

# CONCEPT RIPARIAN AREAS MANAGEMENT PLAN

## RED MOUNTAIN RANCH PUD

Eagle County, Colorado



prepared for:

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## 1.0 INTRODUCTION

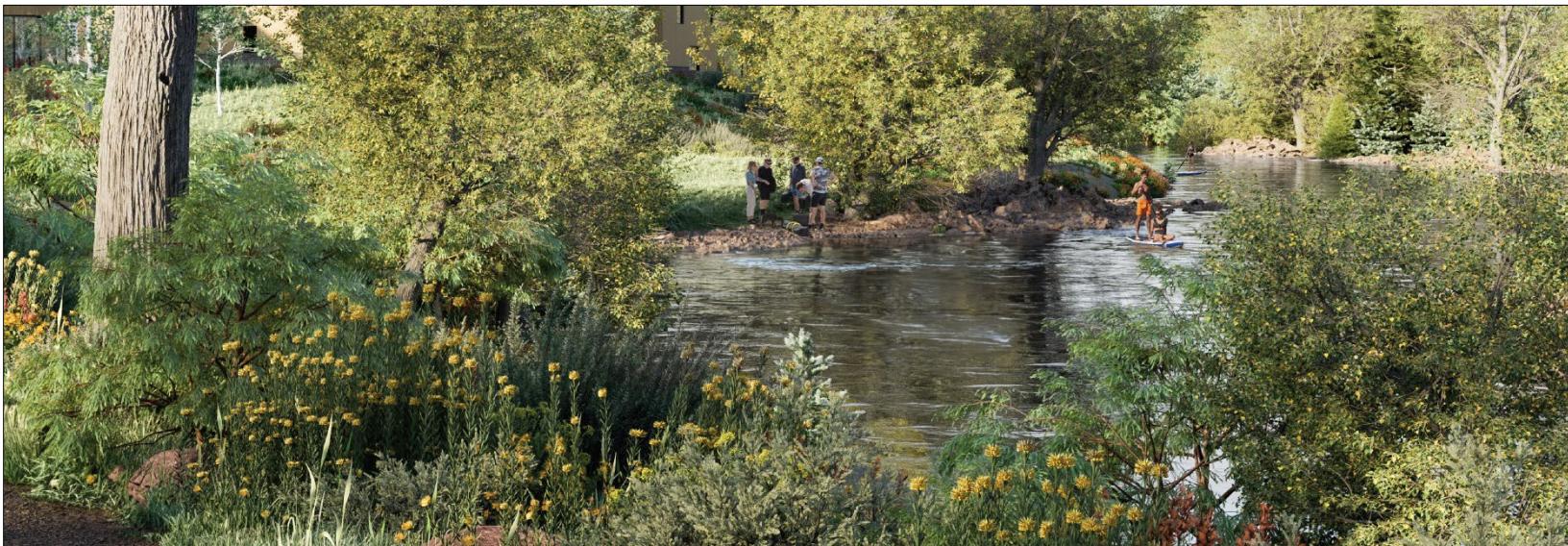
Red Mountain Ranch is a 106.2-acre PUD located just east of downtown Eagle Colorado, between Highway 6 and the Eagle River (Figure 1). The property has been divided into seven planning areas as detailed in the September 15<sup>th</sup>, 2020 PUD Guide. The PUD authorizes a total of 153 dwelling units including single-family, two-family and multi-family housing; commercial space; parks and open space; and amenities such as a community garden, a Discovery Trail, and a Nature Center, as shown by the PUD Zoning Plan (Figure 2; Sheets 1-6).

In accordance with the PUD Guide, site planning will follow the principles of Conservation Oriented Development and Cluster Residential design as articulated in the Eagle Area Community Plan and the Town of Eagle River Corridor Plan. The design will provide for clustered areas of development and integrate buffer zones, formal and informal open space areas within the plan.

A focal aspect of Red Mountain Ranch is designated open space, which will center around and protect the riparian corridor. More than half (56%) of the total area is designated as open space (59.1 acres), which exceeds the required 21.2 acres of open space per the Town Code by 37.9 acres.

This Riparian Areas Management Plan works to realize the vision for Red Mountain Ranch to protect water quality and habitat while providing access to the river for fishing and recreation, education, and community enjoyment. The following descriptions specify Management Plan Concepts and Best Management Practices that can promote the ecological functioning of the Eagle River riparian corridor while providing a balance of land uses for the site.

This Plan is a living document that may be updated as detailed planning progresses for each phase of the project. It is a conceptual plan intended to establish policies and guidelines which will inform project planning and provide for future adaptive management of the riparian corridor.



## 2.0 ENVIRONMENTAL SETTING



Red Mountain Ranch is located between U.S. Highway 6 and the Eagle River, with open space areas that extend south of the river in Planning Areas 1 and 3 (Figures 1 & 2). Red Mountain Ranch includes approximately 1.9 miles of river frontage.

portion of the BLM property extends to the north side of the Eagle River between Planning Areas 1, 2 and 3 (Figure 2). The team is partnering with the BLM to integrate this area north of the river into project planning, with the possibility for a connected trail system that crosses between both properties. Private lands in Diamond Star Ranch border the other planning areas on the south side of the river.

Land uses have included past gravel mining in Planning Areas 1, 2, 4, 5 and 6, with agricultural uses for the other areas. Red Mountain Farm currently operates onsite and grows fresh produce for restaurants from their gardens in Planning Area 2. In addition, the river frontage is actively used for fishing. Red Mountain Ranch encompasses a Colorado Parks and Wildlife fishing easement along the Eagle River within Planning Areas 2-6.



The Eagle River supports riparian vegetation with a mature overstory of cottonwood trees, willows, and abundant native shrubs. Stands of mature balsam poplar (*Populus balsamifera*) and narrowleaf cottonwood (*Populus angustifolia*) trees are a prominent feature of the riparian corridor, growing with scattered blue spruces (*Picea pungens*) on the floodplain.



**Mature tree canopy in OS-1 with younger narrowleaf cottonwoods and hawthorns.**

Along with cottonwood saplings, river hawthorn (*Crataegus rivularis*) shrubs are common in the understory where they grow with native shrubs including skunkbrush sumac (*Rhus trilobata*), silver buffaloberry (*Shepherdia argentea*), basin big sagebrush (*Artemesia tridentata* ssp. *tridentata*), golden currant (*Ribes aureum*) and Wood's rose (*Rosa woodsii*). The cobbly edge of the river is lined by sandbar willow (*Salix exigua*), a native wetland shrub which is important for habitat and erosion control.



**Dense stand of sandbar willow on a cobble bar in the Eagle River.**

In addition to these native species, Russian olive (*Elaeagnus angustifolia*) trees are common along the riparian corridor and will be removed. During weed management, it will be important to distinguish Russian olive from the desirable native silver buffaloberry, which has a similar appearance.



**Silver buffaloberry (far right) grows with two Russian olives along the bank of the Eagle River.**

The understory of the riparian corridor is characterized by introduced grasses growing with abundant weeds, as well as a few native species. The dominant grass is the introduced perennial smooth brome (*Bromus inermis*), an aggressive species that can crowd out native plants. In the shady understory of the cottonwoods, smooth brome grows with dense stands of noxious weeds including Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), and burdock (*Arctium minus*). In the drier areas, white top (*Cardaria draba*), Russian knapweed (*Acroptilon repens*), and Scotch thistle (*Onopordum acanthium*) are problematic.



**Dense growth of Canada thistle, houndstongue and burdock.**

Riparian wetlands line the banks of the Eagle River, as illustrated by the Preliminary Wetland Map prepared by Birch Ecology (Figure 3, sheets 1 to 7). The wetlands illustrated on Figure 3 were delineated in accordance with U.S. Army Corps of Engineers methodology in 2013, 2015 and 2016. However, the mapping is considered preliminary because it has not yet been formally reviewed or approved by the Corps. As the development progresses, the delineation will be updated, and a formal Corps approval will be obtained to provide a basis for wetland permitting. Currently, only minor wetland disturbances are anticipated to facilitate fishing, river access, and irrigation diversions.

Wetland development and the width of the riparian habitat through Red Mountain Ranch have been affected by prior land uses. These have included physical changes to the floodplain and terraces from mining and agriculture, as well as hydrologic changes from irrigation practices. Since our initial wetland mapping was completed in 2008, there has been a significant reduction in groundwater flow and irrigation return flow to through Red Mountain Ranch, which is causing changes in the vegetation. In particular, the landscape directly north of Red Mountain Ranch, between Highway 6 and I-70, is no longer irrigated. This has caused a corresponding decrease in water feeding the wetlands on Red Mountain Ranch, and there has been an increase in weeds at the edge of wetlands. Some of the canopy die-back on mature cottonwood trees could also be related to these hydrologic changes. Future management of stormwater runoff can be used to mitigate some of these changes.



**Wetlands on the floodplain of the Eagle River.**



**Wetland area affected by a reduction in irrigation water.  
This area has been mowed for weed management.**

The upland terrace bordering Highway 6 has been mined for gravel and reclaimed, leaving a highly disturbed habitat in Planning Areas 4, 5, and 6. As shown below, the post-mining landscape has created a sharp transition in both vegetation and topography between the upper terrace and the floodplain of the river, reducing the width of the riparian habitat.



**Formerly mined and reclaimed area in Planning Area 4 with limited riparian habitat.**

Within the mined area, the riparian vegetation quickly transitions to an upland seeding of crested wheatgrass (*Agropyron cristatum*), an introduced annual. Other reclaimed areas have been seeded with Russian wildrye (*Psathyrostachys juncea*), which is growing with whitetop and other weeds. In addition, a few isolated tamarisk (*Tamarix ramosissima*) shrubs were noted during the site inventory; however, none were observed near the river. Tamarisk is a state-listed noxious weed that can threaten habitat quality, so the shrubs in Planning Area 6 will be removed.



**Steep bank in the previously mined area.**

Similarly, the upland terrace in Planning Areas 1 & 2 has been disturbed by agricultural land uses and past gravel mining, and the woody riparian overstory is limited in places, as shown below and on Figure 4.



***Limited riparian habitat in a disturbed section of Planning Area 1.***

Remnant stands of sagebrush, rabbitbrush, and skunkbrush are also present, but these areas typically have a weedy understory. This vegetation will be restored and enhanced as a part of site landscaping to improve the habitat quality along the river.



***Basin big sagebrush grows at the edge of the riparian habitat in Planning Area 2.***

## 3.0 RIPARIAN MANAGEMENT PLAN CONCEPTS

Valuing the riparian corridor, protecting its habitat and the water quality of the Eagle River are fundamental to the vision for Red Mountain Ranch. In support of these goals, the team has adopted a forward-thinking approach that incorporates state-of-the-art techniques for stormwater management and site landscape design, using thoughtful site planning that focuses development to the north, closest to Highway 6 and away from the Eagle River.

The following Riparian Management Plan Concepts incorporate specifications provided in the PUD guide to facilitate the dual goals of public enjoyment and ecological protection. The following list addresses protocols to protect the quality and ecological functioning of riparian habitat, preserve natural beauty, provide enjoyable and responsible recreational access, protect the water quality of the Eagle River, and promote environmental sustainability.

### 3.1 Stream Setback

A key component of project planning is the establishment of a stream setback along the Eagle River (Figure 2). The setback will provide a connected corridor of open space bordering the river which will be maintained in its natural state, then enhanced by controlling weeds, restoring disturbances, and replanting with native vegetation.

In accordance with the PUD Guide, a stream setback shall be maintained between the proposed development and the Eagle River.

- At minimum, this area shall be spaced either 75 horizontal feet from the high-water mark or the edge of the 100-year floodplain, whichever provides greater distance from the river. Additional area may be added to protect streams, wetlands, or riparian areas.
- The stream setback can be reduced to a minimum of 50 feet or the outer edge of the 100-year floodplain following approval by the Director of Community Development or the Public Works Director through a Finding of No Significant Impact ("FONSI").
- The stream setback will be protected in its natural state. This will promote the ecological functioning of the riparian habitat and provide a buffer between the development and the Eagle River to protect water resources.
- Any improvements or activities within this area will minimize site disturbance.
- No grading or removal of vegetation will be conducted within the stream setback, except for those activities listed below, which are specified in the 2020 PUD Guide:
  - Revegetation of previously disturbed areas.
  - Removal of state-listed noxious weeds.
  - Removal of dead or dying vegetation and vegetation removal for wildfire mitigation.
  - Footpaths not exceeding 3 feet in width, following a route which minimizes disturbance, and formed of generally natural pervious materials.
  - Public multi-use paths that are part of the public trail system or that are to be dedicated as public trails through the development review process.



DISCOVERY TRAIL VIEW SINGLE FAMILY HOMES AND EAGLE RIVER

- Head gates, pump houses, hydroelectric wheelhouses and piping, and ditches.
- Flood control and bank stabilization devices.
- Underground utilities, public park improvements, and/or structures that do not have a practical alternative location. These features must be approved as part of a Development Permit or Special Use Permit, or as part of a site-specific development plan, following procedures set forth in the Town Code. Construction disturbance will be revegetated and, if necessary, equipped with temporary irrigation.
- Removal of existing building encroachments.

- Regulated activities in wetlands shall be coordinated with the U.S. Army Corps of Engineers and, if required, appropriate mitigation (including seed mixes for revegetation) shall be approved by the Corps as a part of the wetland permitting process.

### **3.2 Stormwater Management and Water Quality Protections**

The site plan integrates modern stormwater management practices to promote infiltration and reduce runoff from impervious surfaces; limit pipes; and eliminate concentrated discharge points to the Eagle River. As shown by the Site Plan on Figure 5, the design focuses development away from the river and provides natural vegetated buffer regions, with native vegetation in the stream setback to protect the water quality.

- Natural drainage patterns will be used to dissipate stormwater across the site, in contrast to traditional stormwater infrastructure. Runoff will be directed to existing drainage swales to minimize pipes, limit grading, and preserve existing stands of native vegetation.
- Native vegetation in the Stream Setback and adjacent open space areas will filter runoff, remove sediment, uptake nutrients, and protect the water quality of the Eagle River.
- Drainage features will be designed with sufficient capacity to accommodate future changes from on-site and off-site development, with a goal of limiting concentrated discharges to the Eagle River.
- In contrast to traditional curb-and gutter systems, runoff from roads will be directed to grass-lined swales to capture and filter stormwater to remove sediments, nutrients, and pollutants, and promote infiltration.
- Permeable paving will be used for parking areas to promote infiltration of runoff and groundwater recharge.
- Snow storage areas will utilize either permeable paving or landscaped beds to promote infiltration and protect water quality.
- The use of chemical herbicides, especially within the stream setback, will be limited, with a focus on integrated weed management to protect water quality.

### **3.3 Landscape and Restoration Ecology**

The ecology of Red Mountain Ranch is fundamental to the landscape design. Within the stream setback, native plant communities will be restored and enhanced to support the ecological functioning of the riparian corridor. Site landscaping will also incorporate native plants and adaptable water-wise species. As described above, stormwater features will be integrated into the landscape design. Runoff will be routed to grass-lined swales, wetlands, and landscaped areas rather than piped into concentrated discharges. Grading will be limited, with a goal of preserving existing mature trees and stands of native vegetation.

- The stream setback will be restored and enhanced by preserving existing native vegetation, removing noxious weeds and invasive plants, and integrating supplemental native plantings. Table 1 provides a list of recommended native species for restoration of the Stream Setback area.
- Pollinator gardens will support the operations of Red Mountain Farm and will enhance both aesthetics and habitat quality.
- Grading is being designed to minimize changes to natural topography and preserve stands of native vegetation.
- Existing high-value native trees will be retained whenever possible, considering tree health and safety.
- Natural drainage patterns will be enhanced and mimicked to dissipate stormwater through wetlands, grass-lined swales, and vegetated areas.
- Native, adaptable, water-wise plants will be incorporated throughout the development.
- Efficient irrigation systems will limit water use. Raw water will be used for irrigation.

### **3.4 Management of Weeds and Invasive Plants**

Managing weeds within the stream setback will be an important part of habitat restoration. As discussed above, initial site reconnaissance has shown that weeds are already common in many areas of Red Mountain Ranch. A proactive effort using integrated weed management techniques will limit the spread of undesirable weeds and enhance habitat quality along the Eagle River.

- Noxious weeds, as identified by the State of Colorado, shall be controlled within the riparian corridor. The Colorado Noxious Weed List is updated regularly and can be accessed at: <https://www.colorado.gov/pacific/agconservation/noxious-weed-species>.
- A detailed site inventory and mapping prepared by the project ecologist will identify weed management concerns and priorities. This will allow weed management to begin prior to construction.
- Integrated weed management should be used to limit weed dispersal during construction and prevent establishment in new areas.
- Regular site visits by the project ecologist will facilitate a proactive approach to weed management within the Stream Setback.

- Integrated weed management shall be the preferred method of weed control, using a multifaceted approach that includes cultural, mechanical, and chemical methods. A goal of integrated weed management is to reduce the dependence on chemical herbicides over time.
- The use of pesticides, herbicides and chemical fertilizers shall be minimized. The selection of chemical herbicides shall be based on the least environmentally damaging option available to effectively control noxious weeds.

### **3.5 River Access and Trails**

The trail system will provide connectivity across Red Mountain Ranch and public access to the Eagle River. A focal point will be the soft-surface Discovery Trail which will invite visitors to explore the riparian habitat and will connect the park spaces in Planning Areas 5B and OS-1 to the Nature Center in C/PUD-2. The Discovery Trail will highlight the ecology of the riparian corridor and may include educational signage.

All trails will be designed with permeable materials and carefully routed to protect habitat and integrate with the natural environment. Designated river access areas will be provided to direct people through the setback and minimize trampling of riparian vegetation. These access areas have been designed to protect and preserve the highest quality habitats. For example, the river access near the proposed hotel in Planning Area 2 makes use of an existing, highly disturbed area of the riverbank; the adjacent stands of riparian vegetation will be preserved and enhanced. Additional plantings and signage will be used in key locations to control river access and direct users to the designated access points. Finally, a boat ramp will also provide river access within the future Town Park in Planning Area 5B.

- **Trails** will facilitate walkable connectivity across Red Mountain Ranch.
  - Within the stream setback, only soft surface trails are permitted with a maximum width of 3 feet. Outside the stream setback, paths may be a durable hard surface with a minimum width of 6 feet.
  - Trail routes will be selected to minimize ecological disturbance.
  - A pervious surface such as crusher fines will be used to construct soft surface trails. Where necessary, a boardwalk may be incorporated.
  - The Discovery Trail will provide public pedestrian access between the park spaces in Planning Area 5B and OS-1. A concept plan is illustrated by Figure 2, Sheets 2-4; however, the final trail alignment is to be determined along with the Development Permit application for each planning area.
  - The Discovery Trail design and construction will meet the 2013 US Forest Service Trail Accessibility Guidelines.
  - A pedestrian bridge will connect the Nature Center to a preservation area on the south side of the Eagle River within Planning Area 3.
  - Red Mountain Ranch will work with the BLM regarding a potential trail connection between Planning Areas 1, 2 and 3.



DISCOVERY TRAIL VIEW TO PARCEL 2 BEER GARDEN

- **River Access**

- A boat ramp in Planning Area 5B will provide river access within the East Eagle River Park.
- Access points will provide designated areas for river access and protect riparian vegetation in other locations.
- Shrubs will be planted around the access areas to prevent erosion and discourage human activity outside the designated area.

### **3.6 Fishing Access and Management**

Red Mountain Ranch will provide access to a Colorado Parks and Wildlife Fishing Easement that extends out for 25 feet from the high-water line of the Eagle River in Planning Areas 2-6 (Figure 2, Sheets 2-6). A boat ramp and parking lot in the East Eagle River Park in Planning Area 5B will facilitate access to the CPW fishing easement via the Discovery Trail.

Fishing access will be planned to facilitate wise stewardship of natural resources by funneling river access to a limited number of designated locations to minimize trampling of streamside vegetation; by allowing only fly-fishing and catch-and release with no guided trips; and by instituting fishing closures when the Eagle River reaches high temperatures. Signage and an informational campaign will educate users about responsible stewardship and encourage them to “Respect the River.”

Provisions for in-stream fish habitat restoration are also included in the PUD Guide.

- **Fishing Access**

- Red Mountain Ranch will provide access to a Colorado Parks and Wildlife Fishing Access Easement.
- The CPW fishing easement extends 25 feet north of the average high-water mark in Planning Areas 2-6 as shown by Figure 2.
- Activities within the Public Fishing Easement will follow the specifications for the Colorado Parks and Wildlife easement recorded November 30, 1988 in Book 496 at Page 133 in the real property records of Eagle County (the “CPW Public Fishing Easement”).
- Only fly fishing and catch and release will be permitted. Commercial guided fishing will not be allowed. These conditions apply to the entire river frontage of Red Mountain Ranch, including lands outside the CPW Fishing Easement.
- Access to the river will be facilitated by designated access points to limit impact to the riparian areas outside these locations.
- Fishing closures will protect trout during high water temperatures and will be based upon recommendations from Colorado Parks and Wildlife.
- In-stream fish habitat restoration can be conducted during the construction of non-potable diversion improvements or the boat ramp as per the PUD Guide.



EAGLE RIVER VIEW TO HOTEL AND BEER GARDEN

### **3.7 Protections for Wildlife**

Protecting wildlife habitat and use is a central part of the vision for Red Mountain Ranch. As illustrated by Figure 2, more than half of the total project area is designated as open space, including a continuous stretch of river frontage covering approximately 1.9 miles. The Riparian Areas Management Plan is one of many project elements that are designed to protect the ecological functioning and habitat value of the riparian corridor.

- The project will restore areas of degraded habitat within the stream setback, control invasive weeds, and re-plant native riparian trees and shrubs in areas that have been impacted by past gravel mining. This will improve habitat connectivity in disturbed areas of the river corridor.
- Seasonal trail closures may be instituted during elk calving season. CPW will be consulted for recommendations.
- The Eagle River will be closed to fishing when the temperatures are too high, in accordance with CPW recommendations.
- Only catch-and- release and fly fishing will be permitted with no guided trips.
- Dogs are not allowed to run freely.
- Trash receptacles and signage will facilitate waste disposal along trails.
- To prevent attracting and habituating wildlife, residential trash and recycling will not be left outside overnight or will be stored within designated wildlife resistant trash and recycling enclosure structures.
- Fencing will be minimized, and only wildlife-friendly fencing will be used where necessary, following the recommendations provided by the 2009 Colorado Parks and Wildlife document “Fencing with Wildlife in Mind.”
- Dark sky practices will limit light pollution to maintain a natural environment in the Eagle River Valley. Illumination Standards will follow the requirements of the Town Code Section 4.07.010.
- Restriction of bright shiny metal elements will reduce unnatural light reflections that can negatively impact wildlife.

### **3.8 Sustainability**

This PUD seeks to use state-of-the-art sustainable practices, including Conservation Oriented Development and Cluster Residential Design concepts, to carefully steward energy and water resources.

- **Environmental building practices** will include:
  - Conservation Oriented Development and Cluster Residential Design.
  - Energy efficient designs including solar panels.
  - Encouragement of owners to follow LEED guidelines established by the US Green Building Council ([www.usgbc.org](http://www.usgbc.org)).
  - An integrated neighborhood connected by a network of walkable paths.

- Irrigation will be reduced by planting water-efficient vegetation and utilizing runoff for hydration.

### **3.9 Ownership**

Homeowners' associations will be generally responsible for ownership and maintenance of open spaces.

- The master homeowners' association of the greater neighborhood shall have common ownership of buffer regions and open space areas.
- Maintenance of the Discovery Trail shall be conducted by the developer until this responsibility is transferred to a homeowners' association or nonprofit corporation under a maintenance agreement approved by the Town.

## 4.0 BEST MANAGEMENT PRACTICES FOR RIPARIAN AREAS

The following Best Management Practices (BMPs) are included to provide property managers, residents, and guests with a set of concise principles that can be used to inform their management and use of the riparian corridor. The purpose of these guidelines is, first, to educate the residents and visitors regarding the sensitivity, functioning, and importance of the riparian habitat; and second to identify activities and practices that will protect and enhance the functions of the riparian habitat, as well as activities that are discouraged.

- Minimize disturbances within the stream setback.
- Avoid the creation of bare soil areas.
- Limit vegetation removal to what is necessary for health and safety, focusing on diseased or damaged plants that present a safety hazard.
- Prune rather than remove the entire tree or shrub.
- Promote dense vegetation to reduce runoff and trap sediment.
- Landscape with native plants; any additional planting materials shall be from the plant list and/or seed mix tables.
- Leave wood and other natural materials in streams and on the adjacent floodplain.
- Keep grass clippings and other yard waste out of the stream setback area.
- Direct drainage to landscaped areas and grass-lined swales, not directly toward the river.
- Keep pet waste away from the riparian corridor and the river.
- Limit the area of impervious surfaces you create and try to encourage runoff to infiltrate the soil.
- Remain on designated paths and avoid trampling the streamside vegetation.
- Paths to the stream should have a soft surface that will allow water to infiltrate.
- Ensure vegetation is growing along the sides of the path to help anchor the soil.
- If necessary, use only slow-release fertilizers and limit the use of pesticides.
- Nothing shall be poured down storm drains, including soapy water, automobile oil, paint, household chemicals, and pesticides.

## 5.0 MANAGEMENT OF WEEDS AND INVASIVE SPECIES

### 5.1 Priority Weeds of Concern

As described above in Section 2.0, prior land uses have disturbed the Eagle River riparian corridor through Red Mountain Ranch, facilitating the establishment of noxious weeds and aggressive, introduced plants. In addition to physical disturbances from mining and agricultural land uses, changed flood irrigation practices in the area have altered site hydrology and contributed to an increase in weeds. In particular, some wetland areas that may be reverting to uplands have exhibited a marked increase in Canada thistle (*Cirsium arvense*) abundance.

Table 2 lists the noxious weeds and invasive plants of concern identified at Red Mountain Ranch during the 2023 growing season, and major stands are shown on Figure 4, sheets 1-7. As summarized in Table 2, 16 species of state-listed noxious weeds are present; however, none of these are List A weeds, the most serious category. In addition to Canada thistle, the most problematic species include Russian knapweed (*Acroptilon repens*), houndstongue (*Cynoglossum officinale*), burdock (*Arctium minus*), white top (*Cardaria draba*), Scotch thistle (*Onopordum acanthium*), plumeless thistle (*Carduus acanthoides*), musk thistle (*Carduus nutans*), and ox-eye daisy (*Leucanthemum vulgare*). In addition, three woody species of noxious weeds are present - Russian olive (*Elaeagnus angustifolia*), Siberian elm (*Ulmus pumila*), and tamarisk (*Tamarix ramosissima*) - which are notable because they can significantly degrade the quality of riparian habitat. Currently, tamarisk and Siberian elm are restricted to the formerly mined area in Planning Area 6, but Russian olive is common along the banks of the Eagle River. Cheatgrass (*Bromus tectorum*) is the only noxious grass species on the list; it is primarily restricted to dry upland areas outside the riparian corridor and is most abundant in the formerly mined area in Planning areas 4-6.

Other problematic weeds in Table 2 are included because they present a significant threat to the native plant communities. These include several plants that were once listed as noxious weeds but have been reclassified. Some of the most concerning species in this other group of weeds include Russian thistle (*Salsola australis*), kochia (*Kochia scoparia*), yellow and white sweet clover (*Melilotus officinalis*; *M. albus*), purple mustard (*Chorispora tenella*), flixweed (*Descurainia sophia*), and tumble mustard (*Sisymbrium altissimum*).

### 5.2 Weed Management Recommendations

Understanding the life cycle of these weeds is the key for effective management. Treatment methods will vary based on the duration of a plant's life span, from short-lived annual and biennial weeds to longer-lived perennials with below ground parts that can survive from year-to-year.

**Short-lived annual and biennial weeds** die after producing seed. Annuals complete their entire life cycle in one year; biennials will typically grow leaves the first year, then flower, set seed, and die in the second year. Preventing seed production is a key for managing annual and biennial weeds.

- Annuals typically have a shallow root system and they do not overwinter. Hand-pulling can be an effective option if the population size is manageable.

- Biennials live for two years, and they typically have better developed root systems. They can be hand-pulled or dug if the population size is manageable.
- Most biennials grow as a rosette in the first year which can be spot-sprayed with herbicide, minimizing the amount of chemical needed to treat large populations.
- Cutting or mowing can be effective for biennials in their second year to prevent seed formation.
- If the weed has already produced seed, then carefully cutting off the seed head from the rest of the plant and disposing of it in a contained trash bag is recommended to limit seed spread.

**Long-lived perennial weeds** that complete their life cycle over several years are usually more difficult to control, since they have belowground parts that can overwinter, store energy, and help the plant to spread vegetatively.

- Mowing rhizomatous perennial weeds can help reduce seed spread, however they cannot be eliminated without also killing the root. Repeated mowing can help to weaken stands and can be coupled with herbicide treatments.
- Herbicide may be necessary for eradicating certain perennial weeds. Recommended treatments can vary widely by species, so it is important to consult with a professional. Targeted-spot spraying can be used to limit the amount of chemicals applied and should always be the preferred method of herbicide application, especially in riparian areas.
- For woody species such as Russian olive, tamarisk and Siberian elm, hand-pulling is only possible for young seedlings. Both tamarisk and Russian olive form a deep taproot, even on young plants. Regularly monitoring and hand-pulling any seedlings before they are deeply rooted is recommended.
- The most effective method of control for weedy trees is the “cut-stump” method; the tree is cut off just above the ground surface, then herbicide is painted on the freshly cut surface of the stump. This limits the amount of chemical necessary, and it kills the root system without having to disturb the soil.
- Biological control agents are available from the Colorado Department of Agriculture’s Request-a-Bug program for certain perennial weeds. These are used to suppress weed growth and generally do not result in eradication. However they can be an important part of integrated weed management and are a useful tool when coupled with other methods.

## **Guidance on Treatment Methods**

The timing of weed management depends on the ecology of the weed species as well as the chosen method.

**Hand pulling** is most effective when the plant has not yet created a seed head. If the plant has produced seed, it is critical that the seed head is disposed of properly in a closed trash bag. Use caution not to disperse seed during this process. Weed seeds should be sent to the landfill rather than composted to limit the potential for further spread.

When **hand pulling** weeds, it is important to pull slowly and firmly to remove as much as the root as possible. Perennial weeds will re-sprout if the root has not been removed fully, however it is not necessary to get the root of annuals or biennials in their second year. It is difficult to remove the entire root system except under the most favorable conditions, so hand pulling is rarely effective for rhizomatous perennial weeds such as Canada thistle and Russian knapweed. The soil disturbance created by hand pulling can stimulate additional weed seed germination.

**Mowing or cutting** can be used to weaken stands of weeds between other treatments, or to prevent seed formation of taller weeds. However, mowing can contribute to weed seed spread if executed improperly. Moreover, mowing is ineffective for low growing weeds, or species such as kochia which can form hundreds of flowers within a few inches of the soil surface. Mowing rarely kills weeds but can be combined with herbicide treatments to weaken persistent stands. However recently sprayed weeds should not be mowed, so that the herbicide has time to work – most importantly, it needs to be transported to the root system to kill perennial weeds.

**Biological control** uses plant pathogens (usually insects or fungus) to infect weeds and suppress their growth. As discussed above, biological control agents rarely kill weeds so they must be used in combination with other methods. The Colorado Department of Agriculture currently offers biological control agents for five of the weeds present at Red Mountain Ranch: tamarisk, Russian knapweed, Canada thistle, field bindweed, and musk thistle.

**Herbicide** is an important tool for managing weeds in conjunction with other methods. On large properties with extensive infestations, it is a necessity. Herbicides should only be applied by a Licensed Commercial Pesticide Applicator. Careful spot spraying methods should always be used, especially in riparian areas. It is important to consider non-target impacts and avoid herbicide use on flowering plants, to limit potential impacts on pollinators.

It will be important to quickly identify weed problems as they emerge and to aggressively manage the first flush of weeds to prevent seed formation. Diligence during the first few years of a restoration will result in significant long-term cost savings for weed management. The Project Ecologist will provide recommendations for Integrated Weed Management and will oversee the implementation of this program.

## Identification of invasive Russian Olive vs. native Silver Buffaloberry

**Silver buffaloberry** (*Shepherdia argentea*) is a **desirable native shrub** that occurs along the Eagle River riparian corridor at Red Mountain Ranch. It is important to distinguish this species from the invasive, state-listed noxious weed **Russian olive** (*Elaeagnus angustifolia*).

**Silver Buffaloberry** is a thorny shrub or small tree with elliptical to lance shaped, silvery leaves that are covered with a dense layer of scaly hairs. The plant has a wiry and stiff appearance with **OPPOSITE branching**. This is the easiest character to identify, and it is visible year-round. The twigs and bark also have a grayish appearance.



Buffaloberry: Stiff gray leaves are oriented upwards.



Buffaloberry: Opposite branching with a grayish appearance.

Buffaloberry: Thorny shrub that can form dense stands.



**Russian Olive** is an invasive, small to medium-sized tree, often with multiple trunks. The young twigs can have a gray appearance from dense hairs, but the mature branches are a shiny chestnut-brown with long, brown thorns that can reach several inches. Russian olive has **ALTERNATE branching** of the twigs and leaves. The leaves are silvery-gray, but they are softer than buffaloberry, and they are larger and are more elongated with a lanceolate shape. Russian olive fruits are readily eaten by birds, so they are widely distributed in riparian areas and near wetlands with moist soil. Russian olive is shade-tolerant and it can out-compete native riparian vegetation, forming dense stands. The thorns can make the riparian corridor impassible for wildlife. The four-parted yellow flowers produce a sweet fragrance.



**Russian Olive: Softer silver leaves, brown twigs and sweet-smelling flowers. Branching is alternate.**



**Russian Olive: Thorny tree with alternate branching. Leaves are softer and droop down off the twigs. Silvery fruits are readily eaten by birds.**

**Comparison of Leaves and Twigs:  
Buffaloberry (left) and Russian  
Olive (right).**



### **5.3 Integrated Weed Management Techniques**

The Colorado Natural Areas Program describes Integrated Weed Management as “a process by which one selects and applies a combination of management techniques (biological, chemical, mechanical, and cultural) that, together, will control a particular weed species or infestation efficiently and effectively, with minimal adverse impacts to non-target organisms.” Rather than focusing simply on the symptoms of the weed infestation, Integrated Weed Management differs from traditional weed management in that it uses an ecological approach to address the ultimate causes of weed infestation, and considers the biological and ecological characteristics of individual weeds to determine effective means of control. One important objective of Integrated Weed Management is to use a combination of techniques to reduce the need for chemical herbicides over the long-term. In this way, integrated weed management can be used to protect the water quality of the Eagle River.

#### **5.3.1 Cultural Control**

Cultural control methods for weed management seek to limit disturbances that provide opportunities for weed invasion, while establishing and maintaining healthy communities of desirable plant species that are resistant to weed invasion. By controlling cultural conditions, weed abundance can be reduced.

#### **5.3.2 Biological Control**

Biological control utilizes deliberately introduced organisms, usually insects, to control weeds by harming them in some way and thereby suppressing their growth. Biological control can weaken undesirable weeds and reduce seed production, but does not typically result in eradication. This method has limited applicability since biocontrol agents are only available for a few species. However, these can be obtained from the Colorado Department of Agriculture's Request A Bug Program: <https://www.colorado.gov/pacific/agconservation/request-bug>.

#### **5.3.3 Mechanical Control**

Mechanical control methods include physically disturbing or removing weeds. Tilling, mowing, hand pulling, raking with an action hoe, and cutting with a line trimmer are all examples of mechanical control. These techniques can be used to kill plants if they are small and can be removed entirely, or mechanical control can be used in combination with other techniques to reduce seed production and deplete the belowground reserves of perennial weeds.

#### **5.3.4 Chemical Control**

Chemical control methods utilize herbicides to kill or injure unwanted weeds. Over the years, numerous classes of herbicides have been synthesized that act upon different pathways within the plant to cause death or injury. In addition, some herbicides are available that have been derived from plants. The herbicide classes correspond to their mode of action: growth regulators, amino acid inhibitors, grass meristem destroyers, cell membrane destroyers, root and shoot inhibitors, and amino acid derivatives that interfere with plant metabolism.

Herbicides should be carefully selected based on the target weed species, the presence of desirable native species in the area to be treated, soil texture and pH, and environmental conditions, such as the proximity to open water, among other factors. Within the riparian corridor, selection of herbicides should be based on the least environmentally damaging

option available to effectively control noxious weeds. Consultation with a Licensed Commercial Pesticide Applicator is recommended.

## **6.0 MAINTENANCE & MONITORING FOR ADAPTIVE MANAGEMENT**

The Project Ecologist will visit the project site several times during the growing season to observe vegetation conditions, identify problematic stands of state-listed noxious weeds and other invasive species, and provide recommendations for integrated weed management. In addition, the Ecologist will check the health of any restoration areas and the native plantings in the natural areas and will provide recommendations to promote the long-term health of the riparian corridor. The Ecologist will look for social trail formation, vegetation trampling, and any other problems from humans, pets, or wildlife use. If there are bare areas, they will be re-seeded or replanted. If social trails become problematic, strategic plantings, signage, temporary fencing, and/or other means will be evaluated to re-direct foot traffic and restore native vegetation. The Ecologist will provide regular feedback to the Homeowner's Association throughout the growing season, to facilitate adaptive management and assist with implementing the recommendations.

## 7.0 TABLES

**TABLE 1. RECOMMENDED NATIVE PLANTS**  
**Eagle River Riparian Corridor**  
**Red Mountain Ranch**

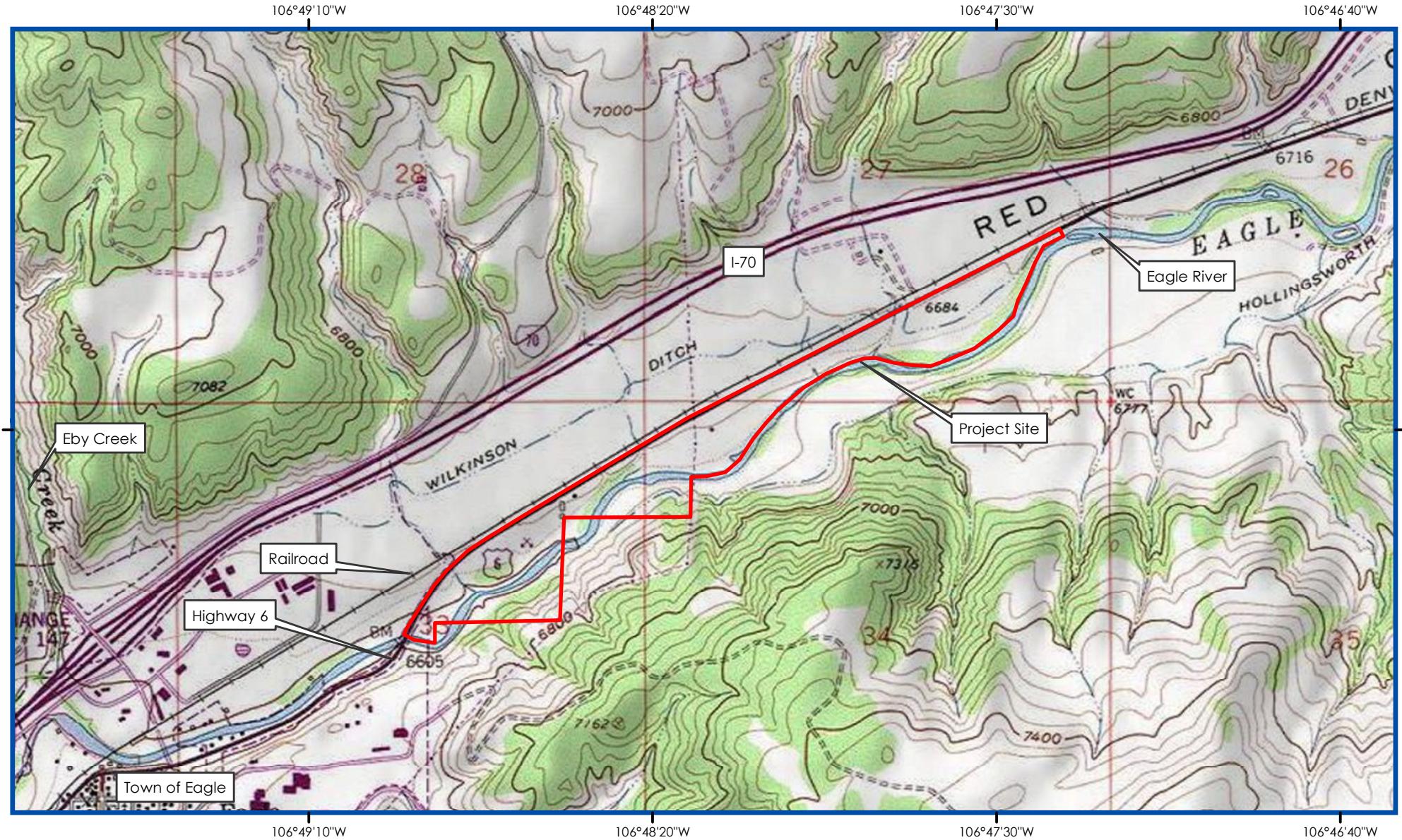
SCIENTIFIC NAME	COMMON NAME	FAMILY
<b>Trees</b>		
<i>Juniperus scopulorum</i>	Rocky Mountain Juniper	Cupressaceae
<i>Picea pungens</i>	Blue spruce	Pinaceae
<i>Populus angustifolia</i>	Narrowleaf cottonwood	Salicaceae
<i>Populus balsamifera</i>	Balsam poplar	Salicaceae
<b>Shrubs</b>		
<i>Alnus incana</i> ssp. <i>tenuifolia</i>	Thinleaf alder	Betulaceae
<i>Amelanchier alnifolia</i>	Serviceberry	Rosaceae
<i>Artemesia tridentata</i> var. <i>tridentata</i>	Big sagebrush	Asteraceae
<i>Betula occidentalis</i> ( <i>B. fontinalis</i> )	River birch	Betulaceae
<i>Cercocarpus montanus</i>	Mountain mahogany	Rosaceae
<i>Chrysothamnus parryi</i>	Parry's rabbitbrush	Asteraceae
<i>Cornus sericea</i> ( <i>C. stolonifera</i> )	Redosier dogwood	Cornaceae
<i>Crataegus rivularis</i>	River hawthorn	Rosaceae
<i>Distegia involucrata</i>	Bush honeysuckle	Caprifoliaceae
<i>Prunus virginiana</i> var. <i>melanocarpa</i>	Choke cherry	Rosaceae
<i>Purshia tridentata</i>	Bitterbrush	Rosaceae
<i>Rhus trilobata</i>	Skunk brush	Anacardiaceae
<i>Ribes aureum</i>	Yellow currant	Grossulariaceae
<i>Ribes inerme</i>	Whitestem gooseberry	Grossulariaceae
<i>Rosa woodsii</i>	Woods' rose	Rosaceae
<i>Salix bebbiana</i>	Bebb willow	Salicaceae
<i>Salix exigua</i>	Sandbar willow	Salicaceae
<i>Salix lasiandra</i> var. <i>caudata</i>	Whiplash willow	Salicaceae
<i>Salix monticola</i>	Mountain willow	Salicaceae
<i>Shepherdia argentea</i>	Silver buffaloberry	Elaeagnaceae
<b>Woody Vines</b>		
<i>Clematis ligusticifolia</i>	Virgin's Bower	Ranunculaceae

**TABLE 2. NOXIOUS AND INVASIVE PLANTS OF CONCERN**  
**Eagle River Riparian Corridor**  
**Red Mountain Ranch**

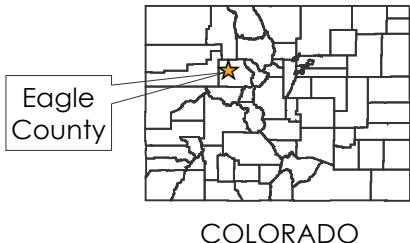
SCIENTIFIC NAME	COMMON NAME	FAMILY	ORIGIN*	NOXIOUS WEED STATUS
<b>Trees</b>				
<i>Elaeagnus angustifolia</i>	Russian olive	Elaeagnaceae	I+	B
<i>Ulmus pumila</i>	Siberian elm	Ulmaceae	I+	C
<b>Shrubs</b>				
<i>Tamarix ramosissima</i> ( <i>T. chinensis</i> )	Tamarisk	Tamaricaceae	I+	B
<b>Perennial Forbs</b>				
<i>Acroptilon repens</i>	Russian knapweed	Asteraceae	I+	B
<i>Cardaria draba</i>	White top	Brassicaceae	I+	B
<i>Cirsium arvense</i>	Canada thistle	Asteraceae	I+	B
<i>Convolvulus arvensis</i>	Field bindweed	Convolvulaceae	I+	C
<i>Leucanthemum vulgare</i>	Ox-eye daisy	Asteraceae	I+	B
<i>Medicago lupulina</i>	Black medic	Fabaceae	I	
<i>Rumex crispus</i>	Curly dock	Polygonaceae	I	
<b>Annual/Biennial Graminoids</b>				
<i>Bromus tectorum</i>	Cheatgrass	Poaceae	I+	C
<b>Annual/Biennial Forbs</b>				
<i>Arctium minus</i>	Common burdock	Asteraceae	I+	C
<i>Carduus acanthoides</i>	Plumeless thistle	Asteraceae	I+	B
<i>Carduus nutans</i>	Musk thistle	Asteraceae	I+	B
<i>Chenopodium album</i>	Lamb's quarters	Chenopodiaceae	I	
<i>Chorispora tenella</i>	Purple mustard	Brassicaceae	I	
<i>Cynoglossum officinale</i>	Houndstongue	Boraginaceae	I+	B
<i>Descurainia sophia</i>	Flixweed	Brassicaceae	I	
<i>Kochia scoparia</i>	Kochia	Chenopodiaceae	I	
<i>Lactuca serriola</i>	Prickly lettuce	Asteraceae	I	
<i>Lepidium perfoliatum</i>	Clasping peppergrass	Brassicaceae	I	
<i>Melilotus albus</i>	White sweet clover	Fabaceae	I	
<i>Melilotus officinalis</i>	Yellow sweet clover	Fabaceae	I	
<i>Onopordum acanthium</i>	Scotch thistle	Asteraceae	I+	B
<i>Salsola australis</i> ( <i>S. iberica</i> )	Russian thistle	Chenopodiaceae	I	
<i>Sisymbrium altissimum</i>	Tumble mustard	Brassicaceae	I	
<i>Sonchus arvensis</i>	Perennial sow thistle	Asteraceae	I+	C
<i>Verbascum thapsus</i>	Great mullein	Scrophulariaceae	I+	C

\*Origin: N = Native; I= Introduced; I+ = Colorado State Noxious Weed

## 8.0 FIGURES



BASE: USGS 7.5' Eagle Quadrangle, Colorado



#### LEGEND

Red Mountain Ranch Boundary



1:24,000

0 600 1,200 2,400  
Feet

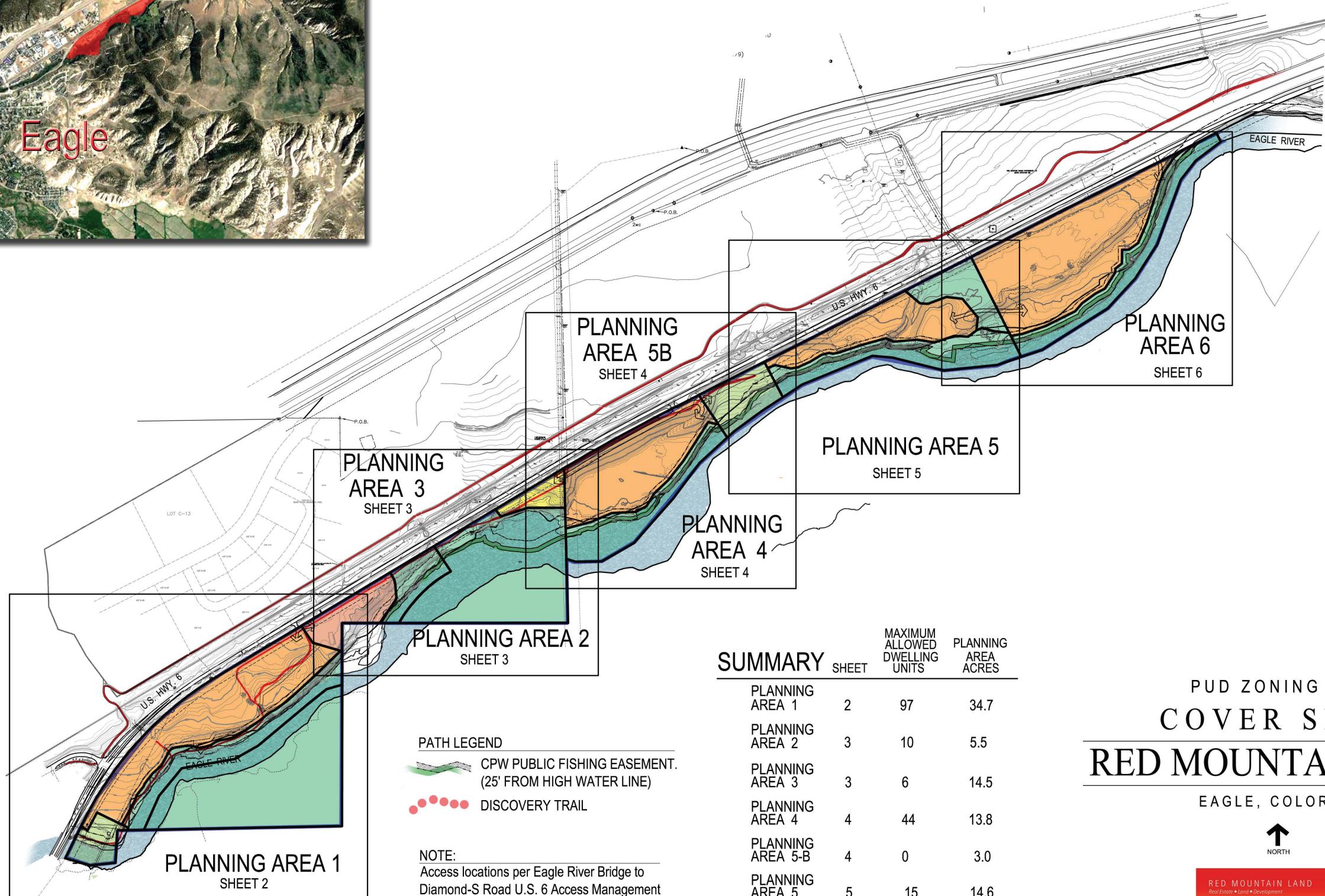
**Figure 1. Project Location Map  
Red Mountain Ranch  
Eagle Colorado**

October 2024

Prepared by:



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PUD ZONING PLAN  
COVER SHEET  
RED MOUNTAIN RANCH  
EAGLE, COLORADO



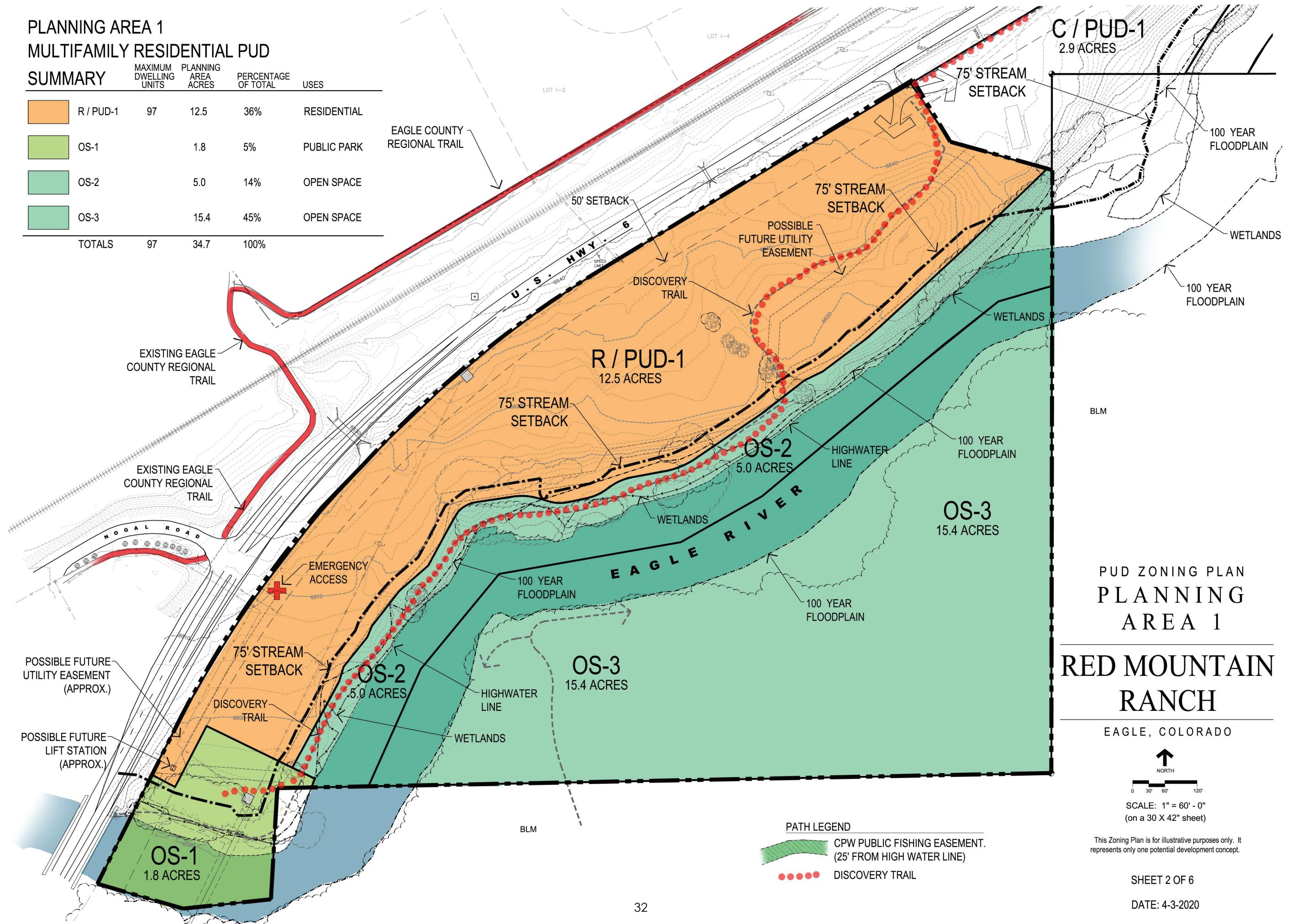
This Zoning Plan is for illustrative purposes only. It represents only one potential development concept.

SHEET 1 OF 6

## PLANNING AREA 1 MULTIFAMILY RESIDENTIAL PUD

## SUMMARY

SUMMARY	MAXIMUM DWELLING UNITS	PLANNING AREA ACRES	PERCENTAGE OF TOTAL	USES
R / PUD-1	97	12.5	36%	RESIDENTIAL
OS-1		1.8	5%	PUBLIC PARK
OS-2		5.0	14%	OPEN SPACE
OS-3		15.4	45%	OPEN SPACE
TOTALS	97	34.7	100%	



This Zoning Plan is for illustrative purposes only. It represents only one potential development concept.

SHEET 2 OF 6

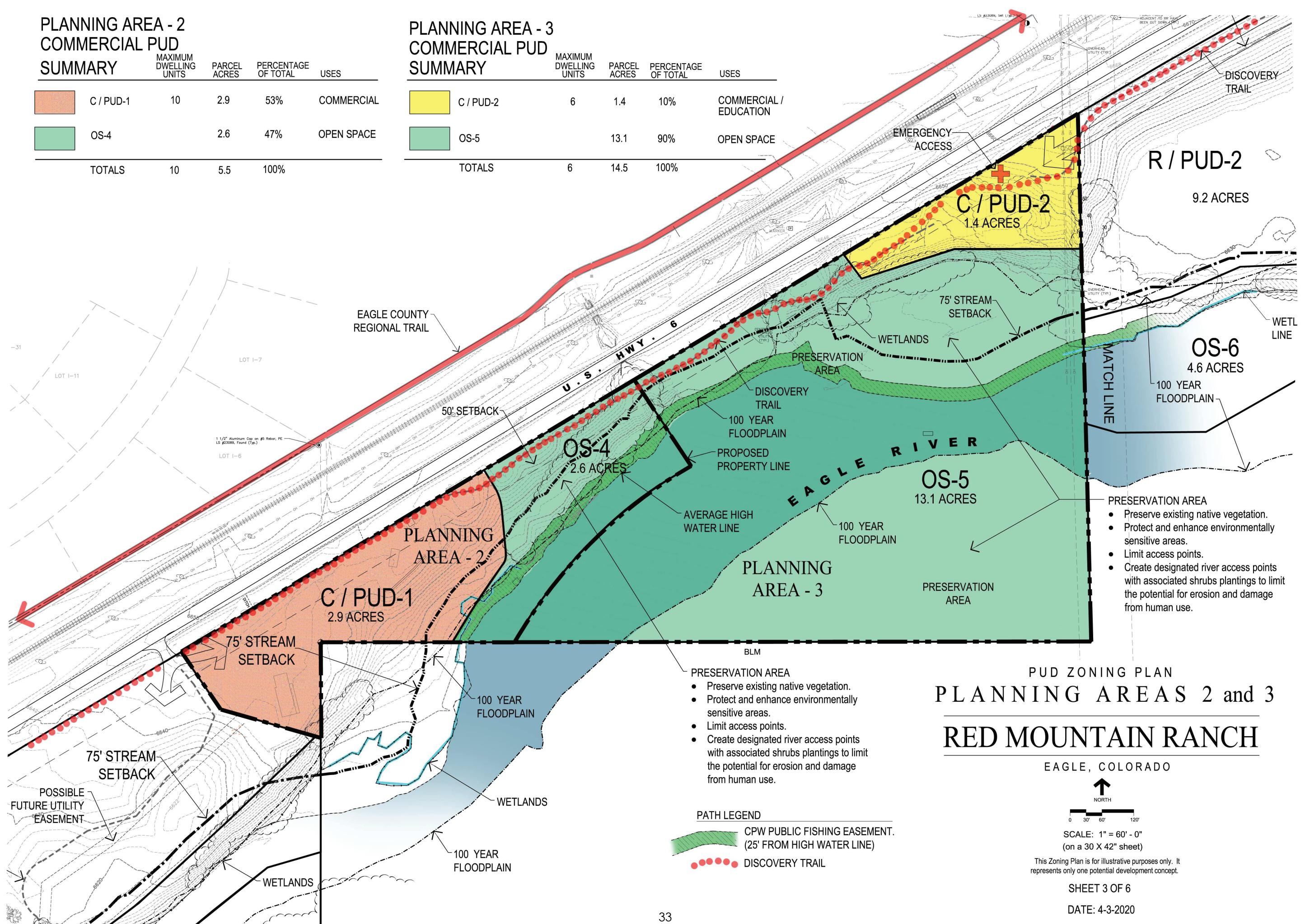
DATE: 4-3-2020

PLANNING AREA - 2  
COMMERCIAL PUD  
SUMMARY

	MAXIMUM DWELLING UNITS	PARCEL ACRES	PERCENTAGE OF TOTAL	USES
C / PUD-1	10	2.9	53%	COMMERCIAL
OS-4		2.6	47%	OPEN SPACE
TOTALS	10	5.5	100%	

PLANNING AREA - 3  
COMMERCIAL PUD  
SUMMARY

	MAXIMUM DWELLING UNITS	PARCEL ACRES	PERCENTAGE OF TOTAL	USES
C / PUD-2	6	1.4	10%	COMMERCIAL / EDUCATION
OS-5		13.1	90%	OPEN SPACE
TOTALS	6	14.5	100%	

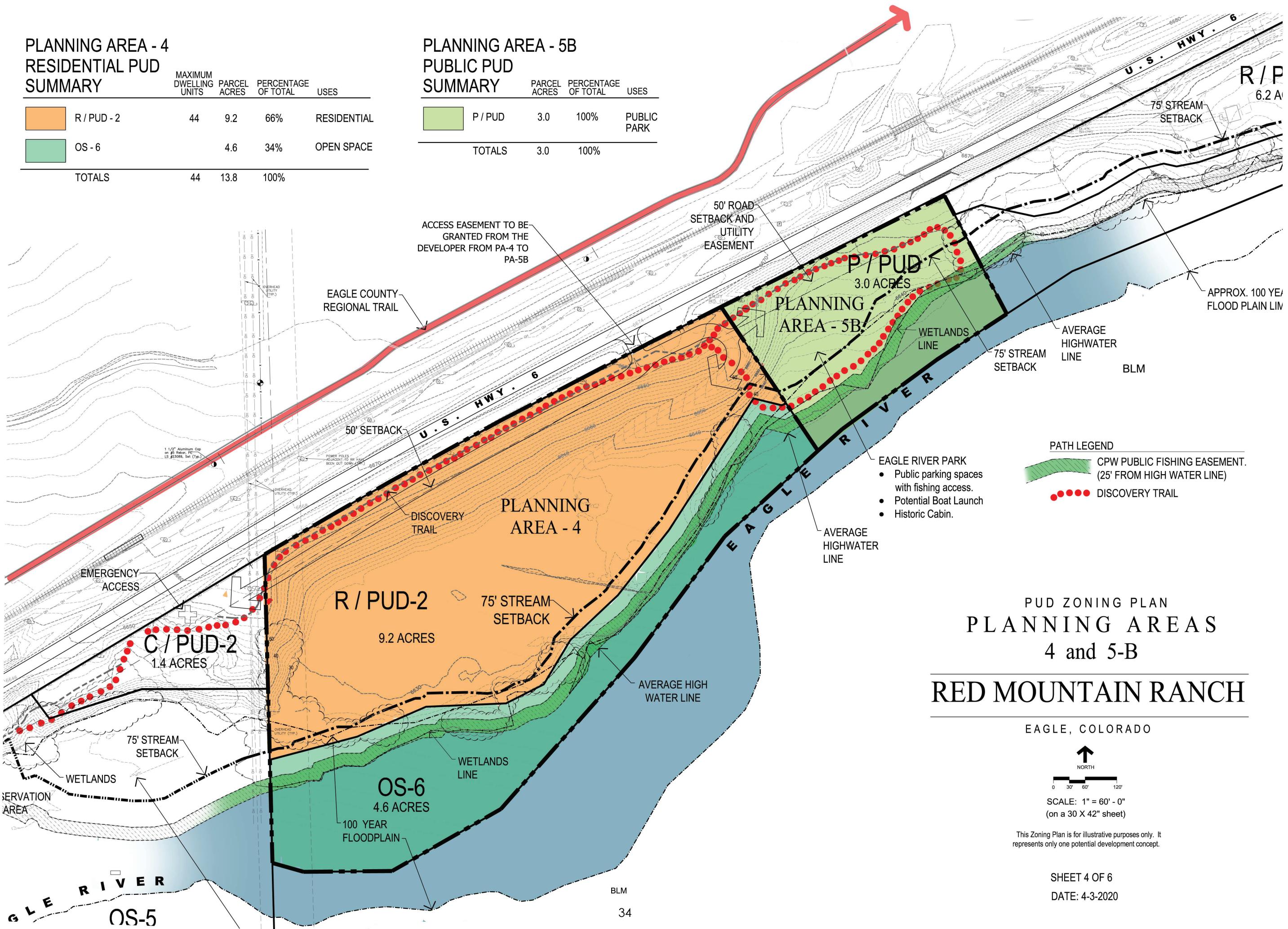


## PLANNING AREA - 4 RESIDENTIAL PUD SUMMARY

RESIDENTIAL PUD SUMMARY		MAXIMUM DWELLING UNITS	PARCEL ACRES	PERCENTAGE OF TOTAL	USES
	R / PUD - 2	44	9.2	66%	RESIDENTIAL
	OS - 6		4.6	34%	OPEN SPACE
	TOTALS	44	13.8	100%	

## PLANNING AREA - 5B PUBLIC PUD SUMMARY

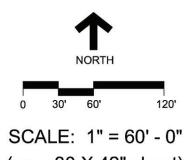
PROJECT SUMMARY		PARCEL ACRES	PERCENTAGE OF TOTAL	USES
	P / PUD	3.0	100%	PUBLIC PARK
	TOTALS	3.0	100%	



PUD ZONING PLAN  
PLANNING AREAS  
4 and 5-B

## RED MOUNTAIN RANCH

## EAGLE, COLORADO



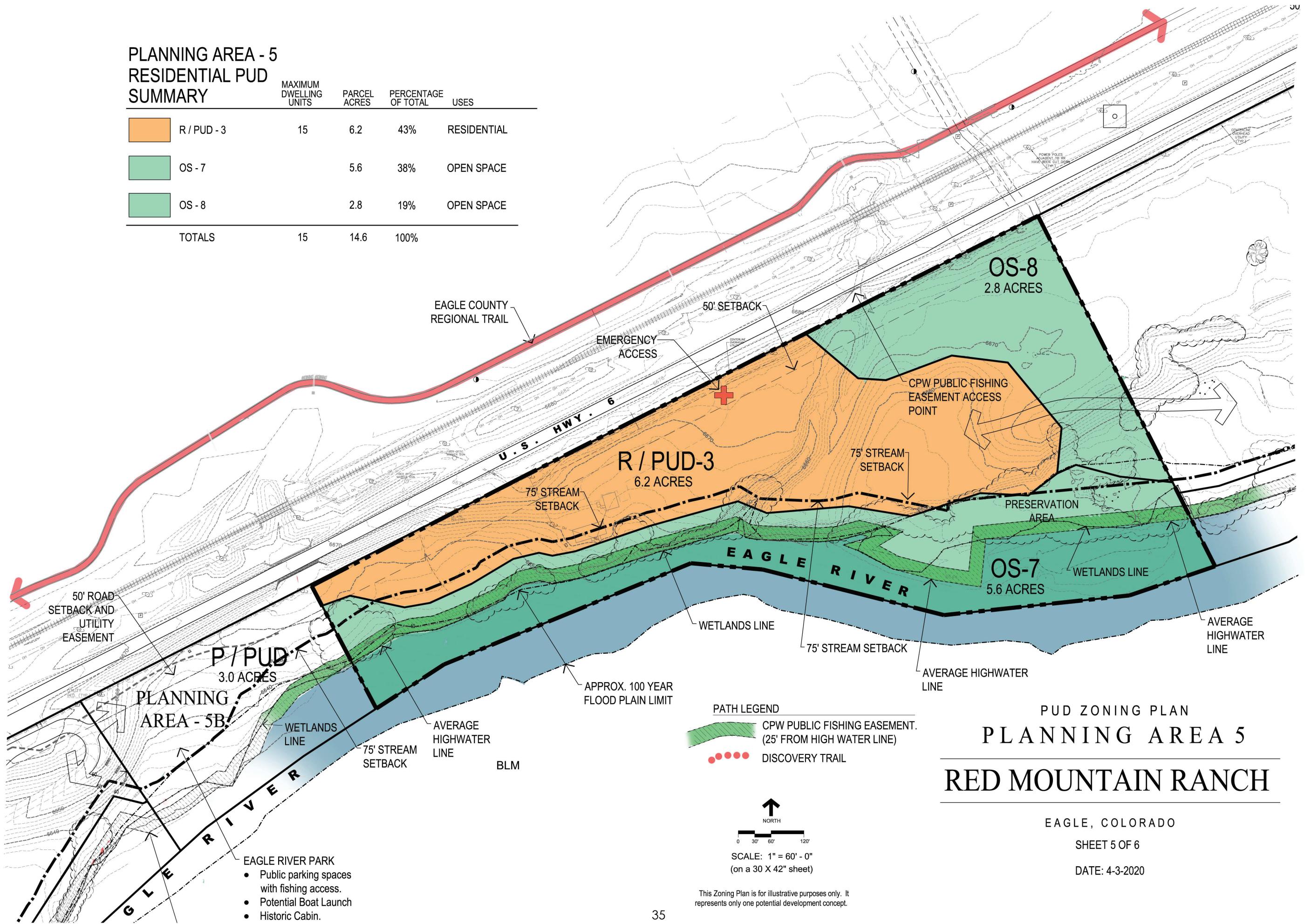
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SHEET 4 OF 6  
DATE: 4.3.2020

## PLANNING AREA - 5 RESIDENTIAL PUD SUMMARY

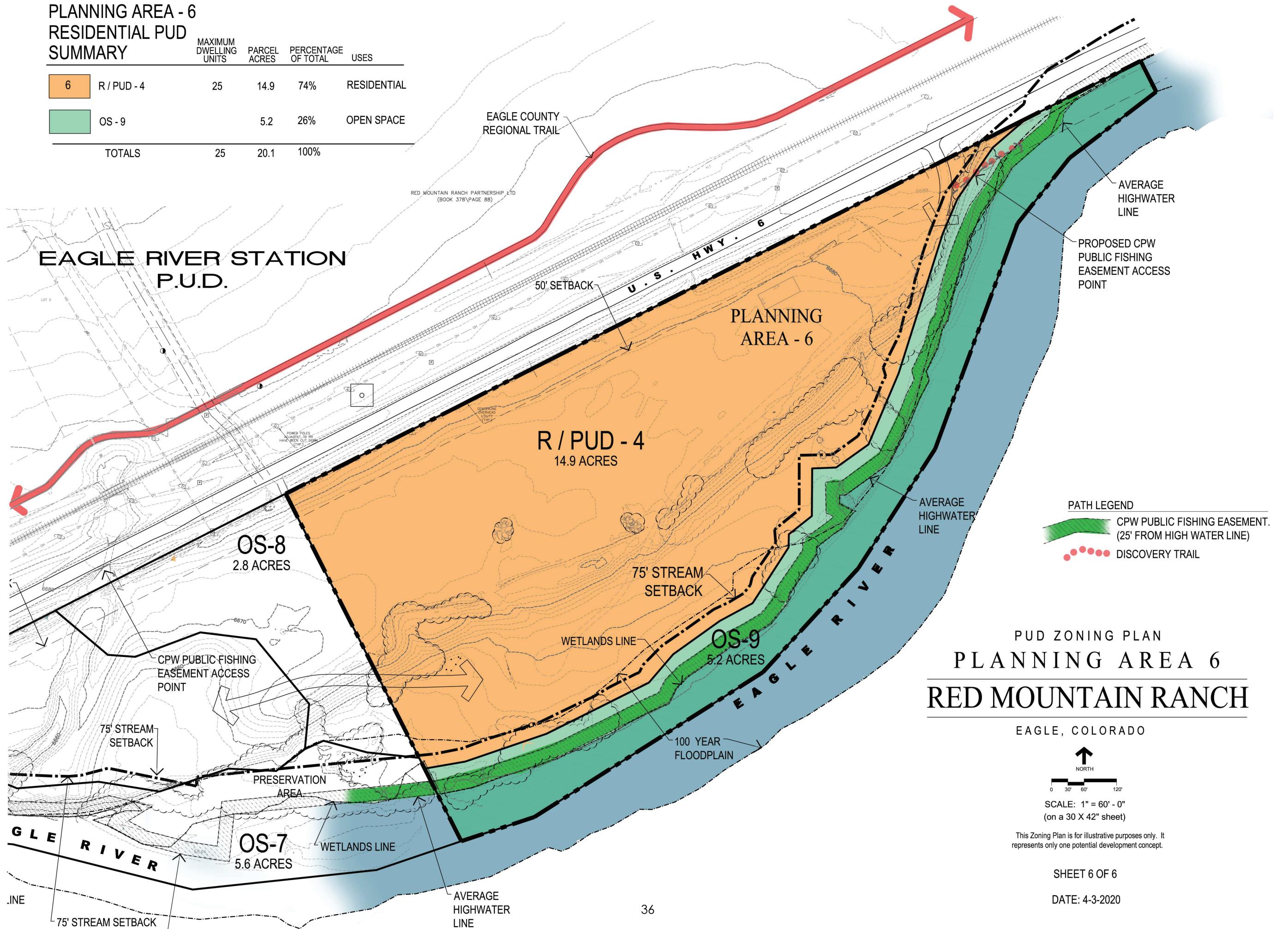
RESIDENTIAL PUD SUMMARY		MAXIMUM DWELLING UNITS	PARCEL ACRES	PERCENTAGE OF TOTAL	USES
	R / PUD - 3	15	6.2	43%	RESIDENTIAL
	OS - 7		5.6	38%	OPEN SPACE
	OS - 8		2.8	19%	OPEN SPACE
	TOTALS	15	14.6	100%	

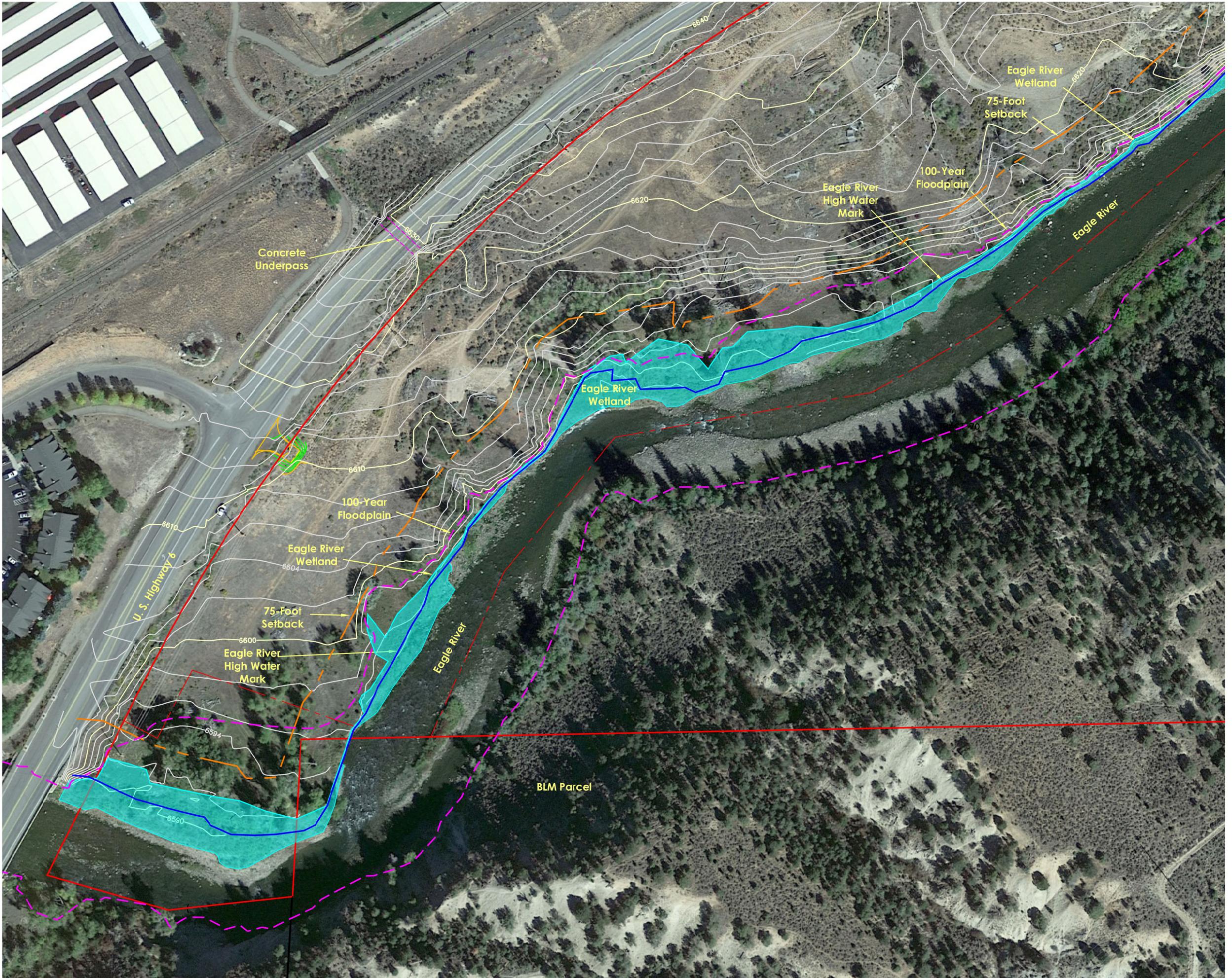


This Zoning Plan is for illustrative purposes only and represents only one potential development concept.

PLANNING AREA - 6  
RESIDENTIAL PUD  
SUMMARY

	MAXIMUM DWELLING UNITS	PARCEL ACRES	PERCENTAGE OF TOTAL USES	
6	R / PUD - 4	25	14.9	74% RESIDENTIAL
	OS - 9		5.2	26% OPEN SPACE
TOTALS		25	20.1	100%





**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 1 of 7**

**LEGEND:**

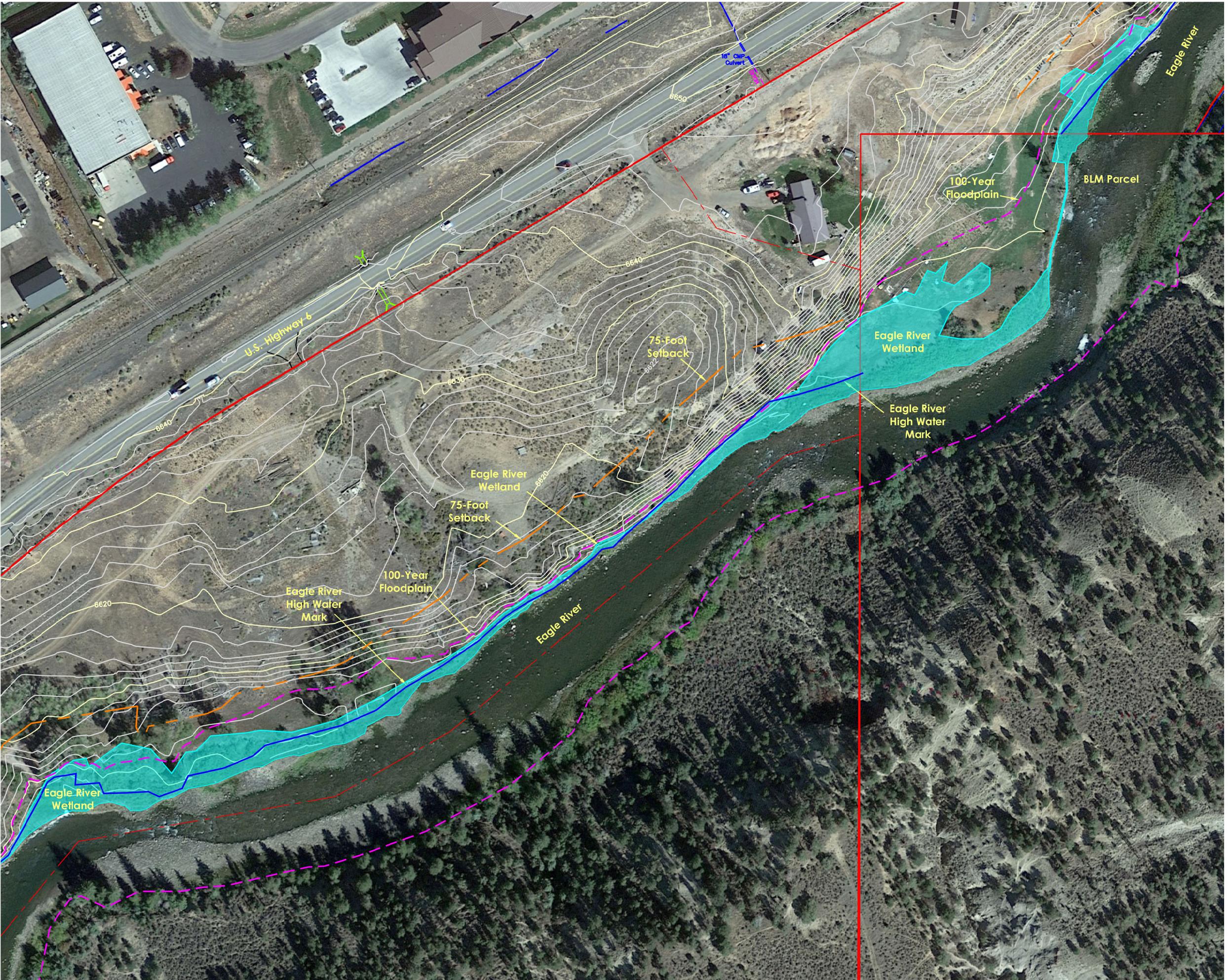
- Wetlands -- Delineated in 2015
- Eagle River High Water Mark
- 100-Year Floodplain Limits
- 75-Foot Setback
- Property Boundary
- Planning Area Boundaries
- Existing Contours
- Proposed Contours



Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:



**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 2 of 7**

**LEGEND:**

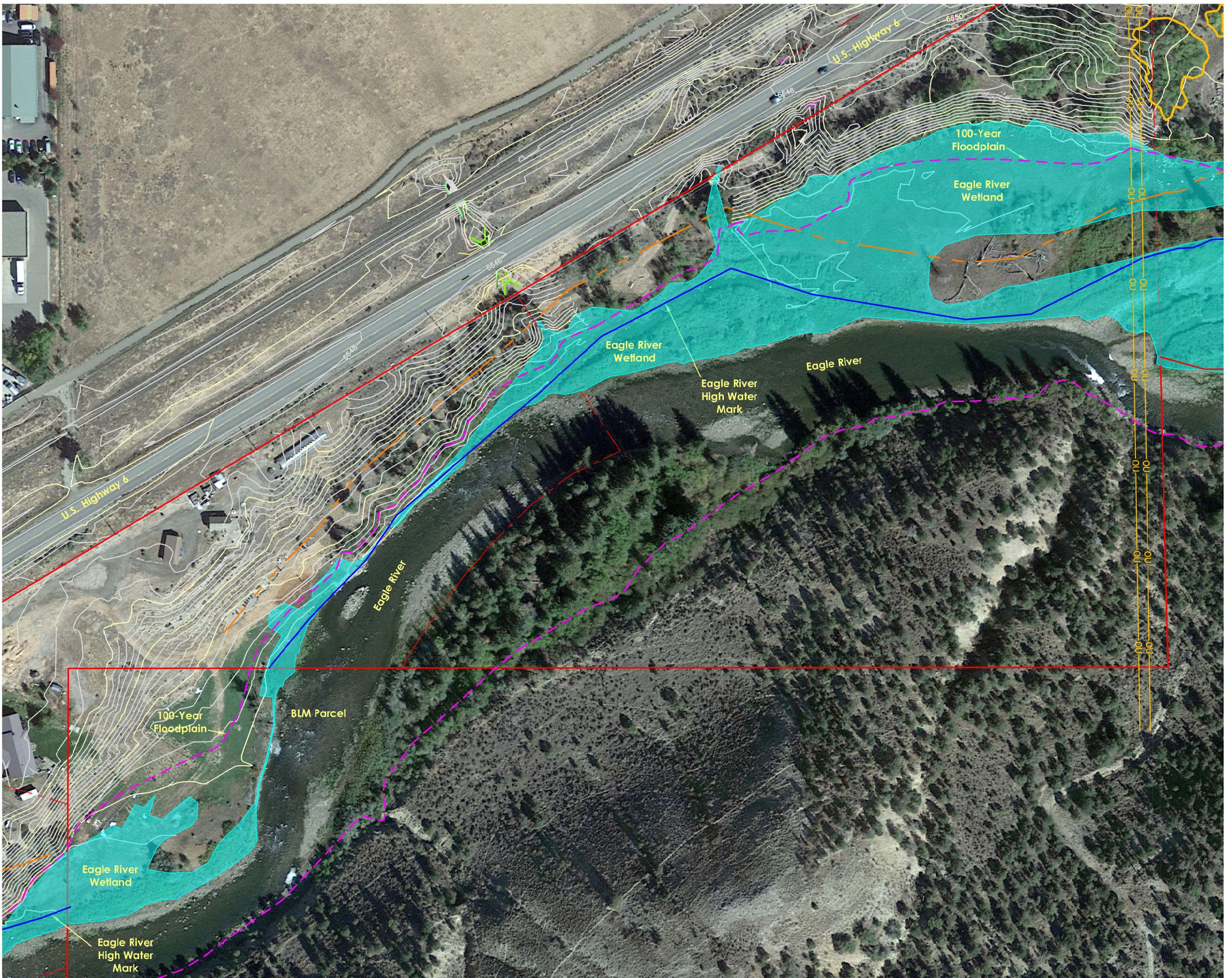
- Wetlands -- Delineated in 2015
- Eagle River High Water Mark
- 100-Year Floodplain Limits
- 75-Foot Setback
- Property Boundary
- Planning Area Boundaries
- Existing Contours
- Proposed Contours

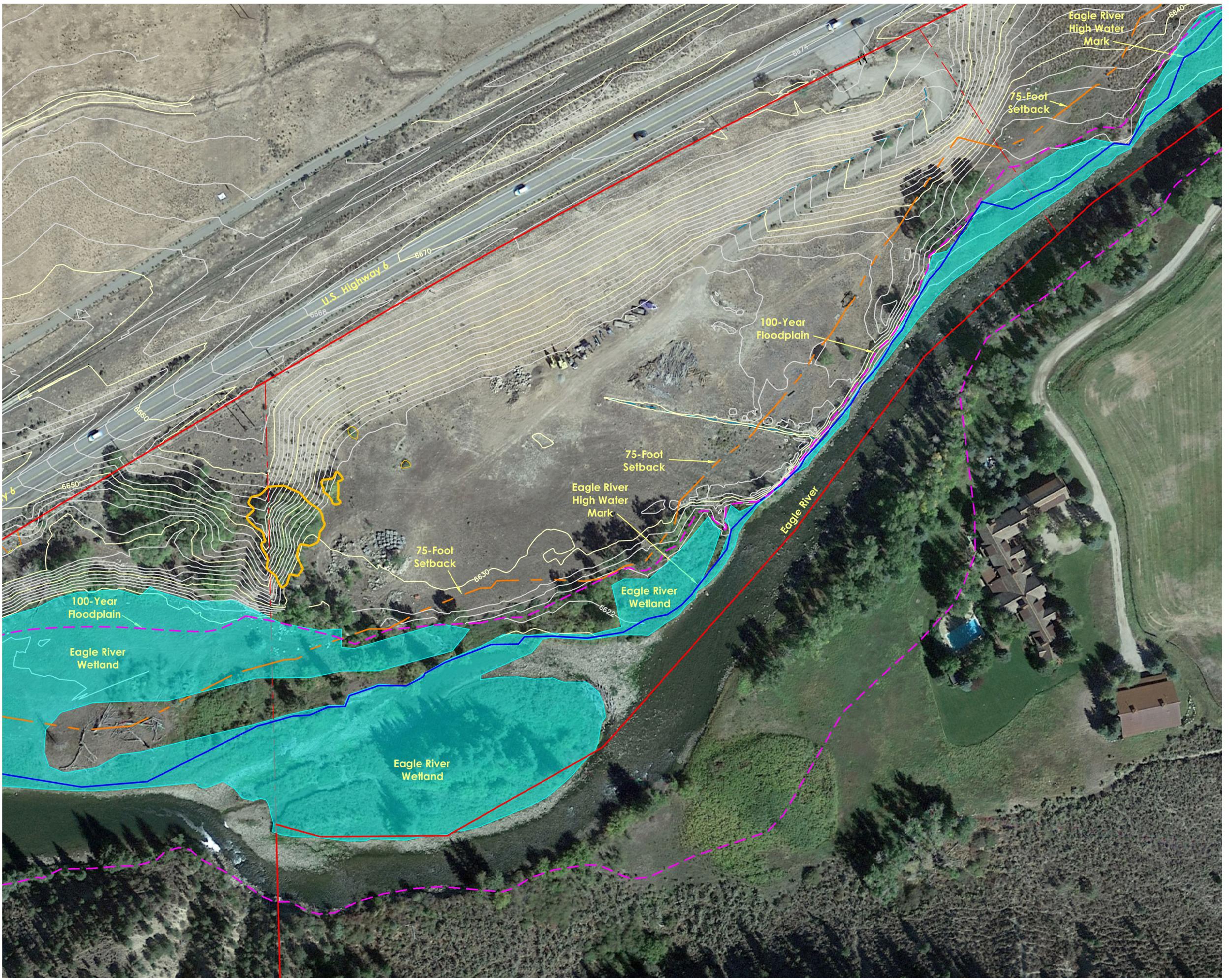


Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:





**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 4 of 7**

**LEGEND:**

- Wetlands -- Delineated in 2013 & 2015
- Eagle River High Water Mark
- 100-Year Floodplain Limits
- 75-Foot Setback
- Property Boundary
- Planning Area Boundaries
- Existing Contours
- Proposed Contours



Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:



**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 5 of 7**



**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 6 of 7**



Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

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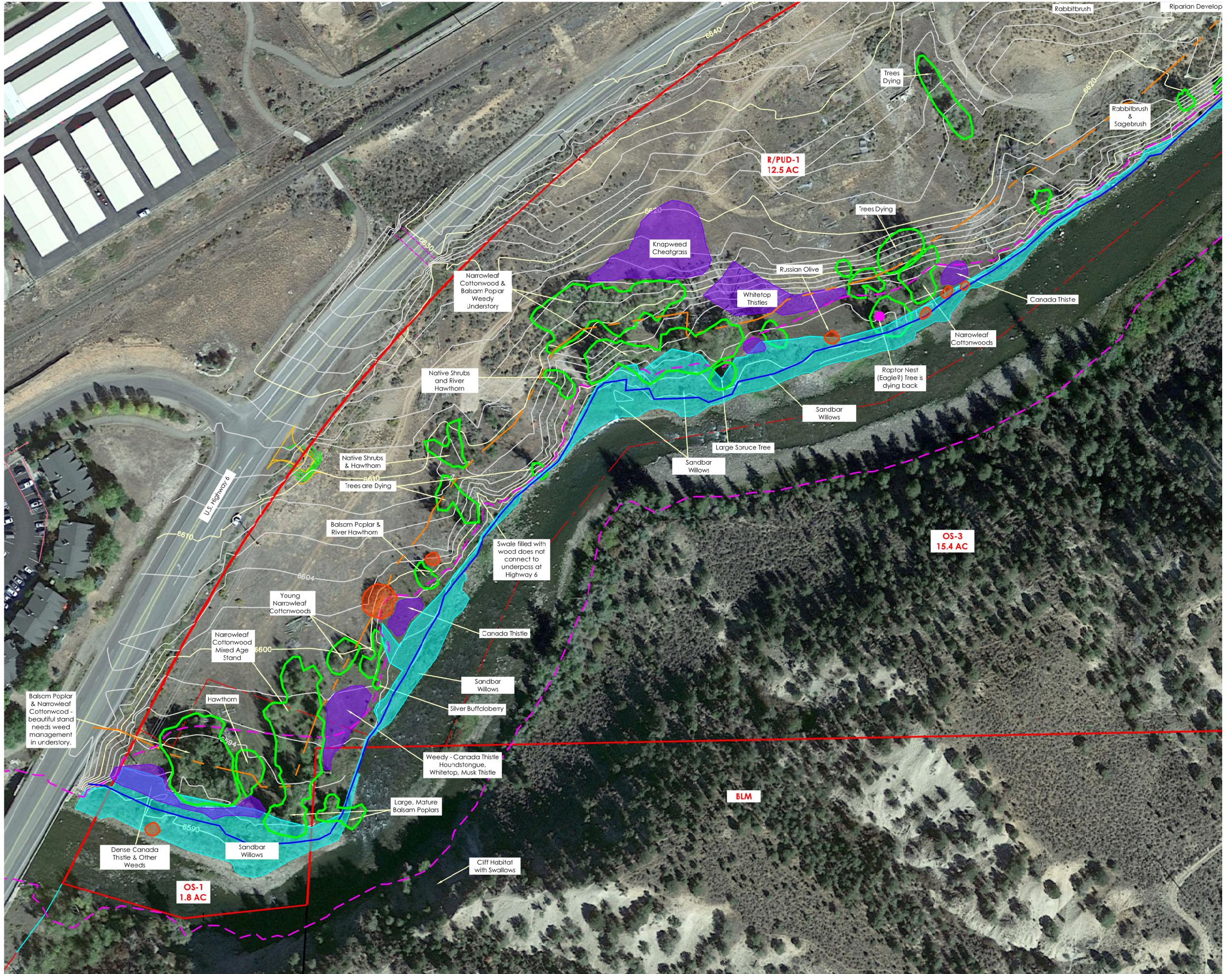


**Figure 3. Wetland Map**  
**Red Mountain Ranch**  
**Sheet 7 of 7**



Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.



**Figure 4. Riparian Corridor  
Existing Conditions  
Red Mountain Ranch  
Sheet 1 of 7**

## **LEGEND:**

-  Weed Dominated Areas
-  Russian Olive Trees to Remove
-  Native Tree Canopy
-  Wetland Boundary
-  Eagle River High Water Mark
-  100-Year Floodplain Limits
-  75-Foot Setback
-  Property Boundary



Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

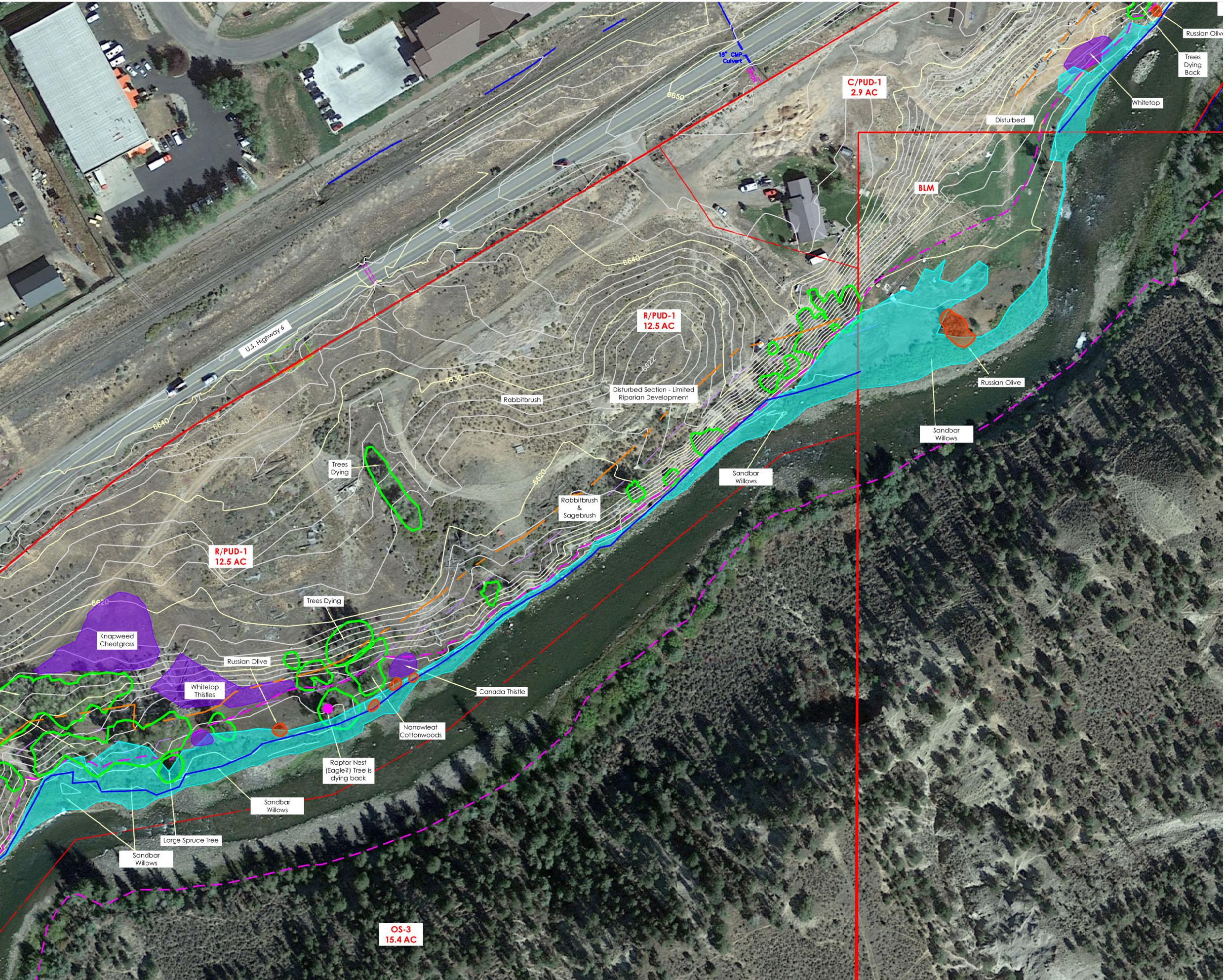
Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:

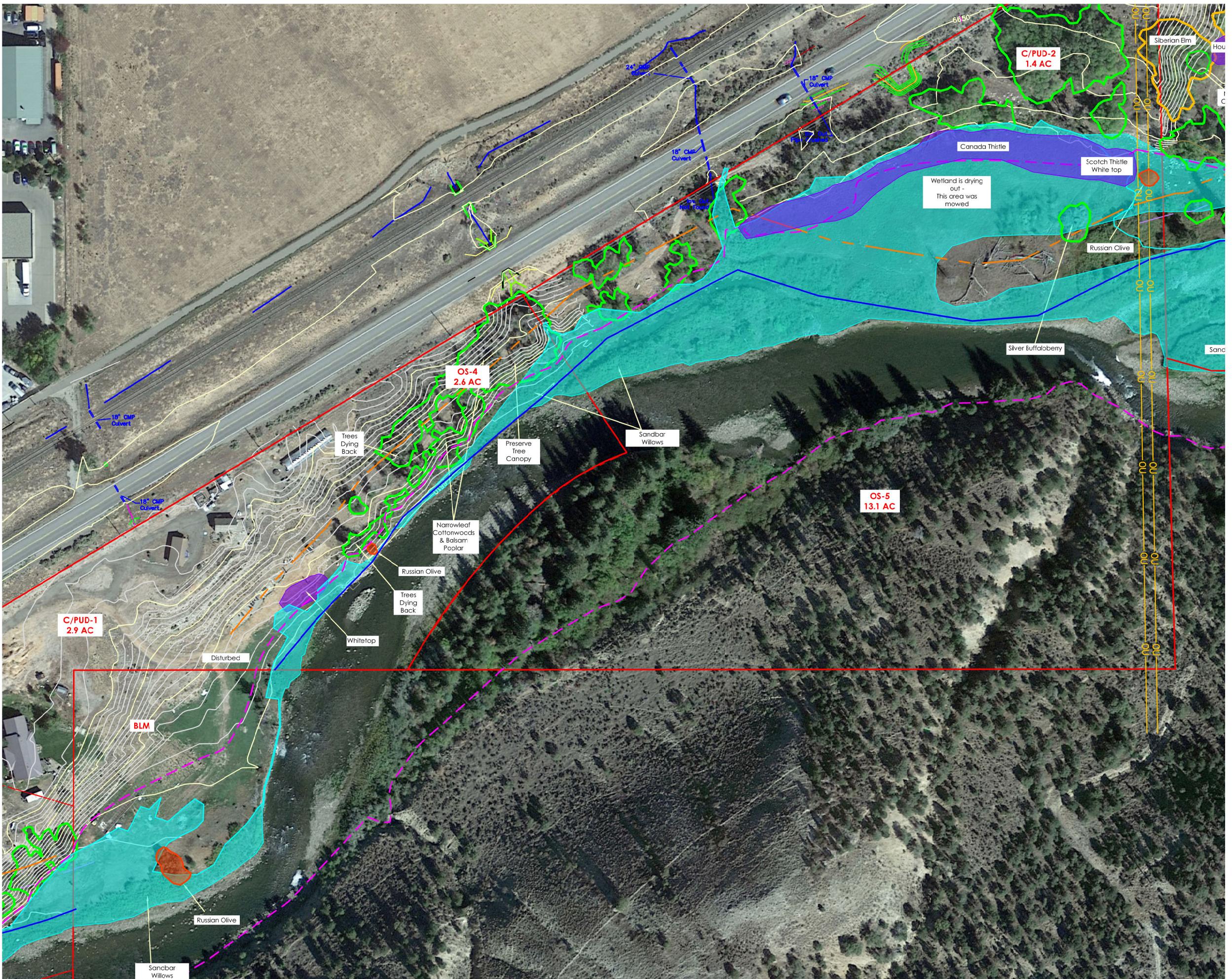


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**Figure 4. Riparian Corridor Existing Conditions  
Red Mountain Ranch  
Sheet 2 of 7**



prepared by:



**Figure 4. Riparian Corridor Existing Conditions Red Mountain Ranch Sheet 3 of 7**

**LEGEND:**

- Weed Dominated Areas
- Russian Olive Trees to Remove
- Native Tree Canopy
- Wetland Boundary
- Eagle River High Water Mark
- - - 100-Year Floodplain Limits
- - - 75-Foot Setback
- Property Boundary

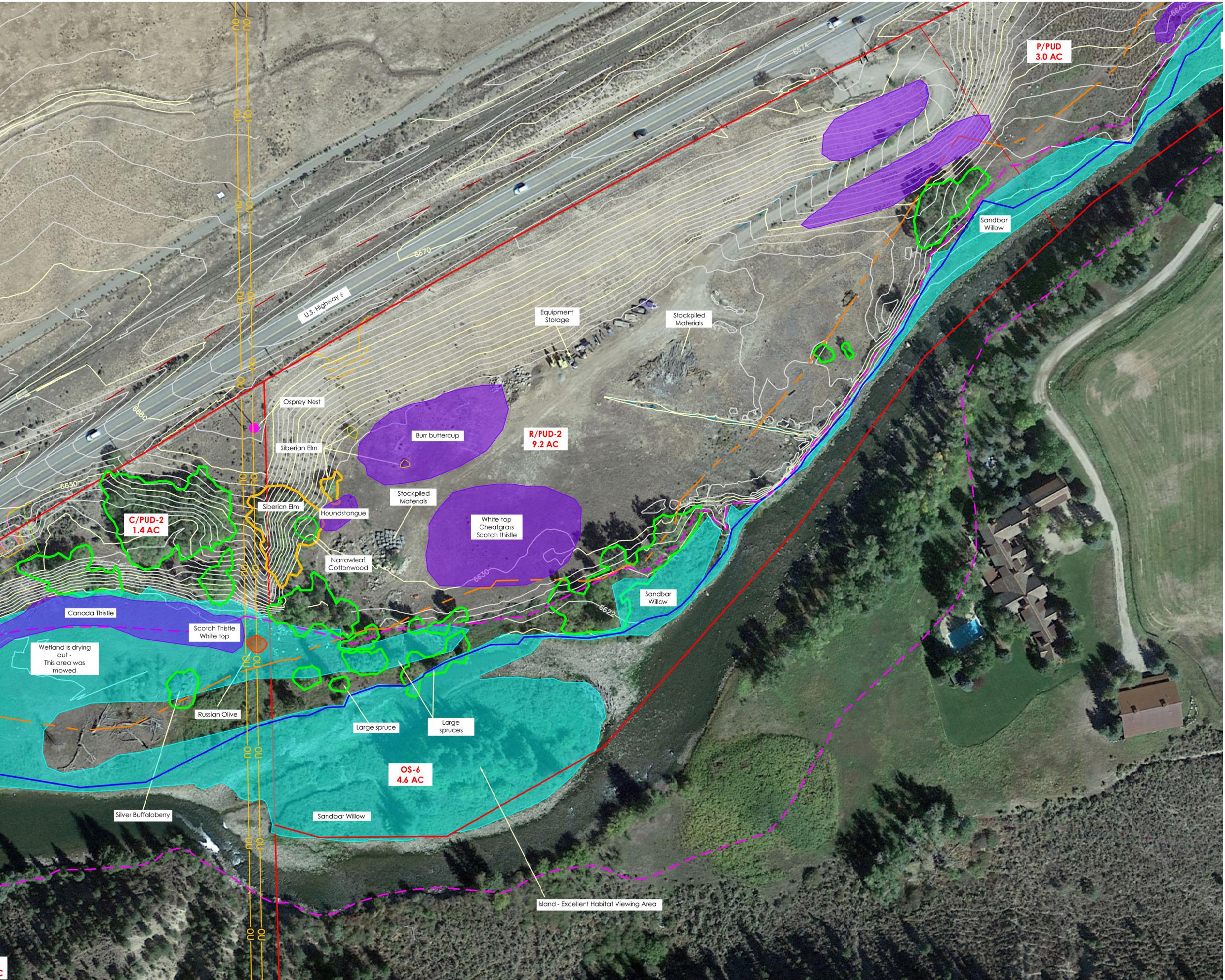


Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

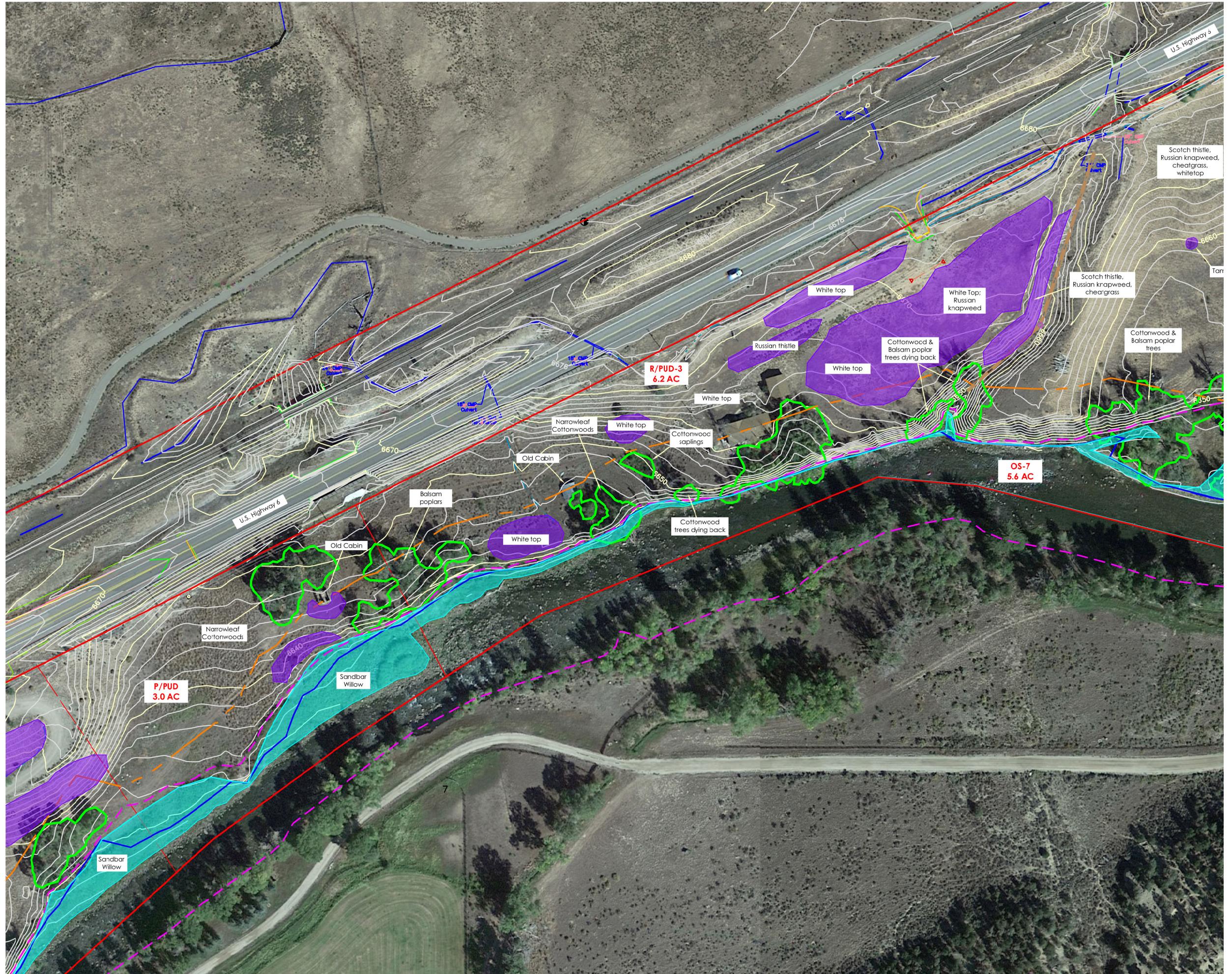
Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:

**Figure 4. Riparian Corridor Existing Conditions  
Red Mountain Ranch  
Sheet 4 of 7**



prepared by:



**Figure 4. Riparian Corridor  
Existing Conditions  
Red Mountain Ranch  
Sheet 5 of 7**

## **LEGEND:**

-  Weed Dominated Areas
-  Russian Olive Trees to Remove
-  Native Tree Canopy
-  Wetland Boundary
-  Eagle River High Water Mark
-  100-Year Floodplain Limits
-  75-Foot Setback
-  Property Boundary



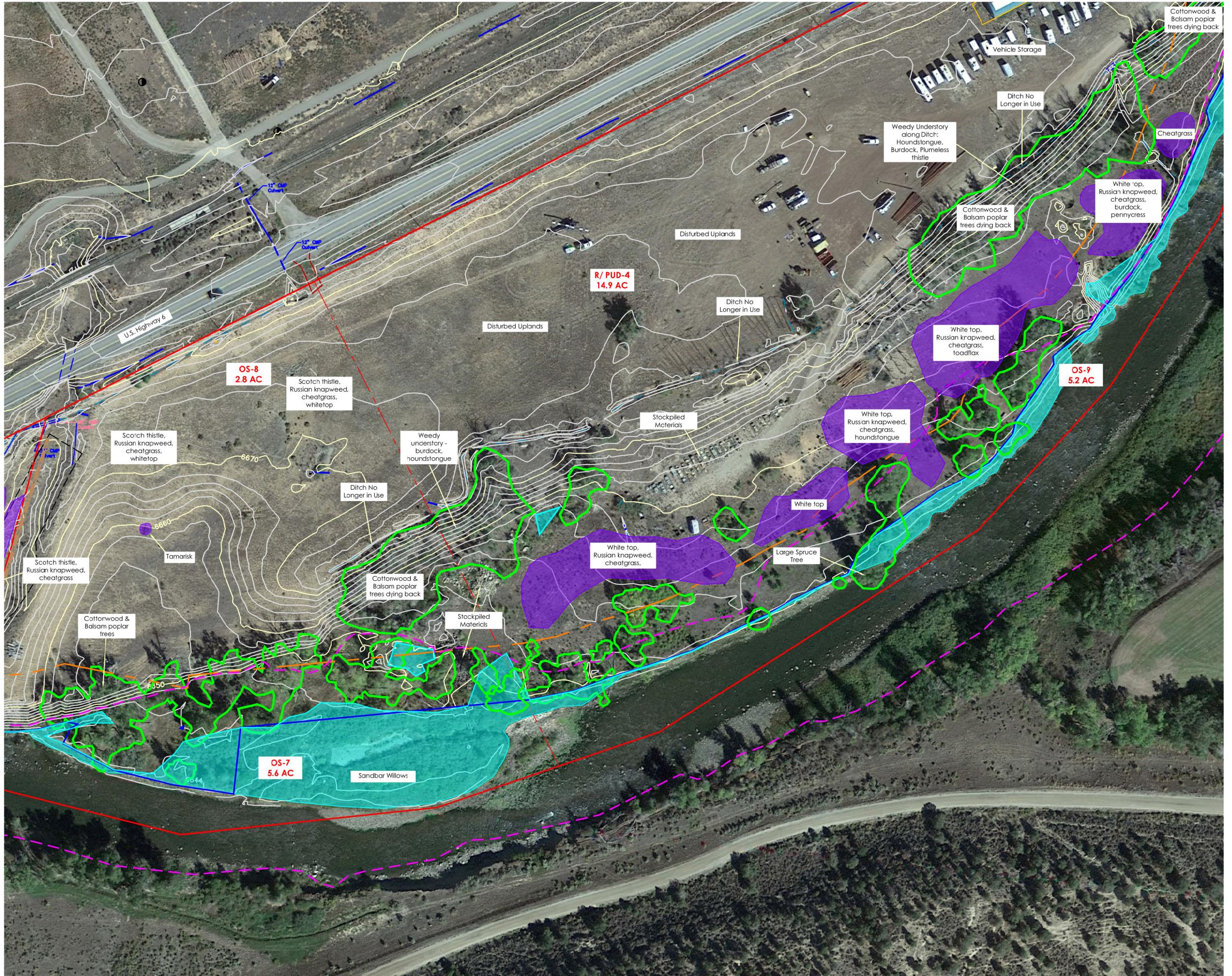
Date: June 2024  
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**Figure 4. Riparian Corridor  
Existing Conditions  
Red Mountain Ranch  
Sheet 6 of 7**

## **LEGEND:**

- Weed Dominated Areas
- Russian Olive Trees to Remove
- Native Tree Canopy
- Wetland Boundary
- Eagle River High Water Mark
- - - 100-Year Floodplain Limits
- - - 75-Foot Setback
- Property Boundary



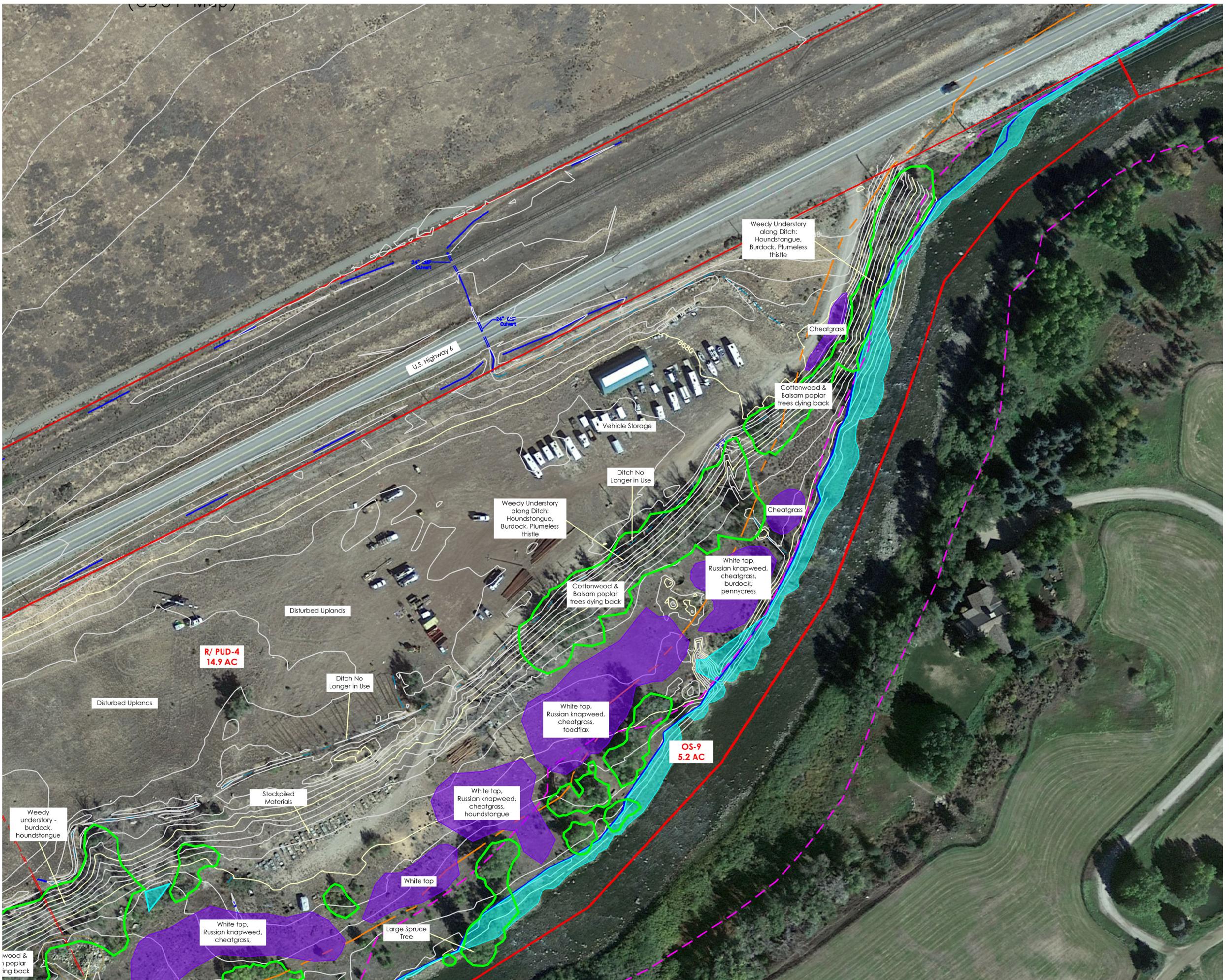
Date: June 2024  
Contour Interval = 2 ft  
Scale: 1 in = 125 ft

Please note, wetland boundaries have not yet been reviewed and approved by the U.S. Army Corps of Engineers.

prepared by:



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**Figure 4. Riparian Corridor Existing Conditions Red Mountain Ranch Sheet 7 of 7**



Figure 5. Site Plan