ecosystem Sciences performed a land cover classification and tree canopy classification for the Wood River Valley (WRV) as part of a different project. The area that was mapped in 2019 includes the Warm Springs Preserve site, and the land cover/tree canopy data from the 2019 project were extracted for the Warm Springs Preserve project. Below is a description of the methods that were used to delineate land cover within the larger Wood River Valley area. Table 1 shows the resulting land cover classifications. Figure 2 and 3 in the map set show the spatial distribution of the land cover and tree canopy, respectively.

A series of steps using remotely sensed data were followed to determine the land cover/tree canopy classes that occur within the WRV (Ecosystem Sciences 2019). The remotely sensed data that were used included: 2019 high-resolution (4-band, one-meter) aerial imagery from the USDA's National Agricultural Imagery Program (NAIP); and 2015 Lidar data of the WRV (Quantum Spatial 2016). The methodology deployed to derive the land cover classes relied on image segmentation and object-oriented techniques. A file geodatabase was created to house the resulting spatial data.

Table 1. Land cover classes in the Wood River Valley that occur within the Warm Springs Preserve project area.

Land Cover Class	Description
Irrigated Vegetation	Irrigated or water-dependent non-canopy vegetation, generally less than 0.2m tall (7 inches) but may include vegetation up to 2m. In urban areas this cover class relates to lawn/parks/ball fields. In non-urban areas this cover class is water-dependent (riparian, within drainage areas, or related to seeps/springs, and active floodplain or low terrace with near groundwater influence).
Scrub/Shrub	Non-canopy vegetation dominated by scrub and shrub vegetation types (sagebrush, bitterbrush etc.). This cover class is naturally occurring in the uplands area and can be found within the urban areas as well.
Tree Canopy – Deciduous	Canopy vegetation that is primarily broadleaf deciduous. In urban areas this class can includes native and non-native hardwoods. In a natural setting this class includes cottonwood, alder, willow, maple etc.
Tree Canopy – Coniferous	Canopy vegetation that is primarily coniferous. In urban areas this class includes planted coniferous trees such as blue spruce (amongst other species). In a non-urban setting this class includes Douglas fir, lodgepole pine ponderosa pine etc.
Soil and Dry Vegetation	This cover class includes bare ground and soil that may or may not include dry vegetation. If vegetation is present within this class, it is generally less than 0.2m (7 inches). The vegetation within this cover class is typically a mix native and non-native, exotic annual herbaceous plants species.
Water	This cover class includes lakes, rivers, creek, canals and ponds. This class does not include swimming pools. This class represents water on the 2019 NAIP imagery on the date it was acquired.

Ecological Units

Prior to visiting the site on September 12, 2022, recent, high-resolution aerial imagery (i.e., 2021 NAIP) and Lidar-derived (Quantum Spatial 2017) one-foot topographic contours were utilized to generate a list of existing land cover units within the project area. A list of vegetation associations and their respective dominant plant species was also generated. During the two-day site visit, geolocated points with attached notes (i.e., land cover type, species composition, etc.) and site photos were collected along several transects throughout the project area. All data collected in the field were then used to create a final characterization of the ecological conditions within the project area.

The project area is generally composed of three distinct surfaces that are separated by relatively steep topographical breaks. The distinct surfaces from lowest to highest elevation relative to Warm Springs Creek can be characterized as: 1) the current active channel and its associated floodplain; 2) a present-day low terrace; and 3) a historical high terrace.

Within the upstream portion of the project area, the low and high terrace surfaces have become disconnected from surface and groundwater hydrology because of long-term, systemic, channel incision (i.e., downcutting). The two hydrologically isolated terraces at the upstream end of the project area are now mostly occupied by native and non-native upland vegetation, including grass lawn in irrigated areas and invasive weeds in non-irrigated areas. Within the downstream portion of the project area, the low terrace surface is more closely connected to the hydrology of the current active channel/floodplain. The upper most landform within the project area is the toe of the forested hillslope and has no historical connection to Warm Springs Creek.

The distinct floodplain/terrace surfaces within the project area informed a more detailed, ecologically focused delineation (i.e., ecological units). These ecological units are described in terms of their hydrological connection to the current active channel/floodplain and their dominant vegetation associations. The extent to which the various floodplain/terrace surfaces have been modified by human activity (i.e., land use) also plays a role in informing the description of each ecological unit. The project area is composed of 10 distinct ecological units, which are characterized in Table 2. The spatial distribution of the delineated ecological units is shown within Figure 4 of the accompanying map set.

Table 2. Ecological unit classes and descriptions.

Ecological Unit Class	Acres	Description
Riverine	5.19	This class is closely associated with the spatial extent of the Current Active Channel/Floodplain and is mostly composed of open lotic water and/or scoured substrate. Located at or below the Ordinary High-Water Mark (OHWM), occurrences of established riparian vegetation are uncommon.
Artificial Impoundment	0.10	This class represents open lentic water. Its occurrence is limited to an excavated impoundment that is situated between the current active channel/floodplain and the historic low terrace at the upstream end of the project area. A diversion structure provides surface water from Warm Springs Creek to the excavated impoundment, which is used to irrigate the managed grassy areas within the low and high terraces.
Riparian	6.69	This class occurs directly adjacent to the Current Active Channel/Floodplain and is sometimes within the Historic Low Terrace Floodplain. Although most of the project area contains a relatively narrow strip of riparian habitat, there are two distinct areas where the elevation adjacent to the Current Active Channel/Floodplain is minimal enough for wetland vegetation to access Warm Springs Creek's hydrology. Common species that occur within this class are: black cottonwood (Populus tricocarpa), narrowleaf cottonwood (Populus angustifolia), coyote willow (*Salix exigua*), peachleaf willow (*Salix amygdaloides*), Booth's willow (*Salix boothii*), Pacific willow (*Salix lasiandra*), bittercherry (*Prunus emarginata*), red-osier dogwood (Cornus stolonifera), and Wood's rose (Rosa woodsii), reed canarygrass (*Phalaris arundinacea*), and Canada goldenrod (*Solidago canadensis*),
Non-Native Dominated Xeric Shrub/Grass/Herbaceous	9.93	This class occurs almost exclusively within the flat surfaces of the upstream portion of the project area that are associated with the present-day low terrace, which is disconnected from the hydrology of Warm Springs Creek. The area within this class is highly disturbed due to human activity and consequently contains predominantly non-native annual herbaceous plant species (i.e., invasive/noxious weeds) mixed with some residual native upland shrub species. Common species that occur within this class are: big sagebrush (*Artemisia tridentata*), green rabbitbrush (*Chrysothamnus viscidiflorus*), yellow salsify (*Tragopogon dubius*), diffuse knapweed (*Centaurea diffusa*), spotted knapweed (*Centaurea maculosa*), and field bindweed (*Convolvulus arvensis*).
Irrigated Grass	12.56	This class occurs within both the low and high terrace surfaces. The area associated with this class is irrigated using a surface water diversion from Warm Springs Creek and is currently managed as open space.

Table 3, Continued. Ecological unit classes and descriptions.

Ecological Unit Class	Acres	Description
Aspen-Cottonwood Complex	0.48	This class mostly occurs as a narrow strip between the Douglas-fir dominated forest at the toe of the alpine slope and the present-day low terrace at the downstream end of the project area. The cottonwood and quaking aspen trees that grow in this class were predominantly recruited by way of high magnitude, infrequent flood events. Other instances of these deciduous patches are evident within the low and high terraces at the upstream end of the project area, but these trees are generally no longer able to access the local groundwater and have consequently died. Common species that occur within this class are: quaking aspen (*Populus tremuloides*) and black cottonwood (*Populus tricocarpa*).
Native Dominated Mesic Shrub/Grass/Herbaceous	9.57	This class occurs within the present-day low terrace at the downstream end of the project area. Relative to the upstream portion of the project area, the low terrace at the downstream end is characterized as having minimal disturbance from human activities. The elevation of the low terrace at the downstream end of the project area is also generally lower and more connected to the hydrology of Warm Springs Creek than portions of the low terrace further upstream. Within this class are instances of discarded construction materials (i.e., old fencing, irrigation pipe, and concrete). Irrigation ditches and small levees have been constructed in the past on this surface. Common species that occur within this class are: quaking aspen (Populus tremuloides), narrowleaf cottonwood (Populus angustifolia), black cottonwood (Populus tricocarpa), Canada goldenrod (*Solidago canadensis),* cow-parsnip (*Heracleum maximum*), Idaho fescue (*Festuca idahoensis*). Patches of non-native weeds—mostly Canada thistle (*Cirsium arvense*)—do occur within this class to a limited extent.
Douglas-Fir Dominated Forest	18.87	This class occurs along the narrow steep slopes that separate the low and high terraces, and within the steep alpine slopes within the project area. Common species that occur within this class are: Douglas-fir (*Pseudotsuga menziesii*), mountain maple (*Acer glabrum*), Oregon grape (*Mahonia aquifolium*), and mountain brome (*Bromus marginatus*).
Unpaved Pathway	0.77	This class is representative of the network of dirt/gravel pathways that intersect the project area to facilitate pedestrian traffic. Although mostly consisting of bare ground, the unpaved pathways do contain some non-native, weedy plant species.
Paved Roadway	0.49	This class is representative of the driveway road used to access the site and the associated parking area. No vegetation occurs within this class.

Warm Springs Preserve

Aerial Imagery (2021) and Transects

Figure 1

0 250 500 1,000
Feet

N

Ecosystem Sciences, LLC
Science Design Planning

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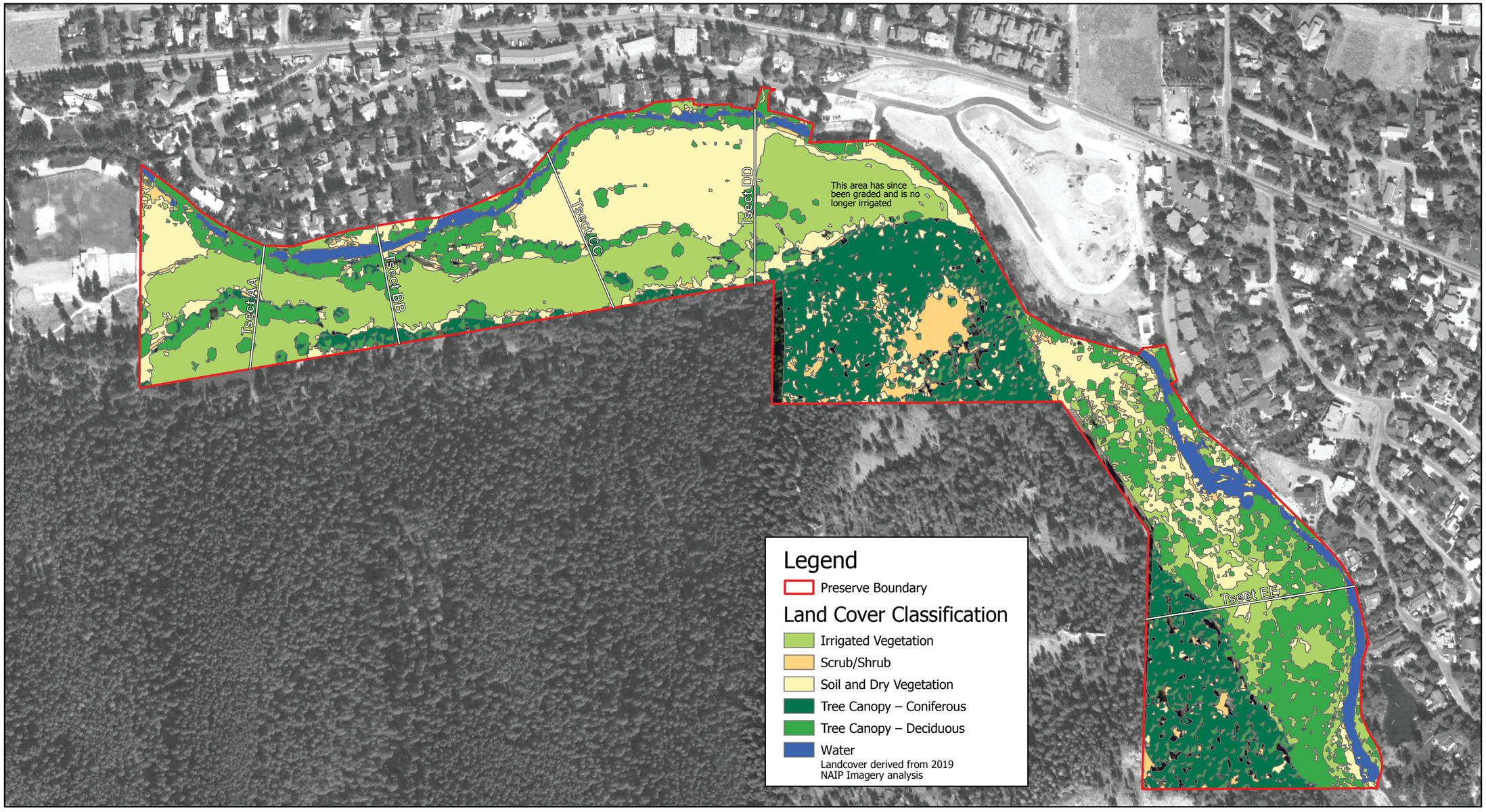

Warm Springs Preserve

Land Cover Classification

Figure 2

0 250 500 1,000
Feet

N

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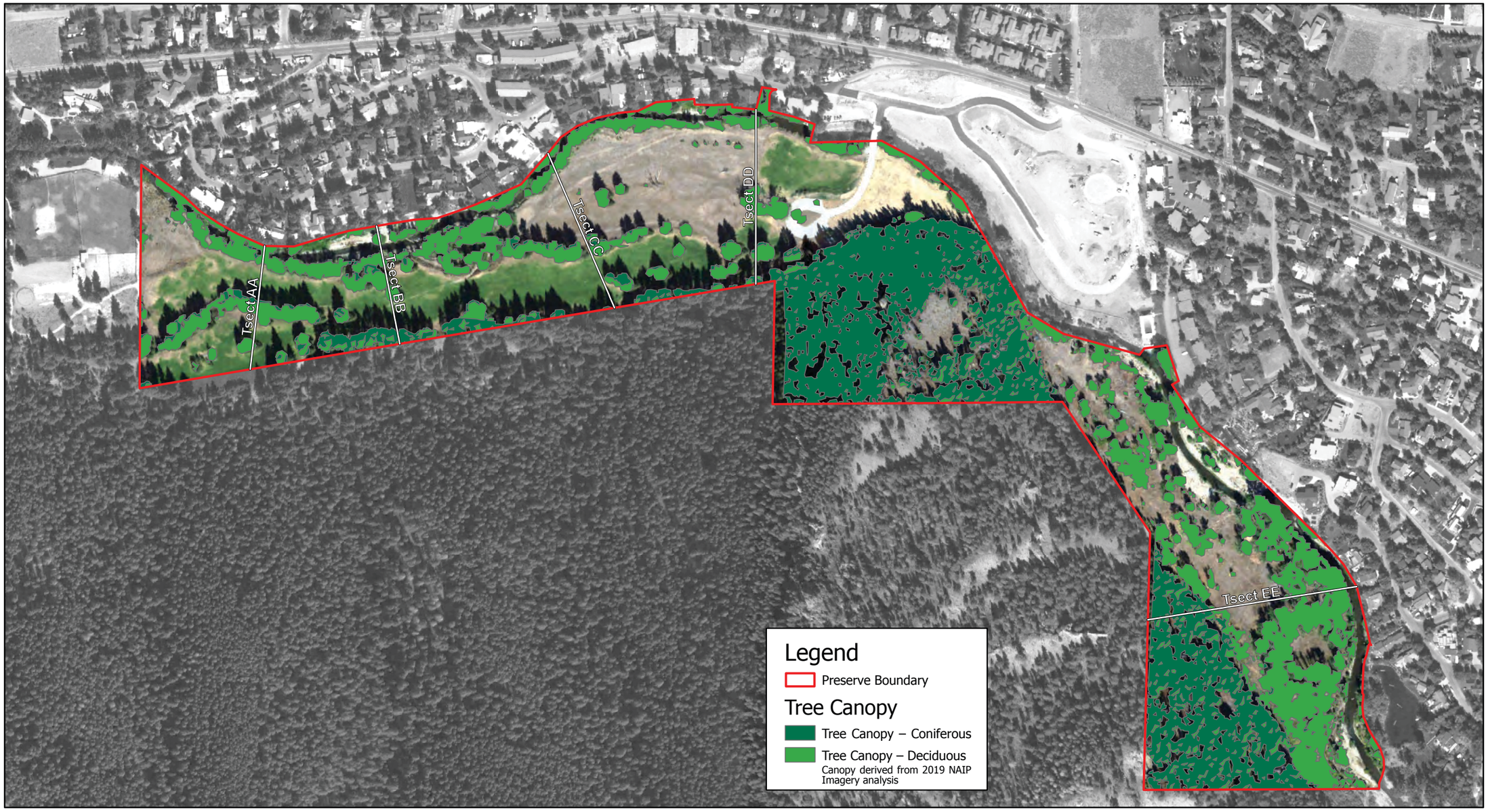

Warm Springs Preserve

Tree Canopy

Figure 3

0 250 500 1,000
Feet

N

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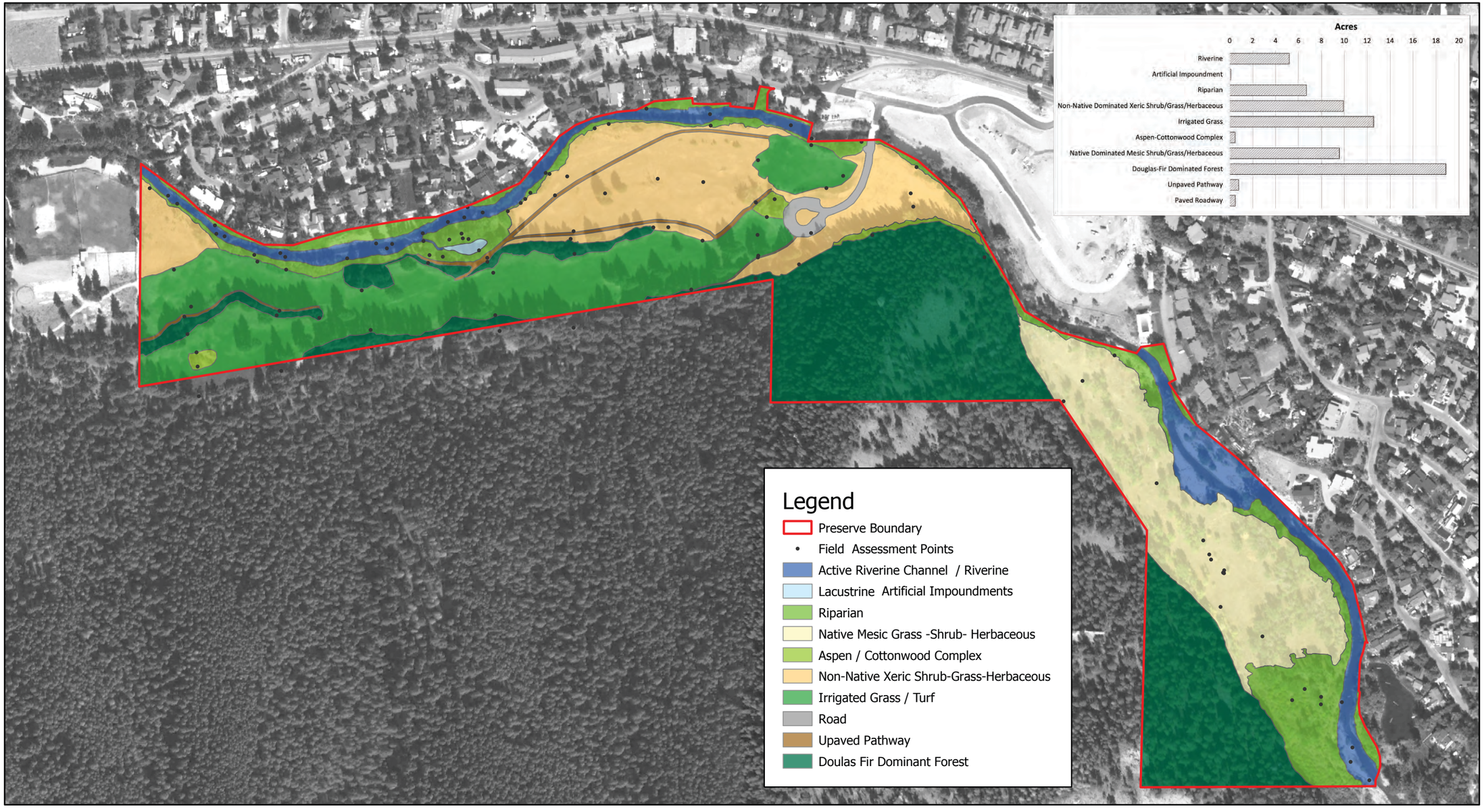

Warm Springs Preserve

Ecological Units

Figure 4

0 250 500 1,000
Feet

N

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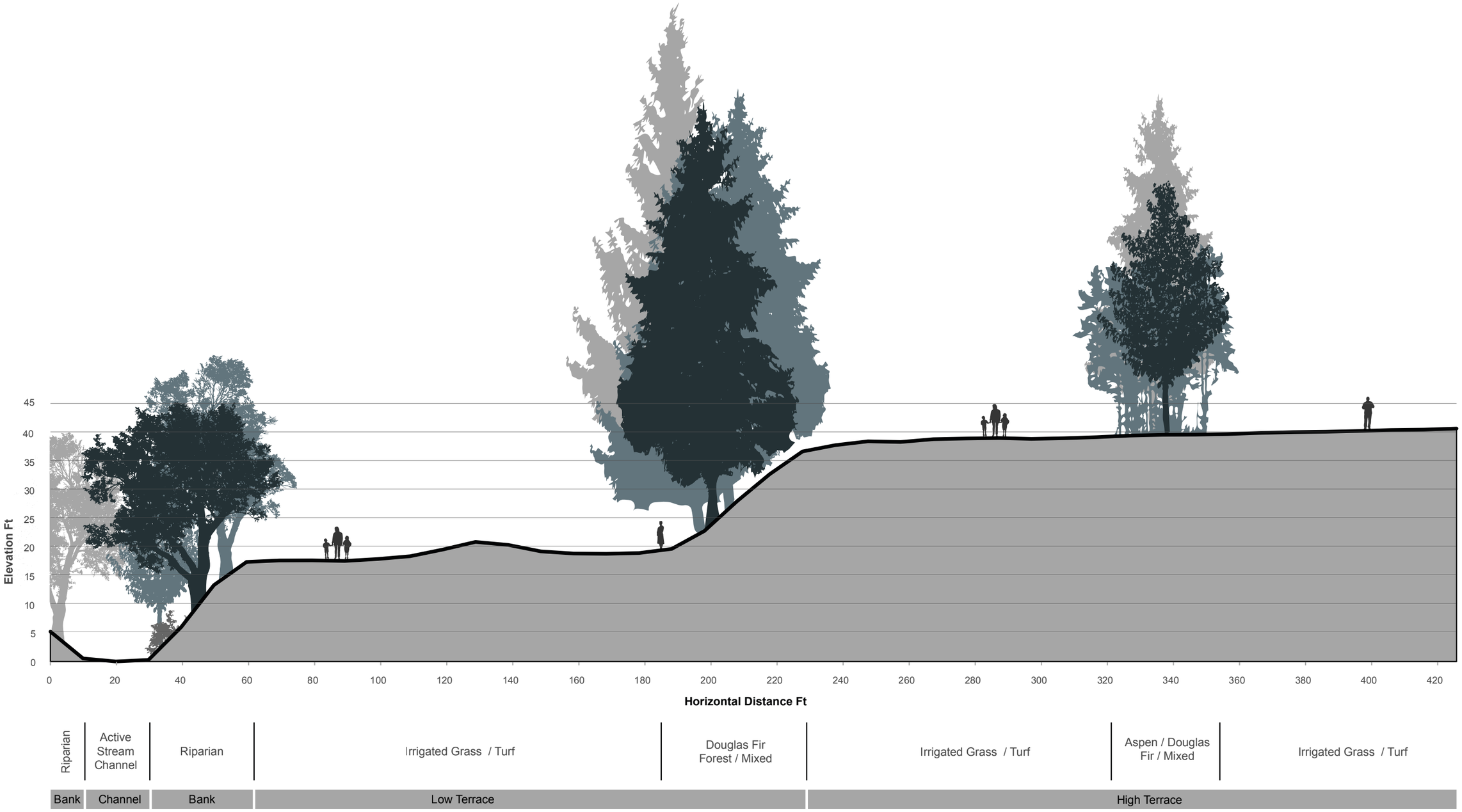
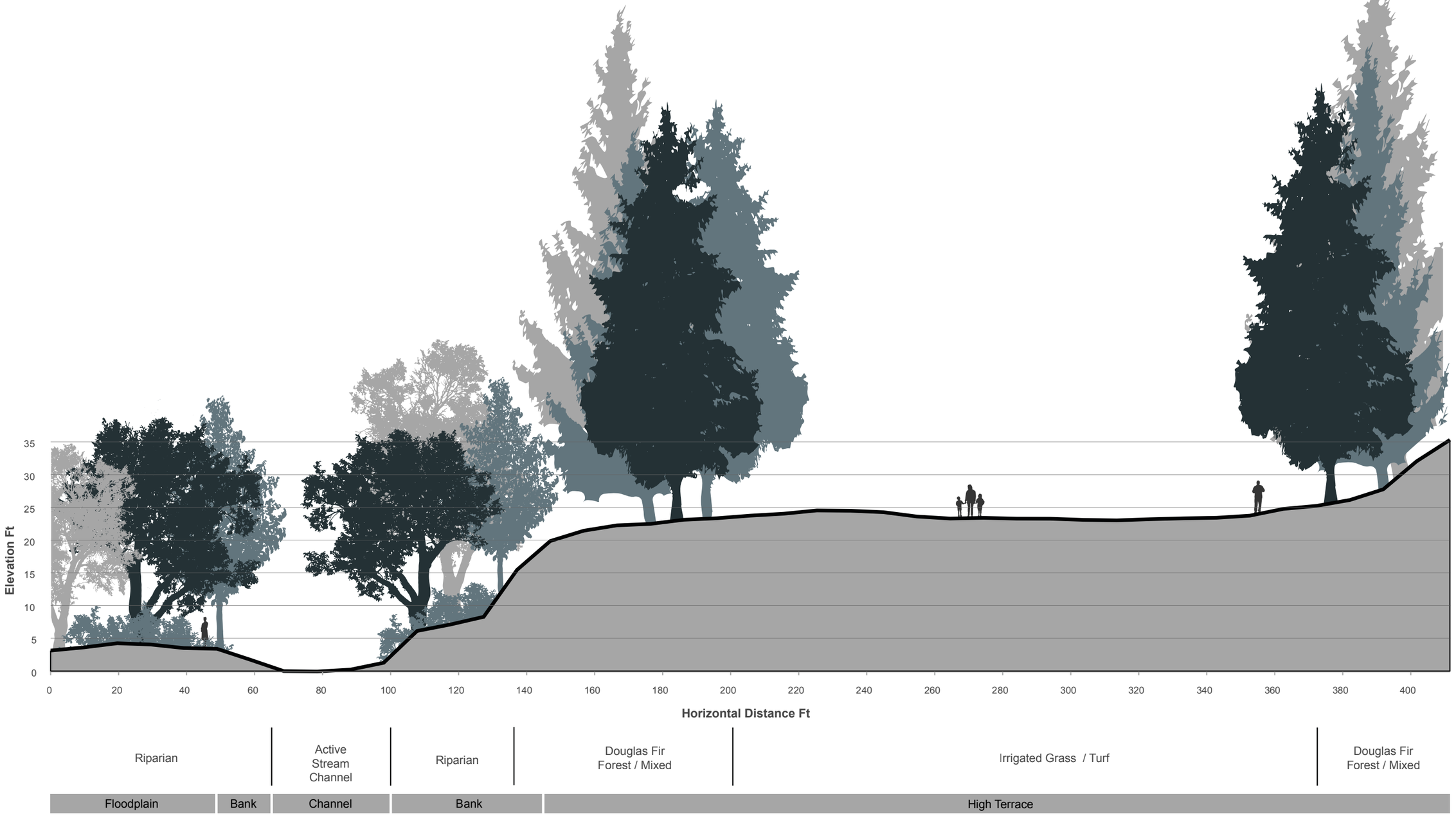


Transect A - A

Transect is a representation of site conditions and existing ecological zones.
Not a survey product

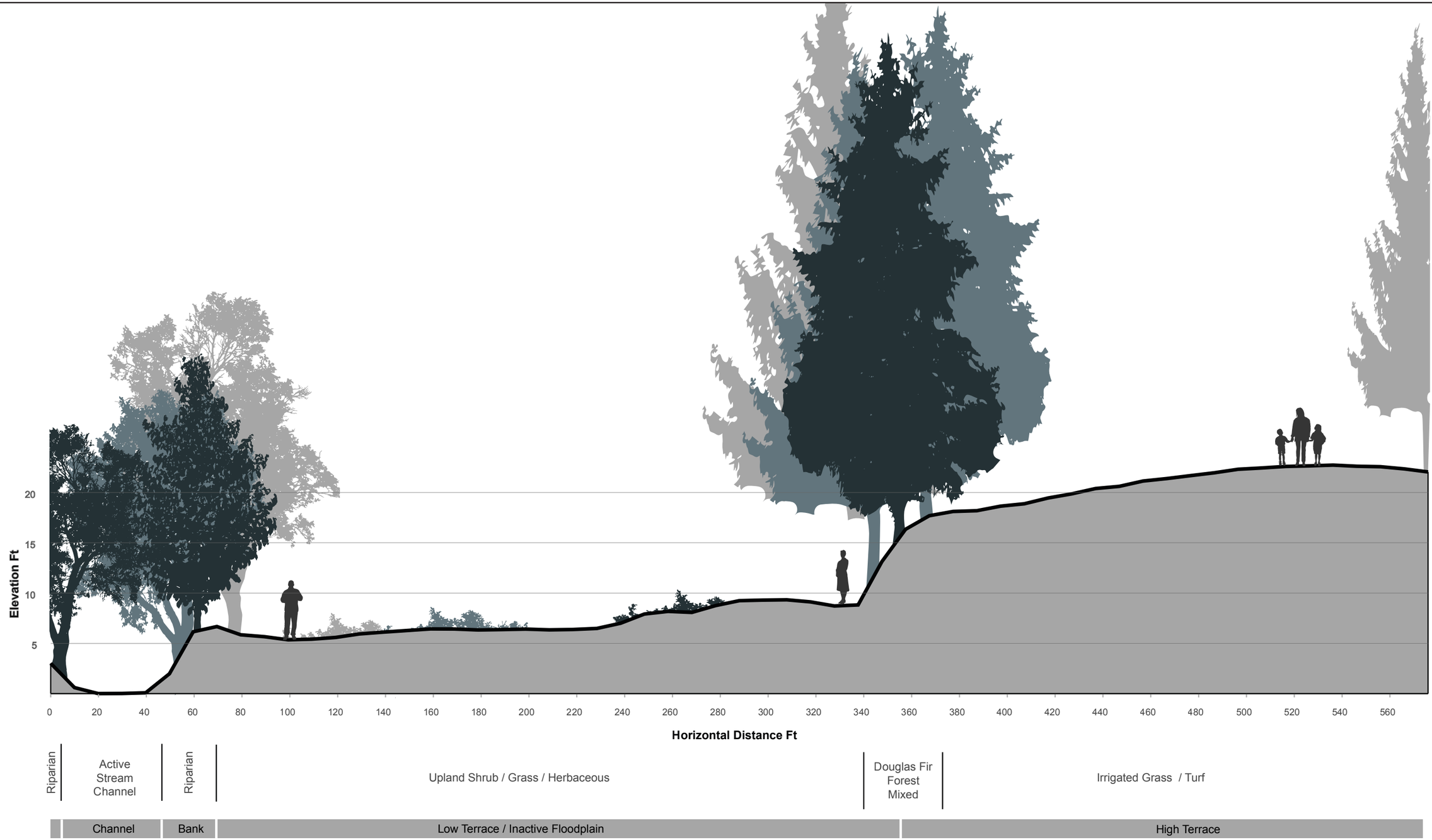
Figure 5



Transect B - B

Transect is a representation of site conditions and existing ecological zones.
Not a survey product

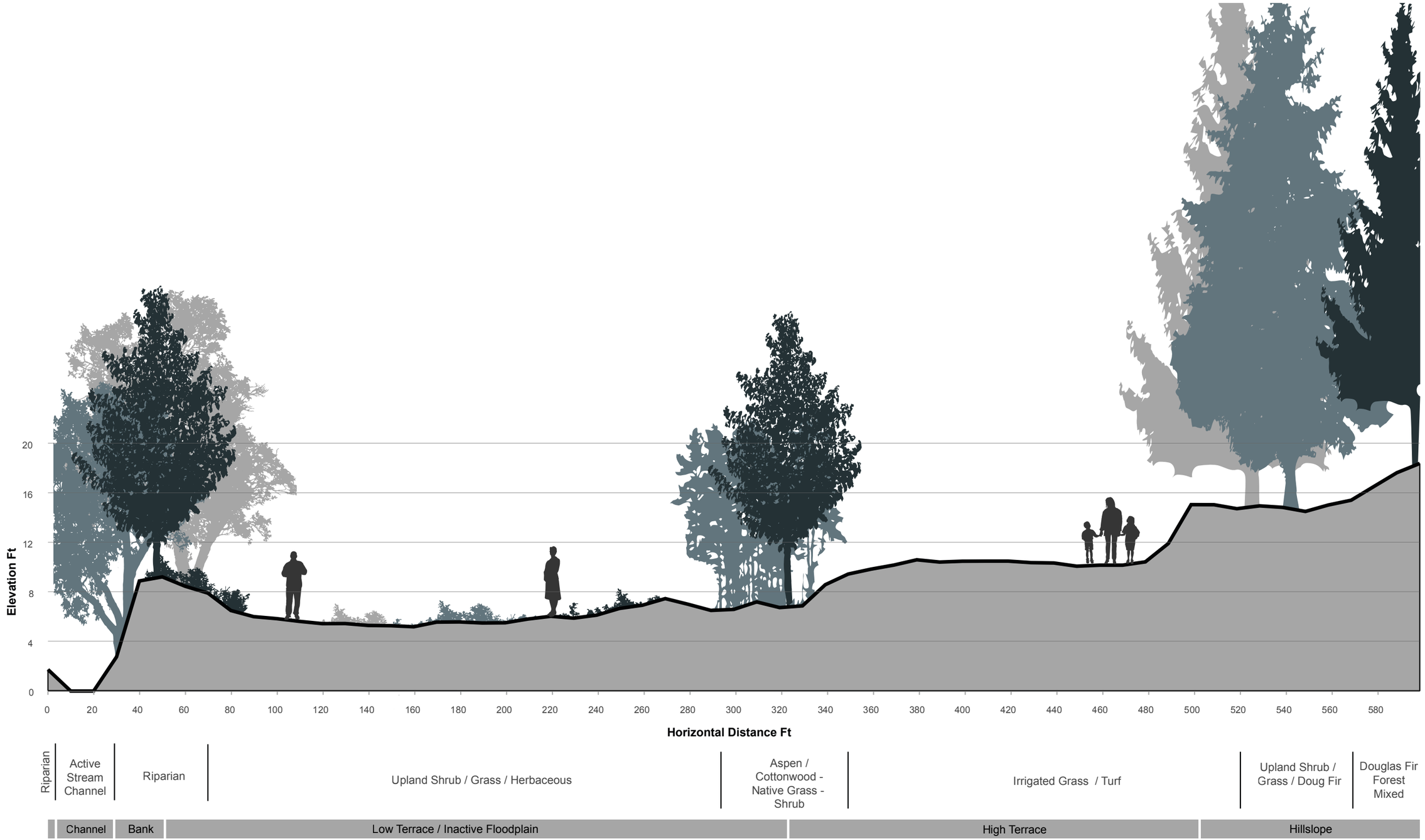
Figure 6



Transect C - C

Transect is a representation of site conditions and existing ecological zones.
Not a survey product

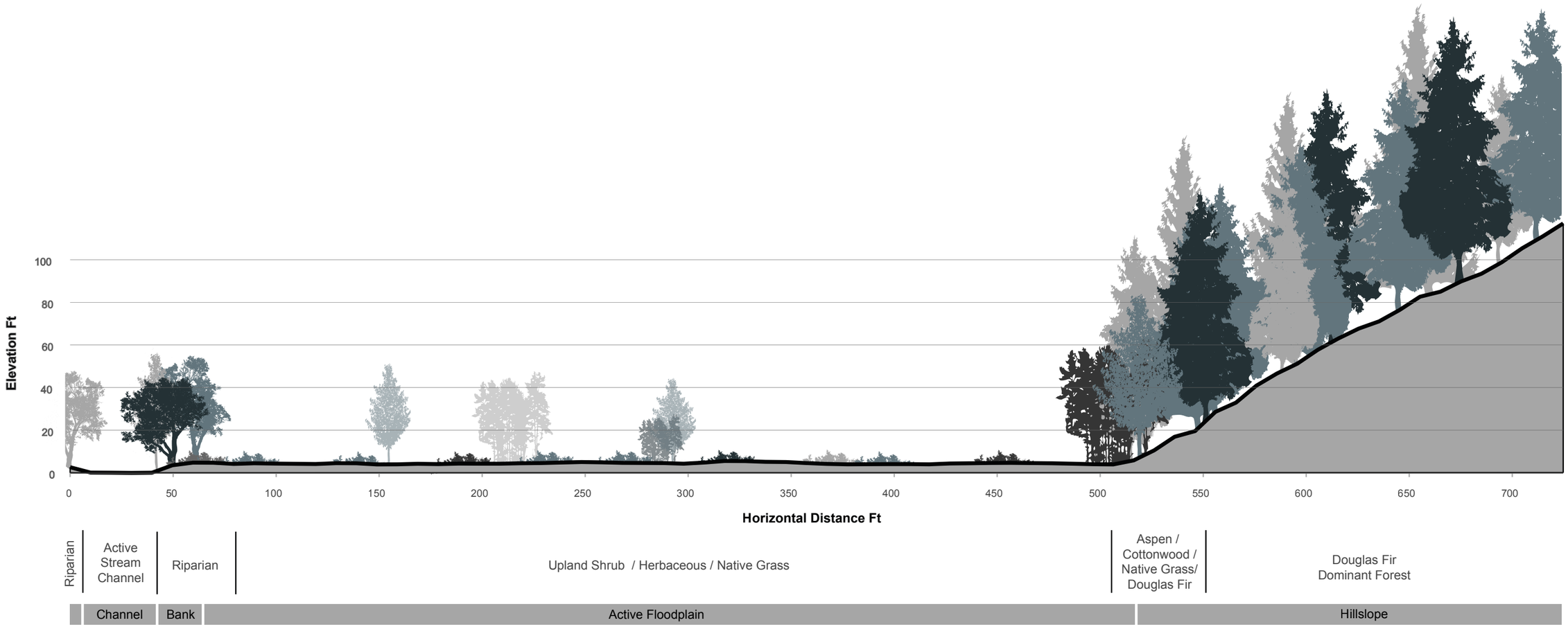
Figure 7



Transect D - D

Transect is a representation of site conditions and existing ecological zones.
Not a survey product

Figure 8



Transect E - E

Transect is a representation of site conditions and existing ecological zones.
Not a survey product

Figure 9

Ecosystem Sciences

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MEMORANDUM

TO: Rob Richardson, Rio ASE

FROM: Zach Hill, Ecosystem Sciences

DATE: February 7, 2023

SUBJECT: **Warm Springs Preserve Plan**

Narrative Guide for Natural Areas Character Zones, Plant Communities, Biogeography, Soils Planning, Invasive and Noxious Weed Abatement, and Construction Precautions

The vision for the Warm Spring Preserve is a renewed landscape for the well-known streamside park within the Wood River Valley. The expectation is that the designed landscape will not only be beautiful and functional, but also sustainable. For the Preserve landscape to perform as expected, it is important to specify a set of ecological conditions that are appropriate for the site. A key ecological consideration in the design includes a plant community plan for each of the natural area character zones, a soil plan, and a weed abatement plan. This memorandum describes some of the ecological considerations for each of these individual plans as a supplement to the design process as it moves toward implementation.

1. Natural Area Character Zones and Plant Communities Guide

A primary component of an ecologically based landscape palette is the native plant communities that are naturally found within an area. Non-native plants, which are introduced from other regions of the United States or parts of the world, are often opportunistic and displace native plant species. The native plants that have evolved within the Wood River Valley over the course of hundreds of thousands of years are adapted to the local soils and climate conditions.

Native plants offer aesthetic and ecological benefits for landscapes. They are crucial to restoring local ecosystems, increasing biodiversity, and providing ideal habitat for wildlife. Native wildlife species have evolved alongside the native plants in this region, using them as food, shelter, and a place to raise their young. They are the foundation of local food webs, giving insects, birds, and other wildlife what they need to survive. Through supporting local food webs, native plant species support local ecosystems more effectively than non-native plant species. From perennial wildflowers to berry-producing shrubs and trees, many native plants are beautiful and functional choices that provide the aesthetic benefits in addition to ecosystem function. Native plants are often hardier and more resistant to disease than their non-native counterparts. With more extensive root systems, native plants typically filter stormwater and greywater more effectively than non-native plants. And once established, native plants are low maintenance and require minimal irrigation.

The Warm Springs Preserve Master Plan includes natural riparian areas that are located in and along the stream edge and adjacent floodplain, a transitional meadow that is immediately upgradient from the riparian zone, and a more manicured lawn terrace that is located upgradient from the transitional meadow and just below the base of the steep mountain slopes. Along the stream, the most sensitive riparian areas are being restored to a natural condition, while the hardier uplands will retain a manicured park-like feel. This restoration and revegetation strategy will provide a gradient from a more natural space near the creek to a more manicured space within the upland terraces at the base of the mountain slopes. The character zones associated with these areas are described in greater detail below.

1.1 Stream Channel and Near Stream Edge Character Zone

Riparian zones are the areas bordering the stream channel and provide many environmental and recreational benefits.

- ***In-Stream Aquatic Vegetation:*** This class is closely associated with the spatial extent of the current active stream channel and is mostly composed of open water and/or scoured substrate. Located at or below the Ordinary High-Water Mark (OHWM) of the stream, occurrences of established riparian vegetation are uncommon. However, in low velocity areas of the stream and in the proposed wetland, emergent aquatic vegetation may include common cattail, bulrush, water sedge, and Baltic rush.
- ***Near-Stream Riparian:*** This class occurs directly adjacent to the active stream channel, proposed side channels, and low-lying portions of the restored floodplain that has access to Warm Springs Creek's hydrology. Currently, only a narrow strip of riparian habitat is present. The restoration strategy envisions a restored and enhanced riparian zone. Common species that occur within this class are: black cottonwood, narrowleaf cottonwood, coyote willow, peachleaf willow, Booth's willow, Pacific willow, bittercherry, red-osier dogwood, Wood's rose, Canada goldenrod, Baltic rush, larkspur, desert phlox.

1.2 Floodplain Character Zone

Floodplains store water and sediment and dissipate flood energy. Large portions of the existing floodplain were historically filled in to create a golf course. Currently, most of the streamflow that is associated with a 100-year flood event would be contained within the main channel throughout the site. The main channel is consequently incised, increasing the potential for high velocity streamflows and associated erosion. Excavating a new floodplain will reduce the erosive force of the creek and lower the risk of flood damage to homes that lie directly adjacent to the creek. The restored floodplain will include side channels, a pond, and a wetland, all surrounded by native riparian vegetation. The restored off-channel habitat will provide an opportunity for aquatic and terrestrial species to inhabit the area. The floodplains are composed of two distinct character zones: mesic (wet) and xeric (dry).

- ***Mesic (wet):***
    - Mesic is a term used to describe the amount of water in a habitat. A mesic habitat is a type of habitat that has access to a moderate or well-balanced supply of moisture. The elevation of the mesic floodplain area is generally lower and more connected to the hydrology of Warm Springs Creek than portions of the xeric floodplain. Mesic habitats transition to xeric in a non-linear fashion and depend on proximity to a water source.
    - Mesic habitats effectively provide drought insurance as land at higher elevations dries out due to seasonal or other changes. Healthy mesic habitats function like a sponge; they effectively store water, which can be utilized by neighboring, drier habitats. Healthy mesic habitats also provide a higher density of herbaceous plants and insects that can be used as cover and forage by organisms belonging to higher trophic levels, such as grouse.

  - Common species that occur within this class are: quaking aspen, narrowleaf cottonwood, black cottonwood, Canada goldenrod, cow-parsnip, Idaho fescue, Baltic rush, larkspur, desert phlox, Ute ladies' tresses.
- ***Xeric (dry):***
  - The term xeric describes a habitat that contains little moisture. This class occurs almost exclusively within the flat surfaces of the project area that are at a higher elevation than the mesic floodplain area. The surfaces that are inhabited by xeric species are disconnected from the hydrology of Warm Springs Creek. The xeric floodplain character zone is a mixed plant community, consisting of some native upland shrub species, wildflowers, grasses.
  - Common species that occur within this class are: big sagebrush, Western yarrow, Western columbine, arrowleaf balsamroot, wild aster, blue camas, buckwheat, wild blue flax, penstemon, prairie clover, goldenrod, Indian ricegrass, blue grama, Idaho fescue, bluebunch wheatgrass, Great Basin wildrye, fern bush, red-osier dogwood, shrubby cinquefoil, syringa, and localized areas of Douglas fir, ponderosa pine are possible.
- ***Side Channels:*** This class is closely associated with the spatial extent of the planned, reconnected floodplain and is mostly composed of red-osier dogwood, Wood's rose, Canada goldenrod, common cattail, bulrush, water sedge, baltic rush, larkspur, desert phlox, Ute ladies' tresses.

2 Biogeography and Plant Selection

An area that is dominated by a single opportunistic species is considered a monoculture. Natural ecological conditions rarely contain monocultures, rather, they contain a diverse mix of individual plant species that interact with one another and the surrounding environment. The arrangement of such a polyculture population in space is the product of all those interactions. An appropriately diverse vegetation design — in terms of genetics, sizes, and ages—is more likely to be successful and self-sustaining. Furthermore, plants that are matched to their surrounding environmental conditions (i.e., soil and climate) are more likely to be healthy and grow with minimal intervention. Selecting plants according to biogeographical principles can help create designed landscapes that will thrive and sustain themselves. The following set of principles should be considered when selecting plants for the site:

- **Choose plants that are adapted to the local environment.** Identify plants appropriate for the conditions within the site. Plants that are ill-suited to the temperature extremes of the site are unlikely to survive their first year in the ground. Native plants are not only adapted to climate extremes on an anatomical and physiological level, but also through their phenology (i.e., the timing of life stage events such as flowering, setting seed, leafing out, and senescence).
- **Create environmental differences at small scales to create microclimates.** An individual plant grows in a particular biome and under a particular climatic regime; however, what matters to its immediate survival are the conditions within its nearest environment. Small-scale variations in environmental conditions create microclimates. Every place within a landscape experiences a variety of environmental conditions—a mosaic of microclimates. The results are often complex, showing the interplay of numerous factors, and demonstrating a clear link between microclimate and vegetation. Factors such as canopy openness, soil conditions, moisture levels, and aspect create important differences in ecotone transitions, especially by affecting the amount of sun and wind exposure.
- **Match plants to microclimates.** Factors such as relative humidity, air temperature, soil moisture, available sunlight, and exposure to wind are all important factors for a plant's well-being, even when that plant is sufficiently cold hardy or heat tolerant and adapted to the natural precipitation of a region. The Preserve site has many inherent microclimates that change dramatically through each season. In particular, north-aspect slopes with cooler and more moist conditions support Douglas fir communities, and surface depressions that locally retain moisture often support aspen communities.

- **Develop planting patterns in concert with ecological processes.** Plants are managed as populations, and their spatial patterns reflect the ecological processes that form them. The populations of the various plant species reflect the environmental array within the site. The near riparian and floodplain zone, the transitional meadow, and the terraced lawn each create a range of conditions from wetter, richer areas to drier, less fertile conditions. The combination of all these factors can result in a diverse community in which clear bands and masses of plant populations are discernible.
- **Distribute plants with respect to spatial structure.** For the designs to function as ecological landscapes, it is important to look beyond the sculptural and visual qualities of plants to the ways in which they grow together. The design can set up self-perpetuating groups of plants that respond to the site, to each other, and to changes that take place over time. To accomplish this, the factors that drive the locations, sizes, genetics, numbers, and proportions of different plants must be considered closely and the plant groupings understood as populations and communities. Planting more shade-tolerant shrubs with larger trees (such as cottonwoods and aspen) recognizing that as the trees grow, the shrubs will need to be tolerant of the shady conditions beneath the tree canopy.
- **Populations should include individuals of different sizes and ages:** Ecological landscapes should aim to develop populations with varied size and age structures for greater resilience and broader ecological function. A varied size structure, which is an expression of genetic diversity in the environment, and a varied age structure promote the resilience of that population in the face of insect pests and disturbance. Variation in sizes also stabilizes ecological functioning and creates the complex habitat on which many other ecological interactions are based.
  - Creating populations with varied size and age structures is most easily done through long-term stewardship of a site. When installing new landscapes, it is possible to jumpstart the process by planting individual plants of the same species at different sizes.
  - Natural plant populations contain individual plants of different sizes. Size is important in the plant kingdom. Because larger plants claim the resources of a larger area and tend to be more successful reproductively, the individual plants that can grow larger influences the evolutionary direction of a plant population. Larger plants can better survive some disturbances, such as fire, but are less able to survive others, such as windstorms. A diverse size structure presents a diverse defensive front to pathogens, herbivores, and natural events or disasters.
- **Species richness increases with area.** Ecologists use the term species richness to describe the number of species found in a particular area. As a rule, the larger an area, the more species it should contain. The species richness of a community is governed not simply by its area but by the overall richness of the region, the number of different habitats, and the frequency of disturbance. The site conditions currently contain many weeds and a low species richness. The Preserve Master Plan proposes increasing species richness and mix of plant community types.
  - In more expansive landscapes, species richness increases more rapidly with area as different habitat types are included. Knowing that this is a driving mechanism, if we want to increase diversity, we can intentionally increase the diversity of microhabitats. If a larger site is similar across its length and breadth, we may either keep species richness lower or create mosaic of areas of different communities.
  - The design should consider, together with the Preserve goals, the size and location of the site and the productivity of the soils to create a plant community with the appropriate species richness. In general, the larger the site, the greater the diversity of habitats.
- **Include large populations of a few species and small populations of others**. Determining relative abundance in designed plant communities is important for both aesthetic and ecological reasons. The plants that are most abundant determine the character and color of an entire zone. The plants that are less abundant serve as accents or, if poorly placed, are hardly noticeable. The repetition and massing of each of these constituents is the designer's traditional art. Findings from classic ecological studies suggest that there is a natural curve of relative abundance, with a few plants making up most of a

community and many others making up the rest. The final design should adapt a balance of aesthetics, ecology, and practicality for landscape and restoration planning.

- **Integrate habitat for pollinators**. Pollinators help over 90 percent of the world's flowering plants create fruits and seeds. Without them, plant communities worldwide would collapse. Some common types of pollinator plants in the area include milkweed, common sunflower, and goldenrod. Most think of honeybees when they think of pollinators, but there are many different types of pollinators, including ants, bats, native bees, beetles, birds, butterflies, flies, moths, and wasps.
- **Create seasonal interest by showcasing plant adaptations to climate.** Create year-round interest in the landscape and recognize the adaptations behind a plant's seasonal displays. This is done through matching plants to the changing environmental conditions of the site throughout the year, which ensures the maximum seasonal effect and reduces the inputs and effort needed to maintain plants that are out of sync with the cycles of the environment.
- **Design plantings for screening views.** In some areas it is recommended for plantings to provide a natural screening of neighboring private property for privacy from more public landscapes on the Preserve.
- **Design and specify plantings for fire resilience.** Healthy, mesic floodplains are naturally resistant to fire and can buffer adjacent areas from wildfire. Consider a mix of plantings in the mesic zones that can add fire resilience to the Preserve.

3 Soil Planning

To increase ecological interaction with the floodplain, the Preserve plan envisions extensive grading will be required throughout the site. Grading and removal of topsoil will significantly change the existing soil conditions. The current conditions of the Preserve site lack topsoil in many areas. Also, there are many areas of thin topsoil associated with past land-use. Much of the topsoil present on site is full of seeds from non-native weeds and invasive plants making it difficult or costly to preserve topsoil in some areas. A soil plan will need to carefully consider how soil is placed or replaced on site and amended prior to planting. Successfully designing soils for a project first requires a full understanding of the limitations of the site's existing soils and the complexities in designing and implementing an appropriate solution. In addition, the design may require different solutions for various areas of the site due to soil conditions and proposed design elements.

3.1 Prepare a Soils Plan

The Preserve plan will require a variety of soil treatments throughout different locations within the site. These treatments include amending existing soils with imported organic matter and nutrients, and/or bringing in manufactured soils. A complete construction documents package should include soil plans and details showing the location of soils across the site and the depth, texture, and composition of the various soil layers.

Each of the soil areas should be described in detail and explain what soil amendment is required to provide the prescribed planting conditions. A cross section and details of each area should be shown on the plans. All areas within the site that are not to be disturbed (e.g., for the protection of existing trees) will need to be shown in bold on the plans. The method of protecting these areas should be specified and limitations to work in these areas should be clearly stated on the plans. Each soil type, soil layer, and drainage layer should be described in detail in the specifications.

The natural areas of the Preserve have specific soil design considerations. Floodplains naturally have thin soils and most riparian trees and plants (i.e. cottonwood, willows, etc.) are adapted to growing in these types of environments. Cottonwood seeds require recent disturbance of the soils, which is typical in riparian area and connected floodplains.

In the soils specifications it is important to discuss the following points in detail:

1) Classify existing soils
2) Identify soil needs for proposed planting zones
3) Develop soil specifications for each zone
4) Identify potential soil amendments per zone
5) Water / Irrigation - specify needs (temporary or long-term irrigation)
6) Soil physical amendments for restoration
    - Reference soil profiles
    - Tillage performance standards
    - Excavation of unsuitable soil material
    - Filling with suitable soil material
7) Soil organic amendments (organic composting, etc.)
8) Installation requirements for imported soils
9) Execution of work and field quality control / inspections

3.3 Discussion

A stepwise process should be conducted for the soils planning. The following discussion points are a guide for the important tasks of evaluating, amending, placing the soil on site and irrigating to maximize planting success and longevity.

Evaluate existing soils and soil amendment or import locations

It is important to determine what kind of soil is needed in specific locations for the project. To determine if amendments or import of soil is needed the existing soil conditions need to be evaluated. Soils have physical, environmental, and chemical properties. These are all important to the health of a growing medium. Physical properties include organic matter, water, drainage, and aeration. Environmental characteristics include light and temperature. Chemical elements include the pH balance, and the presence (or not) of phosphorous, nitrogen, and potassium, which are all critical elements for plants.

Many native plants and wildflowers require well-drained soil. The soils present on the Warm Springs Preserve have formed into porous glacial outwash and river alluvium. Soil profiles from test pits suggest this material may, in some instances, provide suitable base material for well-drained topsoil.

The evaluation of the existing soils and landscape planting design will indicate if and where amendment to the soil may be needed. There are at least four factors to consider in selecting a soil amendment:

- how long the amendment will last in the soil
- soil texture
- soil salinity and plant sensitivities to salts
- salt content and pH of the amendment.

Laboratory tests can determine the salt content, pH and organic matter of organic amendments. The quality of bulk organic amendments for large-scale landscape uses can then be determined.

Develop soil specifications for different zones

Properly prepared soil helps conserve water because it absorbs and holds water more efficiently, while also providing sufficient drainage qualities. Healthy soils support healthy plants that can better resist pests and diseases. Soil structure (how soil particles are held together to form larger structures within the soil) is recognized as an important property of a healthy soil. Structure makes significant contributions to improving root, air, and water movement through the soil. Grading, tilling, soil compaction and screening soils during the soil mixing process often damages structure. Although included in most soil specifications, soil screening can be extremely damaging to structure. Recent research suggests that elimination of the screening and tilling

processes, in favor of mixing techniques or soil fracturing that preserve clumps of residual soil structure, may improve landscape soils. Depending on localized site soil conditions, a modified approach to soil management should be considered.

Profile rebuilding is a process by which four inches of compost is added to the soil. A backhoe then fractures the subsoil to a depth of 2 feet by digging and dropping the soil allowing the compost to fall into the spaces between the loosened subsoil. Profile rebuilding generally performs best to increase potential tree growth, at times even exceeding the growth rates of the undisturbed soil. This technique would be best employed in the middle terrace zones of the Preserve; it would not likely be needed in the floodplain or lawn areas of the Preserve as currently planned.

Update the grading plan to include appropriate scarification
Grading activities that strip topsoil frequently destroy the macro-porosity of the new surface. Thick layers of fill will also need to be at least minimally compacted for geotechnical stability. All finished grading surfaces should therefore address compaction by scarifying (i.e., loosening) the surface soil to a depth of at least 12-inches prior to planting, where necessary. Scarification can be achieved using various mechanical means, including shallow excavation and subsequent soil placement or via mechanical rippers.

Too often native soil is imported and placed over unamended subsoil, which has been compacted during construction. This can create several serious problems. First, the plants cannot root down into the subsoil due to its density. Second, the compacted subsoil can cause a perched water table to occur above the subsoil and cause excessive wetness in the imported soil material. The compacted subsoil can also result in excessively dry surface soils during summer months as plants cannot root down to sufficient soil moisture. The solution is to physically amend the subgrade material immediately before placement of the imported soil if soil permeability has been compromised by compaction.

Place soil and mix in amendments
After the grading and construction have been completed on the site, most soils will need physical amendment to reduce the compaction caused by construction activities. This includes scarification as discussed above, but also other amendments should be considered. A soil amendment is any material added to a soil to improve its physical properties, such as water retention, permeability, water infiltration, drainage, aeration and structure. The goal is to provide a better environment for roots. Native topsoil is very effective at infiltration and storage of rainstorm events; however, minor compaction can destroy much of the macro-porosity.

Amending a soil is not the same thing as mulching, although many mulches also are used as amendments. A mulch is left on the soil surface. Its purpose is to reduce evaporation and runoff, inhibit weed growth, and create an attractive appearance. Mulches also moderate soil temperature. Organic mulches may be incorporated into the soil as amendments after they have decomposed to the point that they no longer serve their purpose.

Native topsoil is very effective at infiltration and storage of rainstorm events; however, minor compaction can destroy much of the macro-porosity. Native soils can be imported to provide a surface soil layer conducive to plant growth when the existing site soils cannot be adequately amended or restored. The soil specification should include, at a minimum, the amendments to the existing site soil, a detailed description of the soil to be imported, soil testing requirements, approval and placement of the soil material, and inspection and testing of the installed soil materials after placement. Sometimes it is important to inspect the native soil material site, collect representative samples, and approve the soil material prior to excavation and import.

When plants are truly well selected for a site, no soil amendment should be needed. However, where original topsoil is removed, soil amendments can help. Also, imported soil may be combined with native soil, changing how well it is suited to native plants. It is worth noting though that imported soils that are prepared and

available commercially are often too rich in organic matter for native plants. When possible, it is important to specify a soil mix that contains minimal manure and organic matter to simulate as best as possible the native soil conditions.

Planting at the appropriate time
Planting should occur in the spring or fall for several reasons. Spring planting helps to avoid the extreme heat of summer and allow the planting an opportunity to grow. Fall planting gives plants a jump-start on the growing season, which results in more robust plant growth. When possible, prepare soil two to three months before planting so the soil can settle.

Soils, Plantings and Irrigation
Irrigation of newly planted areas is critical to the success of the landscape. The initial few years after planting are critical for roots to take hold and for the plants to have success in establishment. The floodplain zones of the project should irrigate temporarily for the first 2-3 years after planting. The upgradient improved area, including the middle terrace, transitional meadow and lawns, should have permanent irrigation installed.

4 Construction Precautions

It is recommended that Best Management Practices (BMP) be incorporated into the construction plan. BMPs include but are not limited to:

- Noxious weeds observed near or adjacent to construction areas should be treated with herbicides or physically removed to prevent further establishment and spread.
- Periodic surveys should take place during the construction period to identify and treat noxious weed infestations.
- Areas of topsoil salvage should be monitored and aggressively treated with approved herbicides to prevent the establishment or spread of invasive and noxious weed species.
- Disturbed areas should be rehabilitated after the completion of construction activities. In areas with high erosion potential, hydroseed and mulch with tackifiers can be used to reduce erosion impacts.
- Certified weed-free mulch should be used in restoration, and certified weed-free straw bales will be used in sediment barriers.

Disturbing the soil can create more problems than it solves because weed seeds, roots and rhizomes lay dormant underground, ready to sprout after tilling. If a site location has some weeds but the preference is not to till or hand-weed, the weeds can be killed by watering them and covering them with clear plastic for several months—a process known as solarization. This process works best in full sun and often creates temperatures high enough to kill the bank of weed seeds if done for a long enough period. Be sure to use clear plastic, as black plastic only causes the unwanted plants to go dormant, ready to spring back to life.

If tilling needs to be done, be sure to go no deeper than one to two inches to prevent the surfacing and germination of weed seeds and apply two or more applications of a nonresidual, post-emergent herbicide to remove existing vegetation. Before application of the herbicide, water the site for a week or two to promote weed germination. Let the seedlings grow one or two weeks and then apply the herbicide. Repeat this process once more to ensure a clean seed bed. Be sure to handle all herbicides with caution, read labels carefully and, if you are near surface water, choose an appropriate one. Wildflowers and native grass seeds can be planted as soon as the competing vegetation is under control.

If a particular location has persistent weeds, it may need a year or more to kill them all, although total eradication may not be practical if the site is extremely degraded or very large. In this case, it may require a modified solarization process where an herbicide is used in place of watering and then cover with clear plastic.

Eliminating weeds as much as possible before planting is easier and less expensive than trying to control them in a newly planted site.

5 Invasive and Noxious Weed Abatement Plan

Invasive and noxious weeds are currently and will continue to be an ongoing issue for the Warm Springs Preserve site due to current established infestations, initial construction ground disturbance, as well as increased recreation use levels. Reducing the establishment of noxious weeds during and immediately after construction is critical. The following actions will help to alleviate establishment:

- Consider treating existing weeds prior to earthwork to limit unintentional spread.
- Consider burying topsoil with weed seedbed under fill-zones rather than reusing these as topsoil.
- Place topsoil, mulch, hydroseed, etc., as soon as possible after earthwork.
- Assuming summer to fall earthwork actions, treat any weeds prior to planting native vegetation during the dormant season (later fall, winter, or early spring).
- Aggressively manage weeds in the first years after construction to prevent wide-spread infestation.
- Irrigate and possibly fence native vegetation as needed to ensure its establishment. The health and maturing of native vegetation can outcompete weeds.

Long-term invasive and noxious weed management objectives for the Preserve should include, but are not limited to:

- Controlling the current spread of noxious and undesirable weeds at the Preserve though mapping existing locations and keeping a record of the species that are present.
- Preventing new infestations through monitoring the effectiveness of control measures and adapting new management strategies and control measures as necessary.
- Meeting state and federal safety guidelines for the use of prescribed burning and chemical application.
- Coordinating with Blaine County, state, and federal weed supervisors on weed control, approved herbicides, and weed mapping.
- Working with residents and the public to educate them on invasive and noxious weeds, and the ecological, social, and economic impacts that they have on the surrounding landscape.

The control and management of invasive and noxious weed species is an essential component of open space and habitat management. A weeds management plan should be adaptive to existing conditions and change over time based on the goals associated with the plan. Some of the tools that have been identified for controlling invasive and noxious weeds include, but are not limited to:

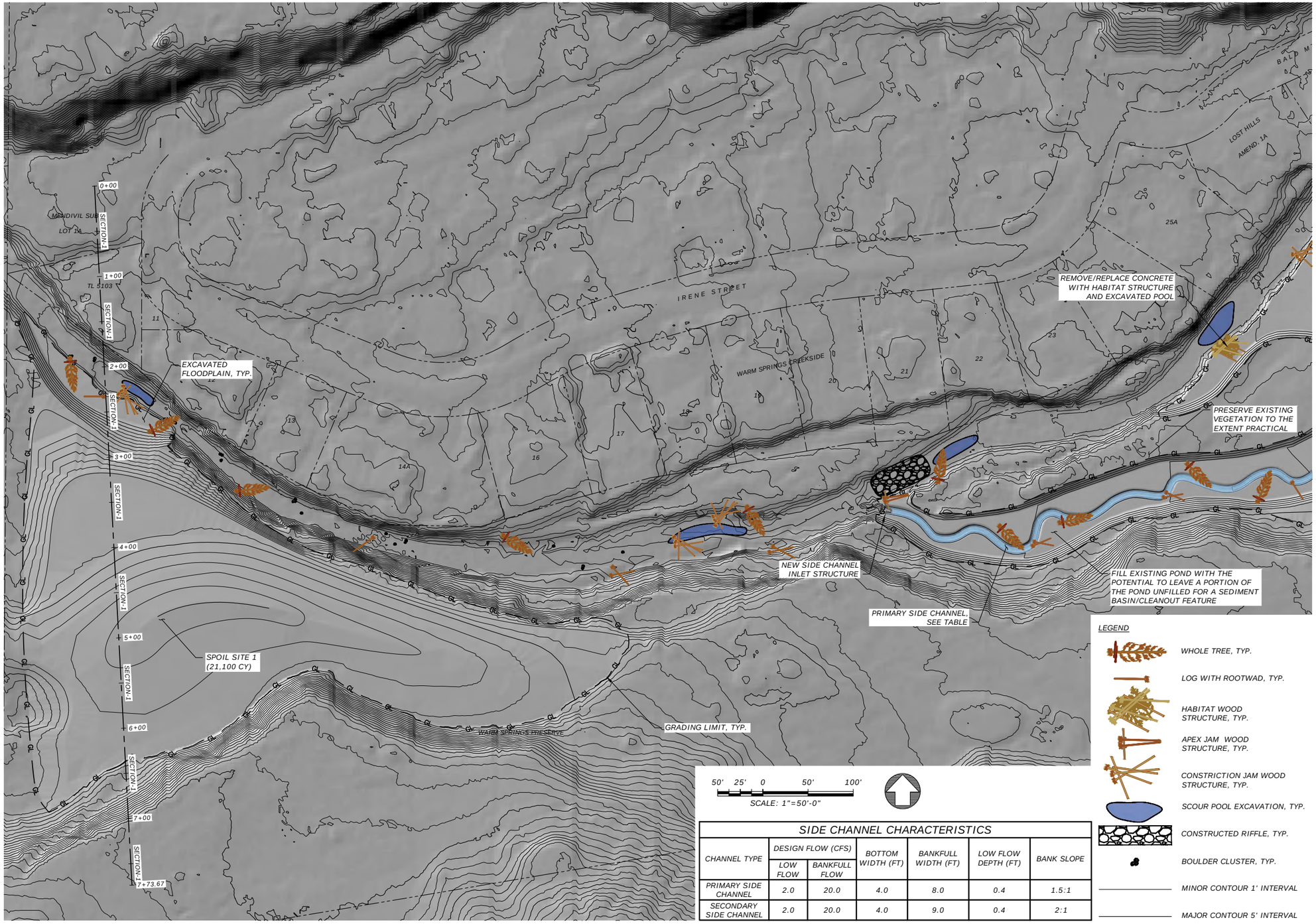
- Mechanical treatment (mowing, hand pulling, plowing, chaining, etc.)
- Biological treatments
- Herbicide application

These types of treatments should significantly reduce mature populations of invasive/noxious weeds, while also decreasing the amount and viability of seed for future generations. In areas with only limited components of invasive plant species present, spot-applications of herbicides, bio-control agents, or mechanical thinning should be used. The initial and continued use of herbicides, as well as the type of herbicide, should be determined on a site-by-site basis. In addition, herbicide application projects should be done in collaboration with Blaine County, and other resource specialists.

A weed management program must be implemented and carried out throughout the year. This program will utilize various treatments, including mechanical, chemical, and biological control methods. For example, spot spraying of invasive grass species in areas with established native species would likely reduce competition for limited resources and increase the ability of young natives to establish and reproduce. However, the use of herbicides can have adverse effects on native species as well. Therefore, mechanical, and biological controls should be used as much as possible in these areas.

It is recommended to limit the use of biological control agents as much as possible to manage and control invasive and noxious weed species. While invasive and noxious weed species can be reduced with chemical and mechanical treatments, these require significant amounts of time and resources and can result in adverse impacts to remnant native population. Biocontrol agents are generally species-specific and have limited effects on other species. In addition, these treatments are less time and resource consumptive and can affect a very large area with a minimal application.

Initial and continuous treatments of the area will be required to control and manage these invasive communities. However, the primary factor in managing the establishment and spread of new populations will be education and support of the residents of the community and the public. An aggressive education program should be emphasized so that residents and the public are aware of the impacts that invasive species have on native communities and wildlife. In addition to on-site programs, the community should have continued communication with, and enter into cooperative programs for weeds management and education with county, state, and federal agencies.



SIDE CHANNEL CHARACTERISTICS

CHANNEL TYPE	DESIGN FLOW (CFS)		BOTTOM WIDTH (FT)	BANKFULL WIDTH (FT)	LOW FLOW DEPTH (FT)	BANK SLOPE
	LOW FLOW	BANKFULL FLOW				
PRIMARY SIDE CHANNEL	2.0	20.0	4.0	8.0	0.4	1.5:1
SECONDARY SIDE CHANNEL	2.0	20.0	4.0	9.0	0.4	2:1

LEGEND

- WHOLE TREE, TYP.
- LOG WITH ROOTWAD, TYP.
- HABITAT WOOD STRUCTURE, TYP.
- APEX JAM WOOD STRUCTURE, TYP.
- CONSTRICTION JAM WOOD STRUCTURE, TYP.
- SCOUR POOL EXCAVATION, TYP.
- CONSTRUCTED RIFFLE, TYP.
- BOULDER CLUSTER, TYP.
- MINOR CONTOUR 1' INTERVAL
- MAJOR CONTOUR 5' INTERVAL

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WARM SPRINGS PRESERVE

CONCEPTUAL DESIGN

CITY OF KETCHUM
--
KETCHUM, BLAINE COUNTY, IDAHO

WORKING DRAFT NOT FOR CONSTRUCTION

DATE: OCTOBER, 2022
DESIGNED: --
APPROVED: --

DRAWING NAME
PROPOSED CONDITIONS

OVERVIEW-01

DRAWING NO.

SHEET -- OF 33

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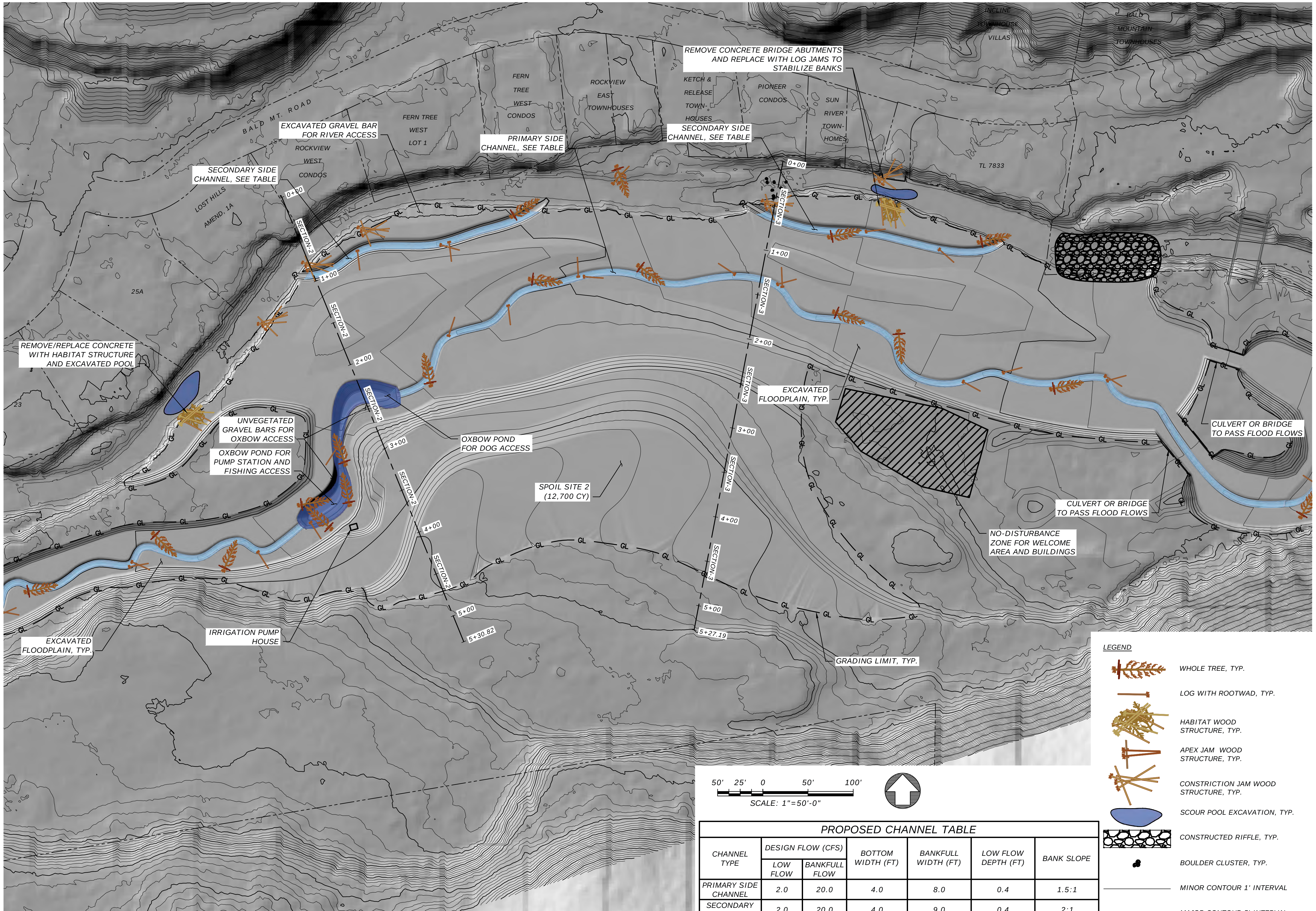

PROPOSED CHANNEL TABLE

CHANNEL TYPE	DESIGN FLOW (CFS)		BOTTOM WIDTH (FT)	BANKFULL WIDTH (FT)	LOW FLOW DEPTH (FT)	BANK SLOPE
	LOW FLOW	BANKFULL FLOW				
PRIMARY SIDE CHANNEL	2.0	20.0	4.0	8.0	0.4	1.5:1
SECONDARY SIDE CHANNEL	2.0	20.0	4.0	9.0	0.4	2:1

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WARM SPRINGS PRESERVE

CONCEPTUAL DESIGN

CITY OF KETCHUM

--

KETCHUM, BLAINE COUNTY, IDAHO

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DATE: OCTOBER, 2022
DESIGNED: --
APPROVED: --

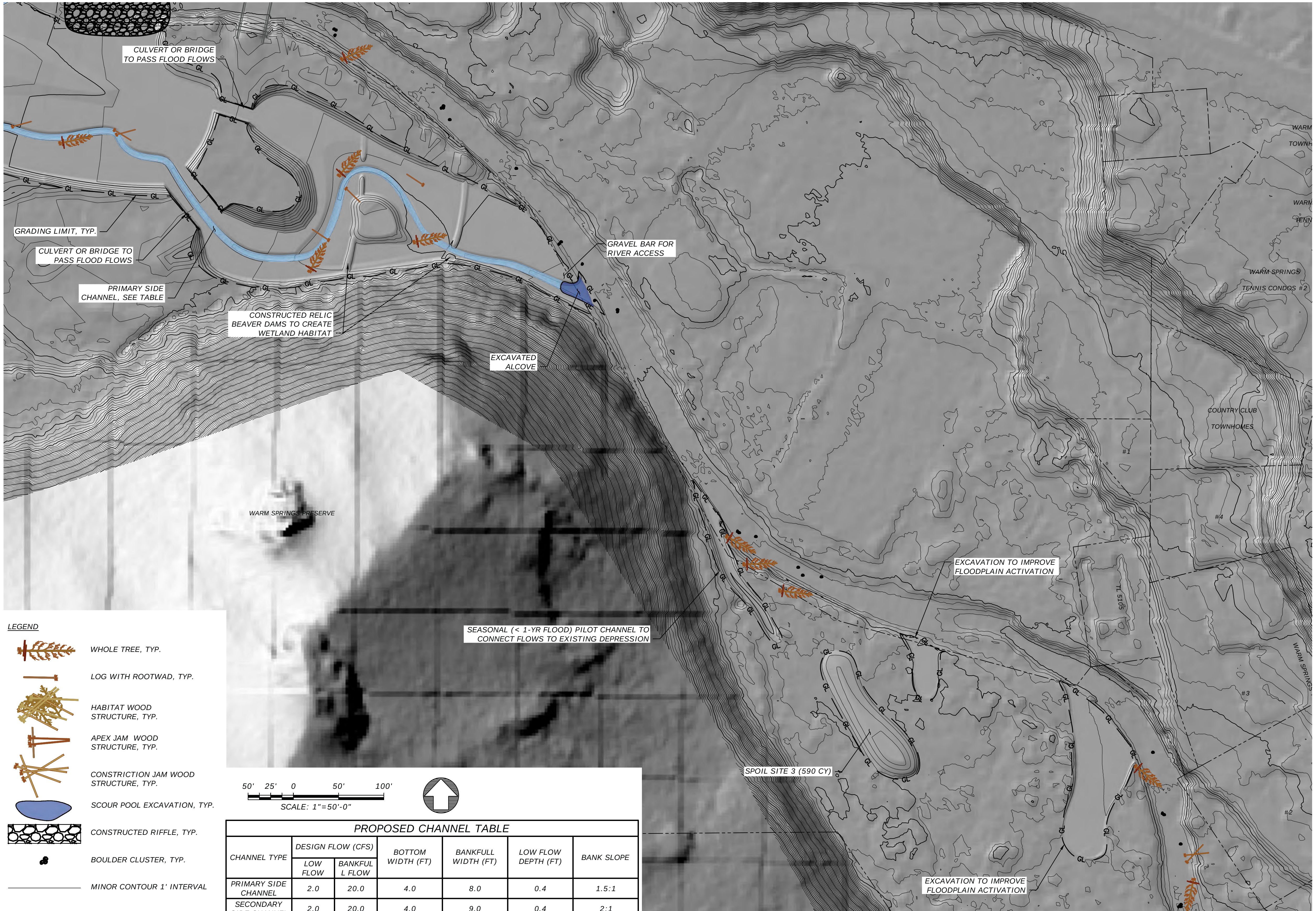
DRAWING NAME

PROPOSED CONDITIONS

OVERVIEW-02

DRAWING NO.

SHEET -- OF 33



PROPOSED CHANNEL TABLE

CHANNEL TYPE	DESIGN FLOW (CFS)		BOTTOM WIDTH (FT)	BANKFULL WIDTH (FT)	LOW FLOW DEPTH (FT)	BANK SLOPE
	LOW FLOW	BANKFULL FLOW				
PRIMARY SIDE CHANNEL	2.0	20.0	4.0	8.0	0.4	1.5:1
SECONDARY SIDE CHANNEL	2.0	20.0	4.0	9.0	0.4	2:1

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WARM SPRINGS PRESERVE
CONCEPTUAL DESIGN
CITY OF KETCHUM
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KETCHUM, BLAINE COUNTY, IDAHO

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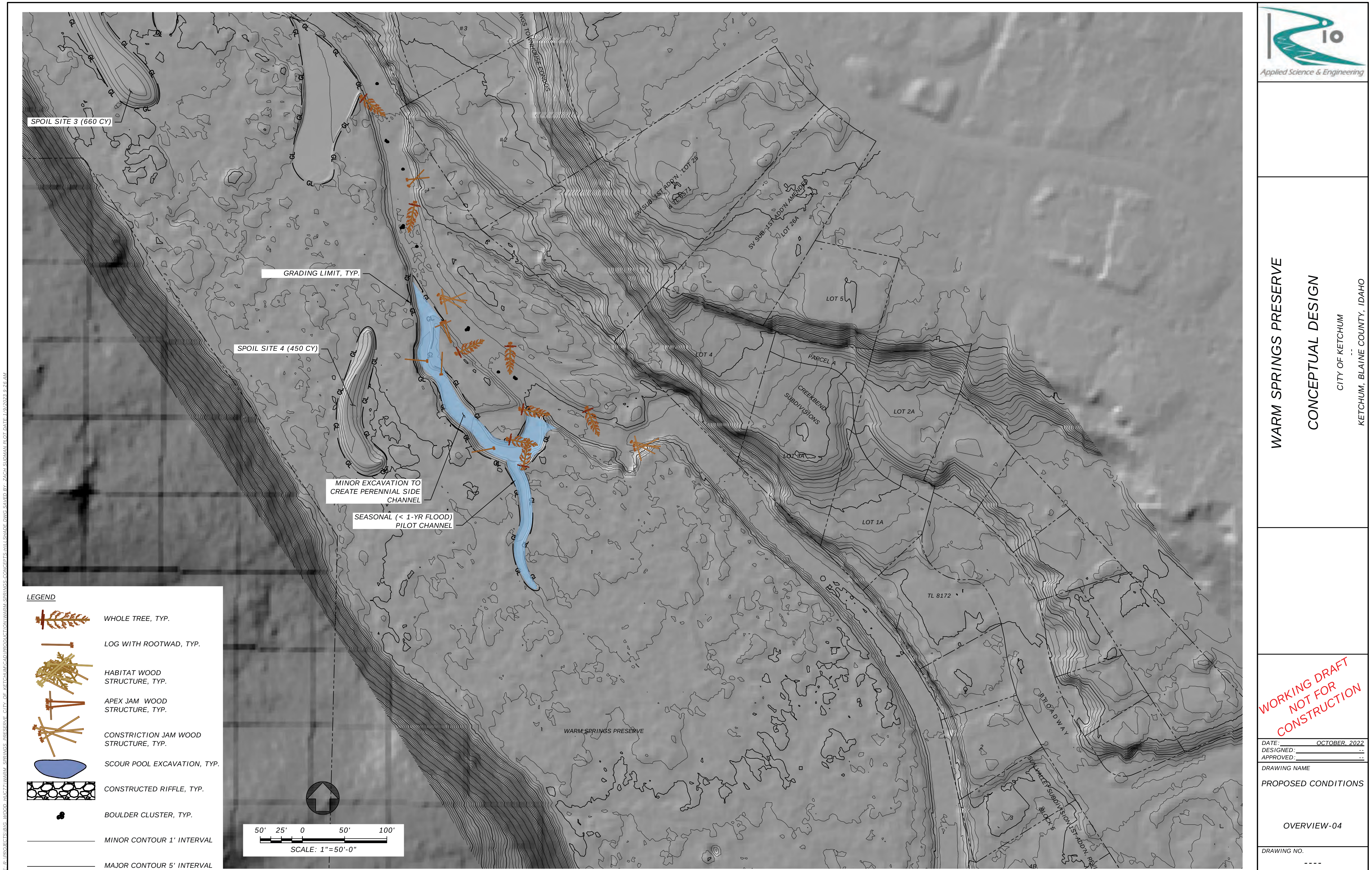
DRAWING NAME
PROPOSED CONDITIONS

OVERVIEW-03

DRAWING NO.

SHEET -- OF 33


SPOIL SITE 3 (660 CY)
GRADING LIMIT, TYP.
SPOIL SITE 4 (450 CY)
MINOR EXCAVATION TO CREATE PERENNIAL SIDE CHANNEL
SEASONAL (< 1-YR FLOOD) PILOT CHANNEL
LOT 5
LOT 4
PARCEL A
CREEKBEND SUBDIVISIONS
LOT 2A
LOT 1A
TL 8172
WARM SPRINGS PRESERVE
BROADWAY
LEGEND
WHOLE TREE, TYP.
LOG WITH ROOTWAD, TYP.
HABITAT WOOD STRUCTURE, TYP.
APEX JAM WOOD STRUCTURE, TYP.
CONSTRICTION JAM WOOD STRUCTURE, TYP.
SCOUR POOL EXCAVATION, TYP.
CONSTRUCTED RIFFLE, TYP.
BOULDER CLUSTER, TYP.
MINOR CONTOUR 1' INTERVAL
MAJOR CONTOUR 5' INTERVAL
50' 25' 0 50' 100'
SCALE: 1"=50'-0"
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WARM SPRINGS PRESERVE
CONCEPTUAL DESIGN
CITY OF KETCHUM
KETCHUM, BLAINE COUNTY, IDAHO
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DATE: OCTOBER, 2022
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DRAWING NAME
PROPOSED CONDITIONS
OVERVIEW-04
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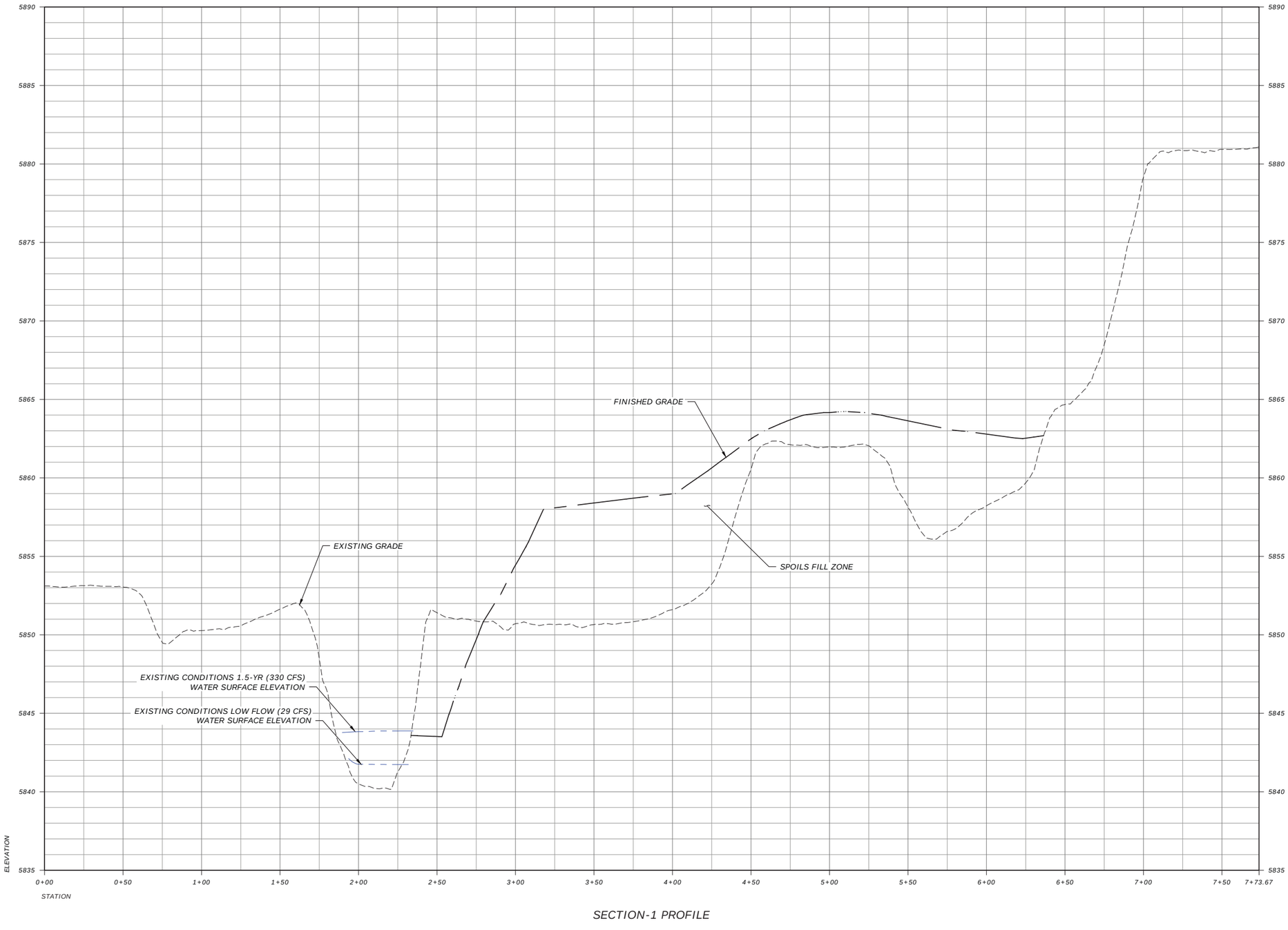
SHEET -- OF 33



SECTION-1 PROFILE

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WARM SPRINGS PRESERVE

CONCEPTUAL DESIGN

CITY OF KETCHUM
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KETCHUM, BLAINE COUNTY, IDAHO

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APPROVED: --

DRAWING NAME
PROPOSED CONDITIONS

SECTION-01

DRAWING NO.

SHEET -- OF 33

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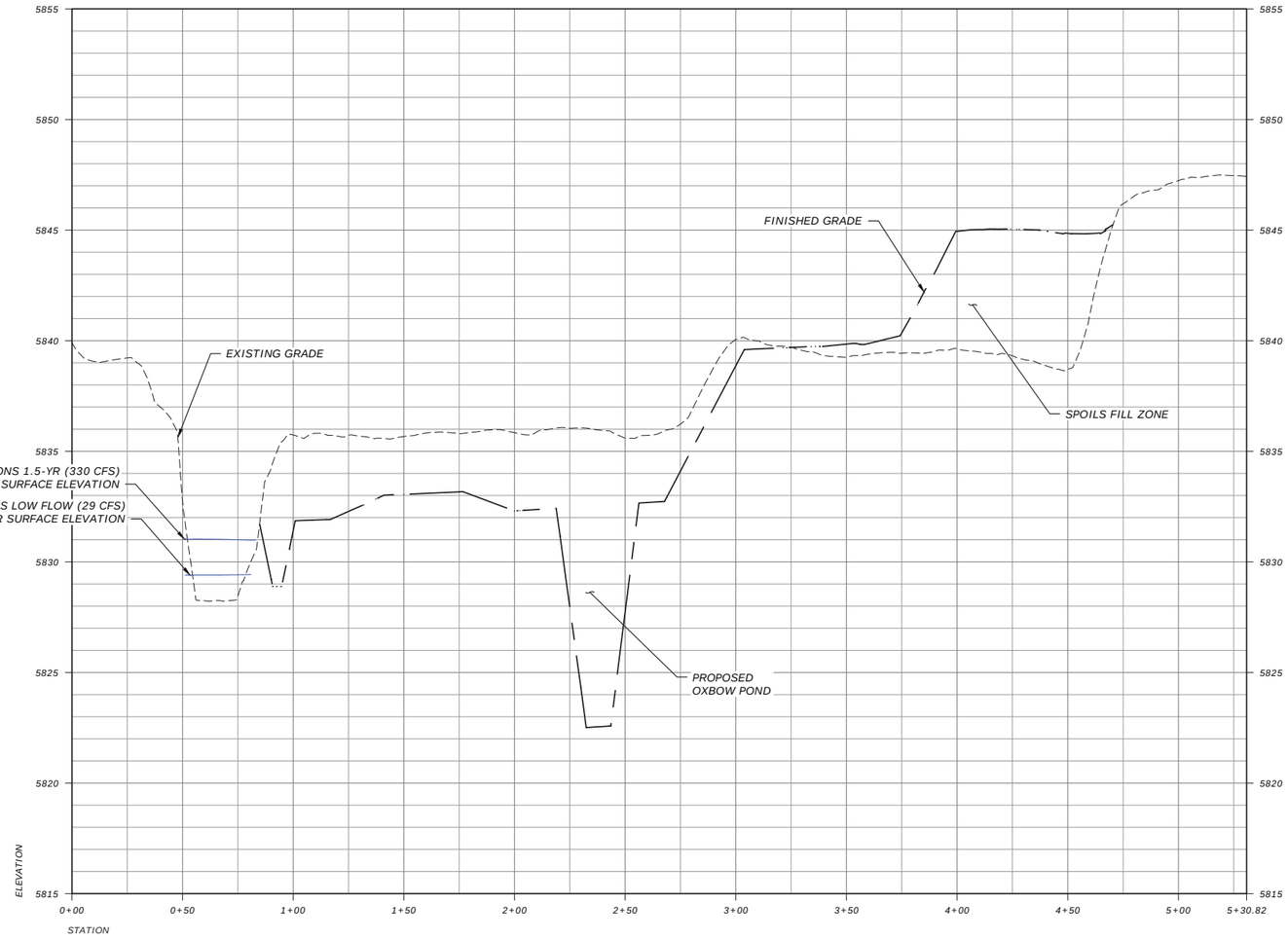

SECTION-2 PROFILE

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Applied Science & Engineering

WARM SPRINGS PRESERVE

CONCEPTUAL DESIGN

CITY OF KETCHUM
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KETCHUM, BLAINE COUNTY, IDAHO

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CONSTRUCTION

DATE: OCTOBER, 2022
DESIGNED: --
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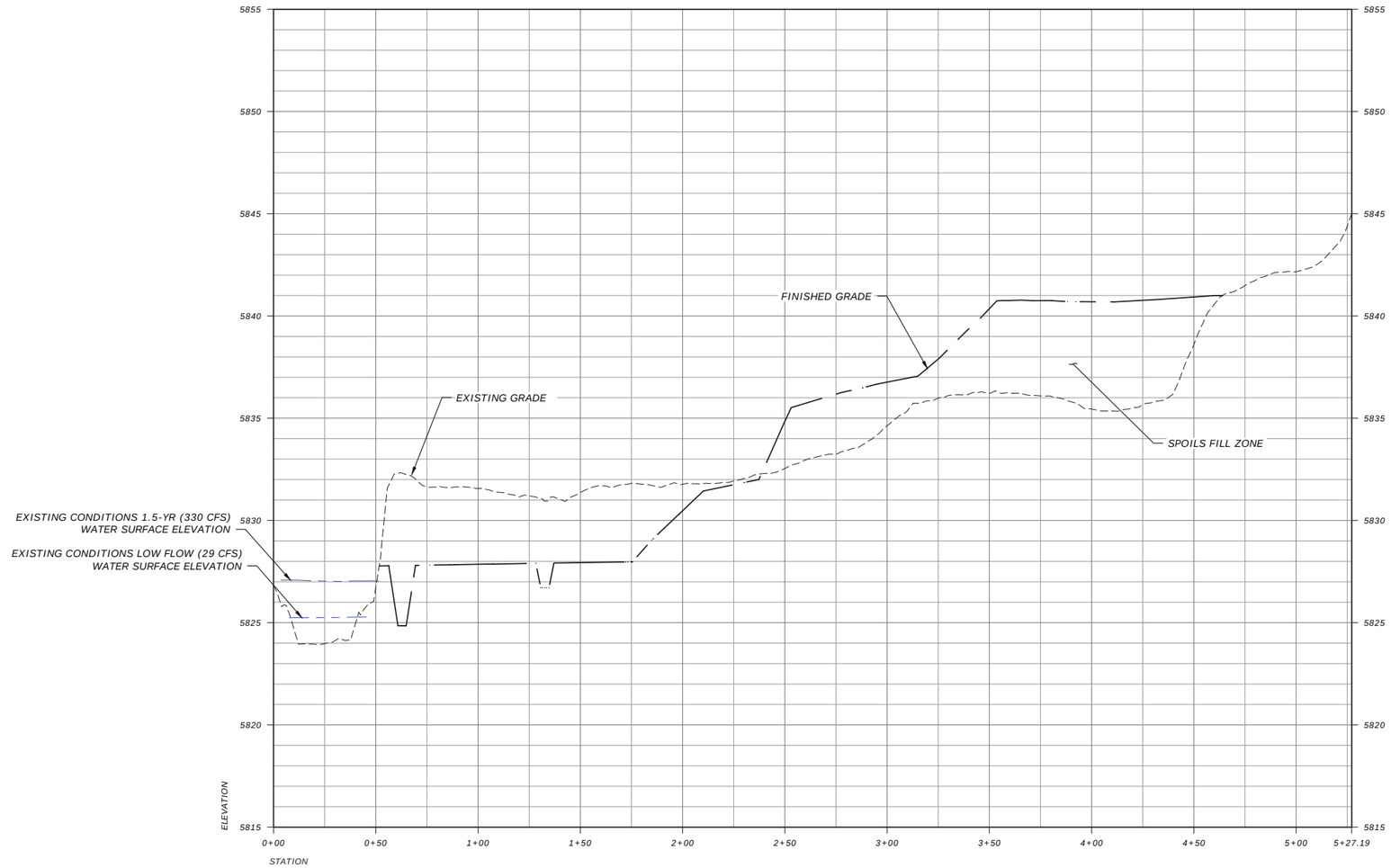
DRAWING NAME

PROPOSED CONDITIONS

SECTION-02

DRAWING NO.

SHEET -- OF 33



SECTION-3 PROFILE

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WARM SPRINGS PRESERVE

CONCEPTUAL DESIGN

CITY OF KETCHUM
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KETCHUM, BLAINE COUNTY, IDAHO

WORKING DRAFT
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CONSTRUCTION

DATE: OCTOBER, 2022
DESIGNED: --
APPROVED: --

DRAWING NAME

PROPOSED CONDITIONS

SECTION-03

DRAWING NO.

SHEET -- OF 33

For more information and to get involved:

www.WarmSpringsPreserve.org