

APPENDIX G  
DRAINAGE REPORT

**PUD SKETCH PLAN  
DRAINAGE REPORT**

**FOR**

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**RED MOUNTAIN RANCH  
EAGLE, COLORADO**

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**May 2017**



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DRAINAGE REPORT**

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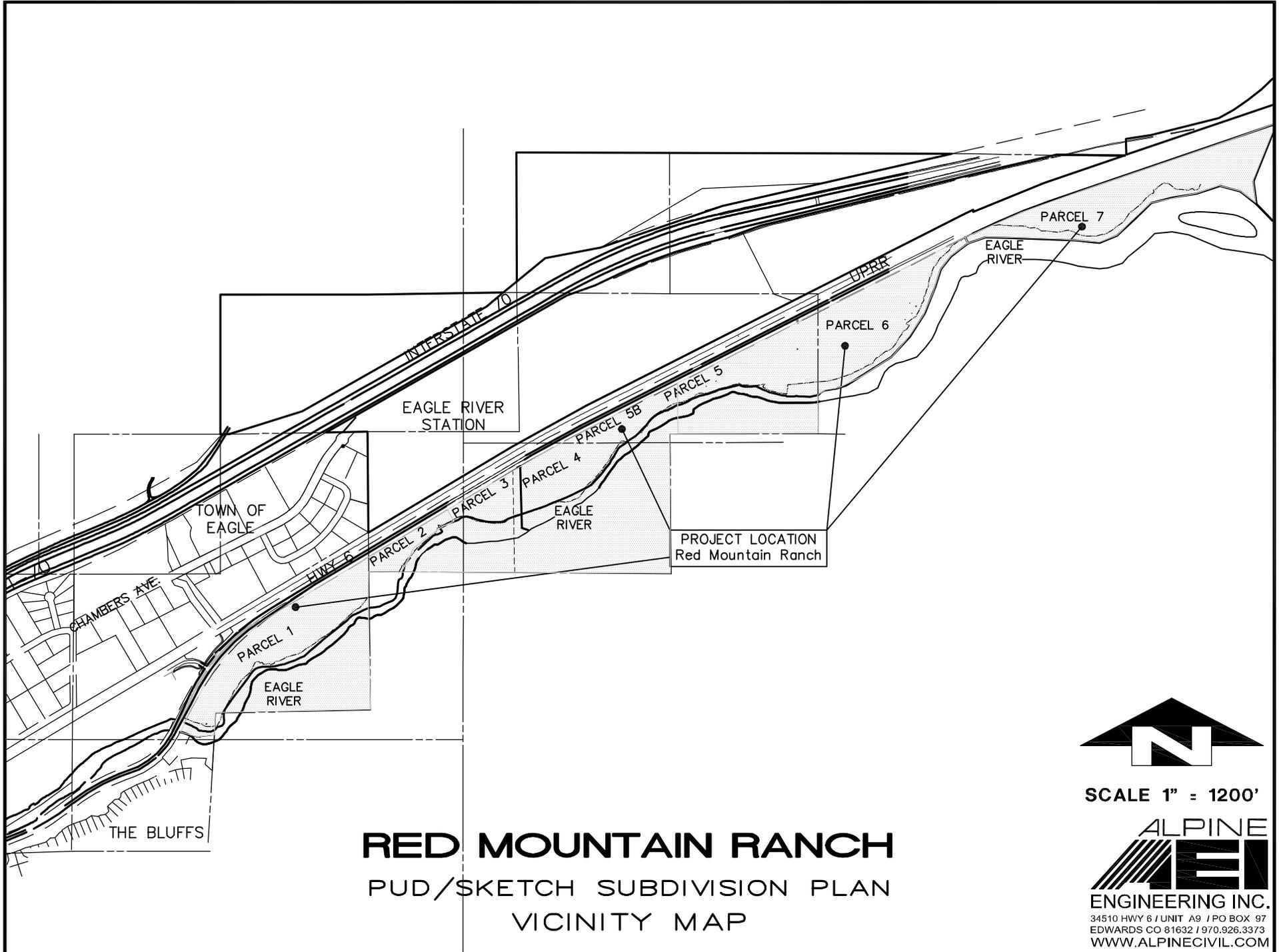
**May 2017**

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# RED MOUNTAIN RANCH

PUD/SKETCH SUBDIVISION PLAN  
VICINITY MAP



SCALE 1" = 1200'



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## **II. Introduction**

The purpose of this Conceptual Drainage Report is to summarize the existing hydrologic conditions found at the Red Mountain Ranch development site and to outline the guidelines that will be used to evaluate the historic and developed conditions for the proposed project. This report contains a general description of the planned low impact design for stormwater practices, historic drainage patterns, and methodology for calculating developed conditions flows, a discussion of typical water quality measures and anticipated Colorado Department of Public Health and Environment permits that will be acquired for the project.

The Red Mountain Ranch PUD will contain a total of 153 dwelling units, 3,200 square feet of commercial space, an environmental education center, public and private open space, active and passive parks, recreation areas and trails on 130.835 acres of land within the Town of Eagle, Eagle County, Colorado as described in the approved Red Mountain Ranch PUD Sketch Plan.

The Red Mountain Ranch drainage design will adhere to the concepts provided in the Town of Eagle – Eagle River Corridor Plan. There are recommendations in it specific to the Red Mountain Ranch area.

It is anticipated that a Riparian Management Plan will be prepared for the site. The intent of the plan will be to preserve, protect and enhance the quality and diversity of the Eagle River riparian corridor, including the wetland habitats of the floodplain of the Eagle River, protect recreational values and protect the water quality of the Eagle River.

## **III. Site Description**

The majority of the existing property is currently grasslands covered with sage and grasses as well as riparian area since all parcels have frontage on the Eagle River. There are several existing buildings on the property.

The proposed Red Mountain Ranch development is located east of Eagle on the south side of U.S. Highway 6 and adjacent to and north of the Eagle River. It is proposed to be annexed to the Town of Eagle, Colorado. The site contains several development parcels as shown on the concept plan.

Parcel 1 is the closest to the Town of Eagle and extends from the new Eagle River Bridge on Highway 6 to the east for approximately 2,000 feet. It is proposed to contain a mixed use of condominiums, 4 and 6–Plex units, townhouses, duplex and single family units. The parcel area is 34.6 acres.

Parcel 2 is called the Farm and is east of and adjacent to Parcel 1. The Farm is anticipated to be a restaurant and 6–Plex units. The Farm parcel is 5.0 acres.

Parcel 3 is east of the Farm and is a parcel that is proposed to be donated to Walking Mountains as a nature center. It will be constructed and maintained by Walking Mountains. The parcel area is 15.0 acres.

East of the Walking Mountains parcel is Parcel 4. Parcel 4 will have single family lots and open space. This development parcel is 13.7 acres.

Parcel 5B is east of Parcel 4 and is the Eagle River Park. The Eagle River Park area is 2.9 acres. The Eagle River Park will be dedicated to the Town of Eagle and is proposed to have a boat ramp to access the Eagle River.

East of Parcel 5B is Parcel 5. Parcel 5 will have single family lots and is 15.4 acres in area.

East of Parcel 5 is Parcel 6. Parcel 6 will have single family lots and is 19.2 acres in area.

Parcel 7 is east of Parcel 6. Parcel 7 will have single family lots and open space and is 24.5 acres in area.

The balance of the acreage will either be undeveloped, natural open space or more formal open space containing trails and park appurtenances.

#### **IV. Low Impact Design (LID)**

The proposed Red Mountain Ranch development will implement the sustainable practice of Low Impact Design (LID) practices where feasible. To implement sustainable LID, the Denver Urban Drainage and Flood Control District (UDFCD) four-step process will be used as a guideline for the design of stormwater facilities. The four steps include: (1) employing runoff reduction practices, (2) providing water quality capture volume (WQCV), (3) stabilizing drainageways and (4) considering industrial and commercial BMPs.

##### **1. Runoff Reduction Practices**

Runoff peaks and volumes from developed areas may be reduced by utilizing a technique called minimizing directly connected impervious areas (MDCIA). Impervious areas may be reduced and runoff from impervious surfaces will likely be directed over grass areas to slow down runoff and encourage infiltration. This may be achieved by designing some of the following: building smaller parking lots, designing taller buildings to reduce the impervious footprint, draining impervious areas over grass buffers and constructing grass swales. Benefits of reducing imperviousness include increased infiltration, decreased flow rate and volume of site runoff, decreased WQCV and WQCV facilities, reduced size of channels and detention facilities, less curb and gutter, smaller

storm sewer systems, smaller pavement areas and reduced runoff rates and volumes further downstream in the watershed. Best Management Practices (BMPs) that reduce runoff volume and peak runoff include grass buffers, grass swales, porous landscape detention and rain gardens, sand filter extended detention and constructed wetland channels.

## **2. Water Quality Capture Volume (WQCV)**

The WQCV calculations allow the engineer to determine effective impervious area and more accurately quantify potential volume reduction benefits of BMPs. The purpose of designing BMPs based on the WQCV is to improve runoff water quality and reduce hydromodification and the associated impacts on receiving waters. Stormwater quality capture volume should be released slowly to achieve long-term settling of sediment and pollutants. Types of potential BMPs that provide treatment of the WQCV are porous landscape detention, extended detention basins and sand filter extended detention basins.

## **3. Stabilize Drainageways**

Developed areas increase stormwater runoff. Natural drainageways are subject to bed and bank erosion where development occurs. Therefore, it is important to stabilize drainageways that receive flows from development.

## **4. Industrial and Commercial BMPs**

Storage and handling areas should be covered. There should be a plan for spill containment and control provided by the contractor.

# **V. Conceptual Drainage Design**

Historic and Developed drainage conditions will be analyzed in more detail during the Preliminary Plan review of this project within the Preliminary Drainage Report as required by the Town of Eagle's development submittal requirements.

### **a. Offsite Drainage Basins**

Offsite drainage flows predominately north to south onto the site in ephemeral gullies. These existing drainageways are dry except during storm events. Offsite drainage basins will be passed through the site in drainage corridors designated on the plans. Stormwater flows for the offsite drainage areas have been taken from two drainage reports obtained from the Town of Eagle engineering department. The Eagle River Station Preliminary Drainage Analysis prepared by J&K, Inc. dated May 5, 2011 provided the preliminary 100 year frequency offsite flows

from north of most of the Red Mountain Ranch property. These flows have been shown on the maps along with the approximate drainage divide lines. These flows are generally expected to be passed through the site. On the west end of the Red Mountain Ranch property above Parcel 1, the Eagle Valley Commercial Park, A Resubdivision of Tract A, Eagle Valley Commercial Park, Preliminary Drainage Study by Johnson, Kunkel & Associates, Inc. dated December 1, 1995 calculated the detention required to attenuate the 10 year storm from the Eagle Valley Commercial Park. The flow to be released is shown on Map 1.

No existing drainage studies were found for the offsite drainage basins for the eastern portions of the site but large drainage corridors have been reserved to pass the offsite drainage flows through the site and to the Eagle River maintaining the historic drainage patterns.

**b. Historic Drainage Basins**

Historic drainage basins will generally be maintained and stormwater will flow from north to south to the Eagle River.

**c. Developed Drainage Basins**

The Red Mountain Ranch development is conceptually proposed to have stormwater water quality ponds to treat runoff from developed areas (see attached maps). These ponds will provide treatment of developed flows by treating the WQCV per the Design Methodology section of this report. The ponds will also function as Sediment Control traps during construction. By providing a pond in these drainage basins there will be stormwater and sediment controls for each phase of the project.

It is anticipated that most of the existing irrigation ditches on the parcel will be abandoned during development of the site and that the proposed drainage facilities will maintain historic drainage patterns.

**d. Design Methodology**

Peak flows will be calculated using the WinTR-55 computer program “Small Watershed Hydrology”, as prepared by the Natural Resource Conservation Service (NRCS). WinTR-55 will be used to calculate Runoff Curve Numbers (RCN), Time of Concentration (Tc), and Flow Rates (Q) for each drainage basin that requires flows to be quantified. The 24-hour precipitation values were taken from NOAA Atlas 2, Volume III, Isopluvials and were found to be 1.6 and 2.4 inches for the 10 and 100-year storms respectively. Flows will be calculated using the actual soil types as obtained from the U.S. Soil Conservation Service. Runoff Curve Numbers (RCN) will be generated using pasture and sagebrush for historic conditions. For developed conditions: open space, pavement, open ditches or curb and storm sewer, sagebrush and 1/8 acre residential districts and larger

lots based upon the concept plans for Red Mountain Ranch. The proposed culverts will be designed using the proposed land use for each tributary drainage area. The Time of Concentration (Tc) will be calculated using the NRCS WinTR-55 method.

Stormwater ponds for the Red Mountain Ranch project will be fully analyzed and sized as a part of the Preliminary and Final Drainage Reports. It is anticipated that several ponds will be needed in order to provide treatment of the WQCV. These basins are anticipated to be located at the low end of the site. These have been conceptually located on the plans.

The Urban Drainage and Flood Control District (UDFCD) manual will be used to calculate the WQCV based upon impervious area percentages of each developed drainage basin.

Hydraflow Hydrographs 2007 computer program using the U.S. Soil Conservation Service (SCS) method will be used in pond design to calculate developed flow rates and to provide flood routing through the proposed pond structures. The ponds will be sized to treat the WQCV, possibly attenuate the developed 10 year storm to historic flow rates and route the developed 100-year storms through the ponds as prescribed by the Town of Eagle regulations.

Hydraflow Hydrographs input parameters include drainage area, runoff curve number, time of concentration, pond elevation and storage volume. The available storage volume in each proposed pond is calculated by taking the area at each pond contour and then computing the cumulative volume. The flow rate out of the pond is then calculated at different elevations based upon the size of the outlet pipe. Hydraflow Hydrographs uses the inflow, storage volume, and outflow rate at different elevations to generate the peak outflow and a maximum water surface elevation in the pond. It is an iterative process based upon storage volume, but once the outflow rate is less than or equal to the historic flow rate and the water surface elevation within the pond is acceptable, the pond size and the pond outfall pipe size are acceptable.

**e. Water Quality**

Each pond will provide water quality treatment of stormwater. The pond riser structure will be modified to filter out sediments during construction. After the site is stabilized, the pond riser will have the modifications for sediment control removed and a permanent water quality appurtenance will be constructed. This could consist of a water quality plate on the riser. There will be water quality controls implemented both during and after construction for each drainage basin. Implementing LID can help reduce disturbed and impervious areas, thereby reducing detention facility sizes.

## **VI. Storm Sewer Design**

Open ditches will be utilized along roadsides to convey stormwater to culverts wherever possible. Curb and gutter and a closed storm sewer system of inlets and pipes may be used at some of the denser development areas.

## **VII. Floodplain Determination**

The Federal Emergency Management Agency (FEMA) floodplain for the Red Mountain Ranch development has been delineated on FEMA FIRM panels 08037CO387D, 08037CO391D and 08037CO392D, effective date: December 4, 2007 which is the most recent study. This is a detailed study with floodplain and floodway areas in Zone AE with base flood elevations determined. The AutoCad overlay for the FEMA floodplain has been obtained from the Eagle County Engineering website and has been shown on the plans. In areas where detailed field topography has been obtained for the site on the same vertical datum as the FEMA floodplain, the floodplain has been adjusted using the actual elevation of the floodplain from the detailed FIRM study on the detailed topography. Impacts to the floodplain are not expected from the development of Red Mountain Ranch.

## **VIII. CDPHE Permits**

It is anticipated that sediment control for the Red Mountain Ranch will be addressed through the Colorado Discharge Permit System (CDPS), Stormwater Discharges Associated with Construction Activity permit depending upon the final disturbed area. This permit is obtained from the Colorado Department of Public Health and Environment (CDPHE) and requires the preparation of a Stormwater Management/Best Management Practices (SWM/BMP) plan. A SWM/BMP plan will be prepared for the site to ensure that sediment control measures will be installed to control sediment from leaving the site.

A groundwater discharge permit may be obtained for this site should any dewatering of groundwater be required during construction. This permit is also obtained from the CDPHE as part of the CDPS permit system.

The State of Colorado (CDPHE) Air Pollution Control Division also requires an Air Pollution Emissions Notice (APEN) Fugitive Dust for Land Development Construction permit be obtained for construction sites disturbing more than 25 acres or lasting more than 6 months in duration. This permit will be applied for and obtained as required.

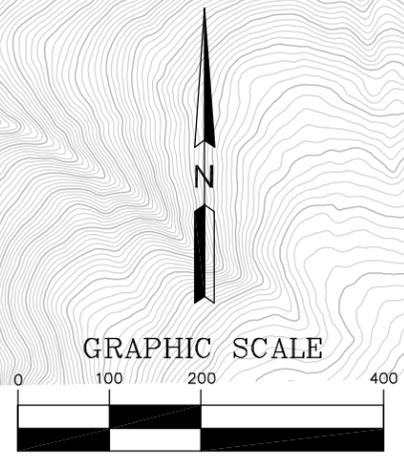
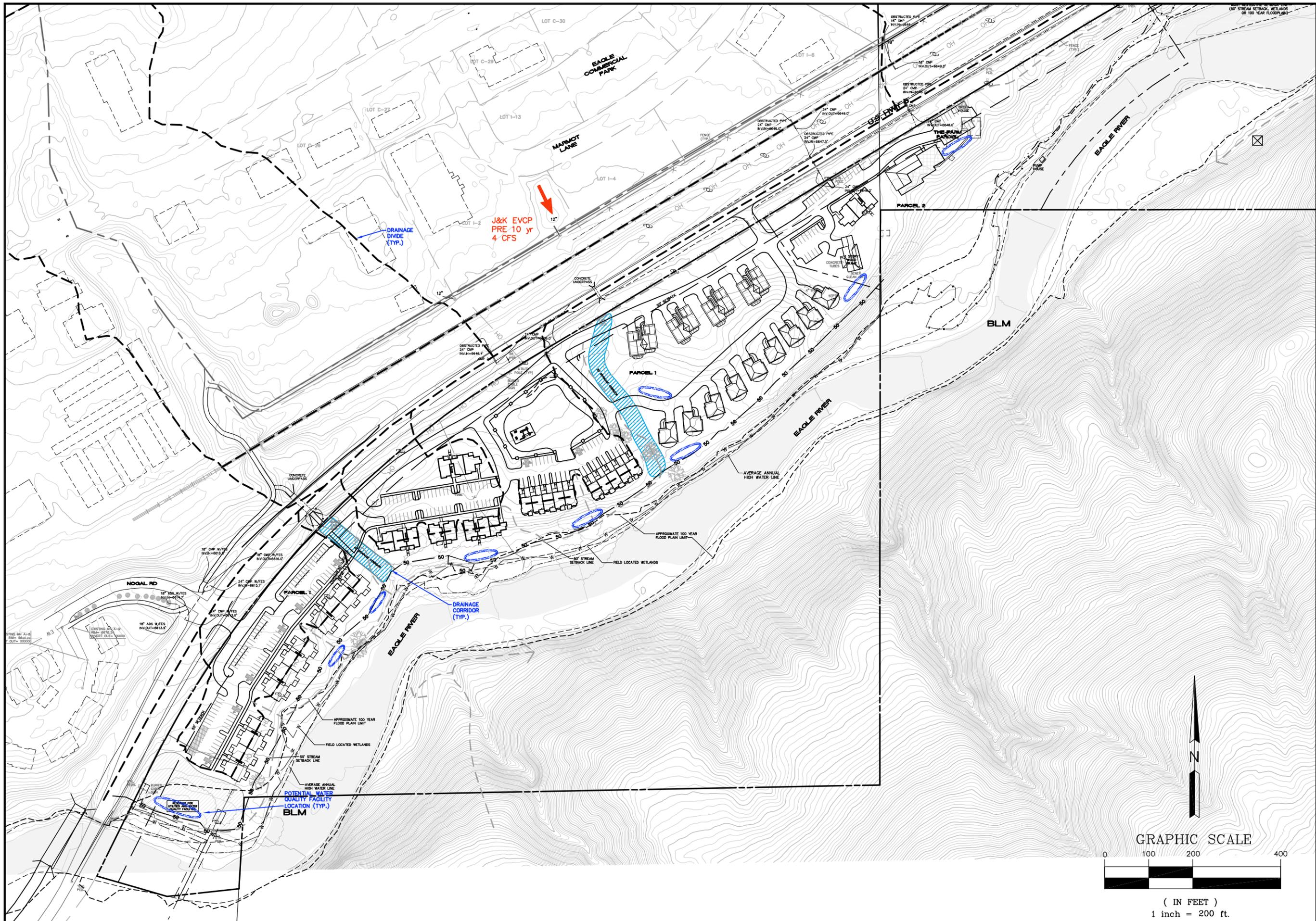
## **IX. Summary**

As the site planning is refined, potential low impact design practices that could be used to treat stormwater flows will be analyzed. Water quality treatment of stormwater will be

provided by various methods including treating runoff in water quality ponds or other permanent treatment BMPs. The appropriate permits will be obtained from local, state and federal agencies.

## **MAPS**

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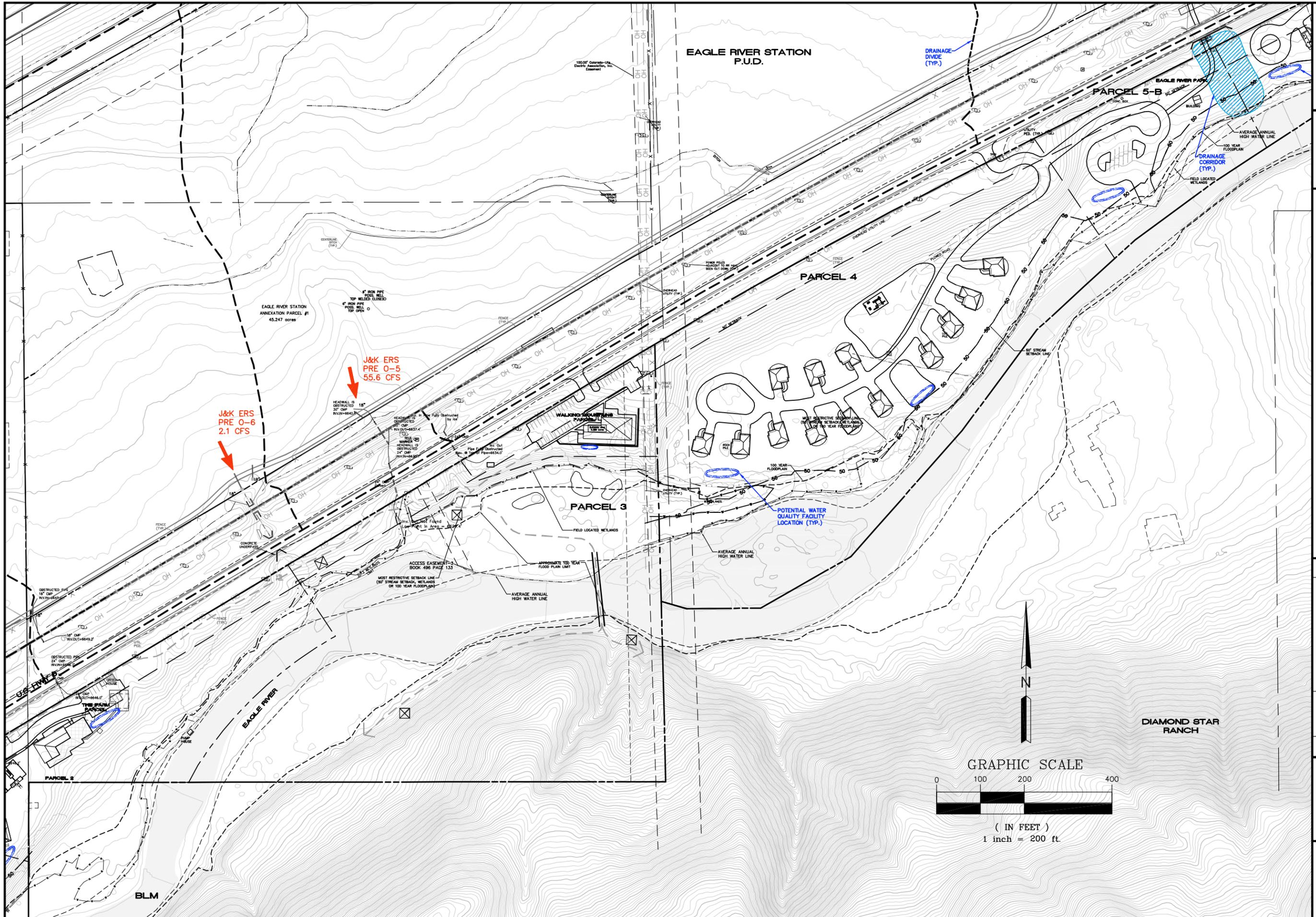
**RED MOUNTAIN RANCH**  
 PUD SKETCH PLAN  
 OVERALL  
 DRAINAGE AREA MAP

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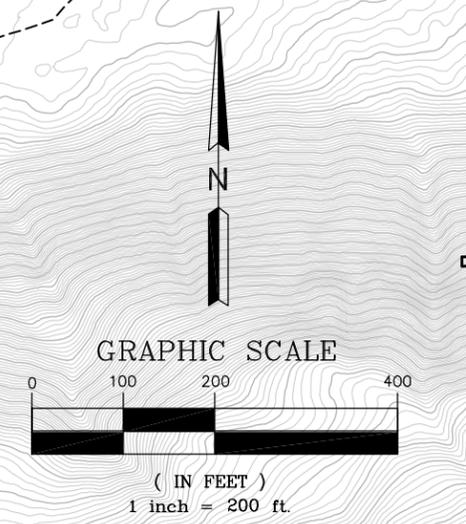


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**RED MOUNTAIN RANCH**  
PUD SKETCH PLAN  
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DRAINAGE AREA MAP

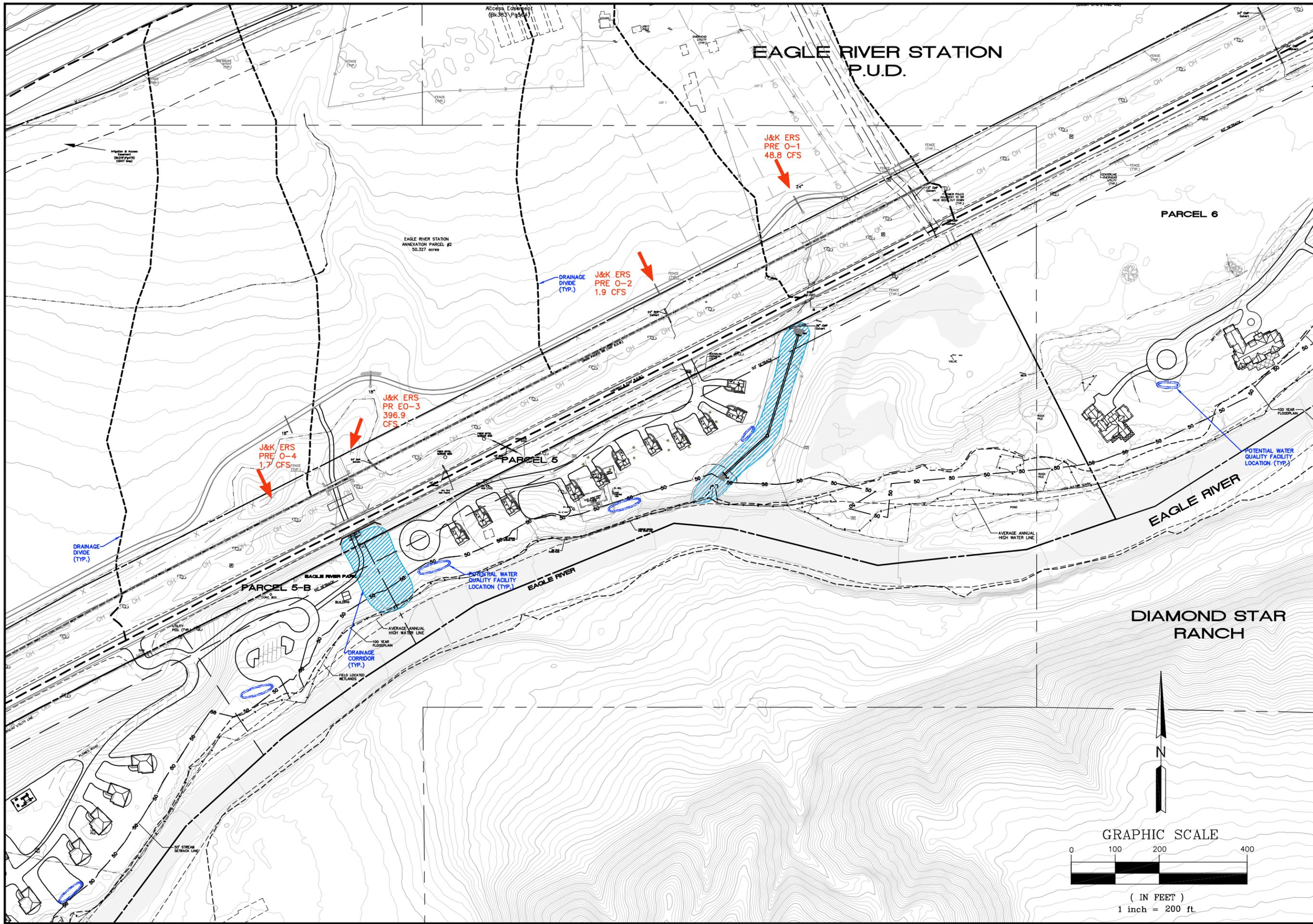
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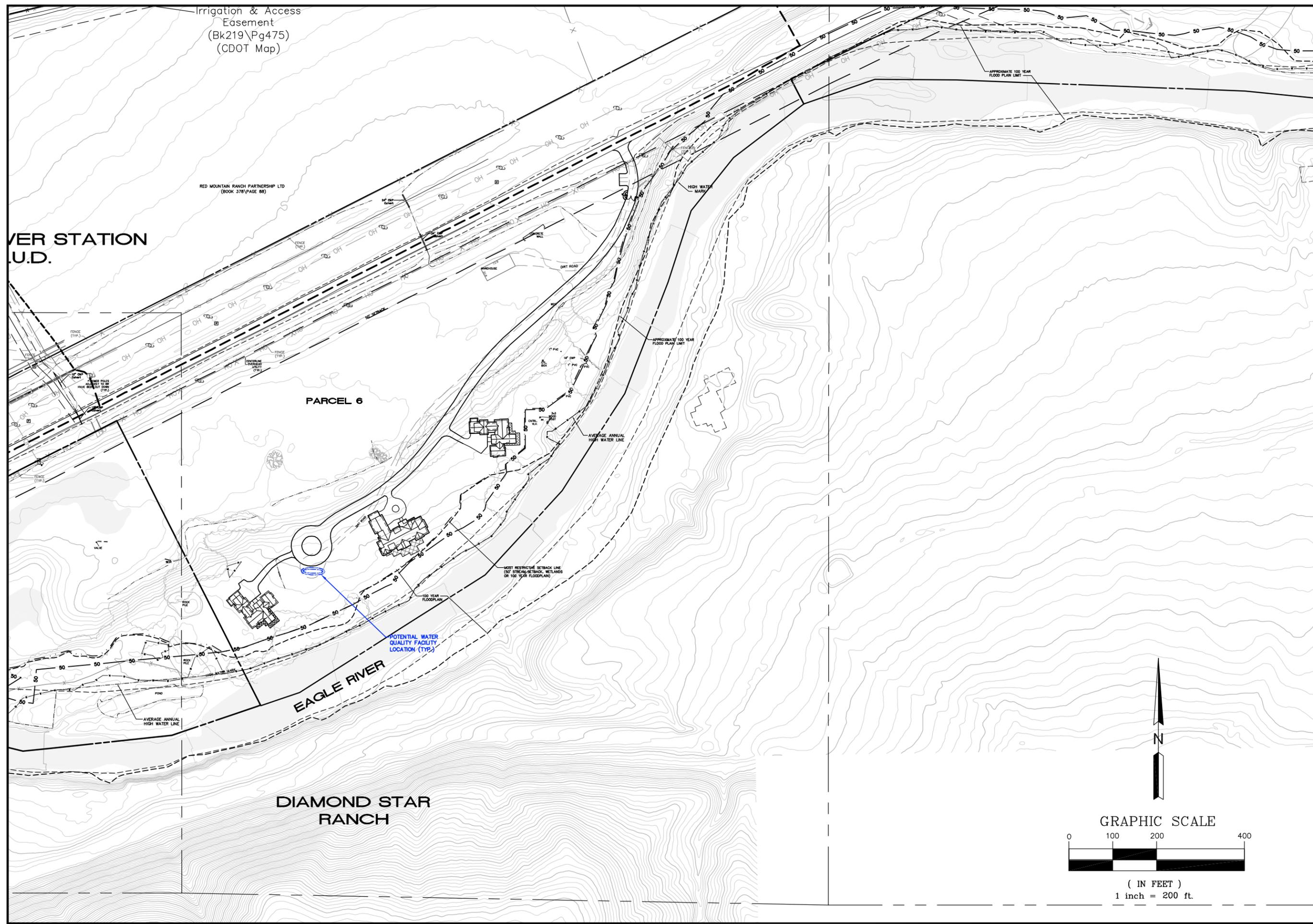
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**RED MOUNTAIN RANCH**  
 PUD SKETCH PLAN  
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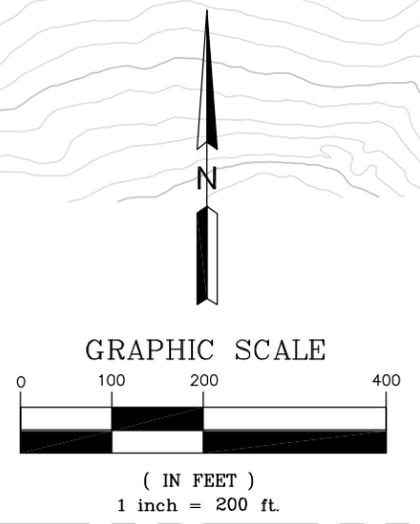


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**RED MOUNTAIN RANCH**  
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