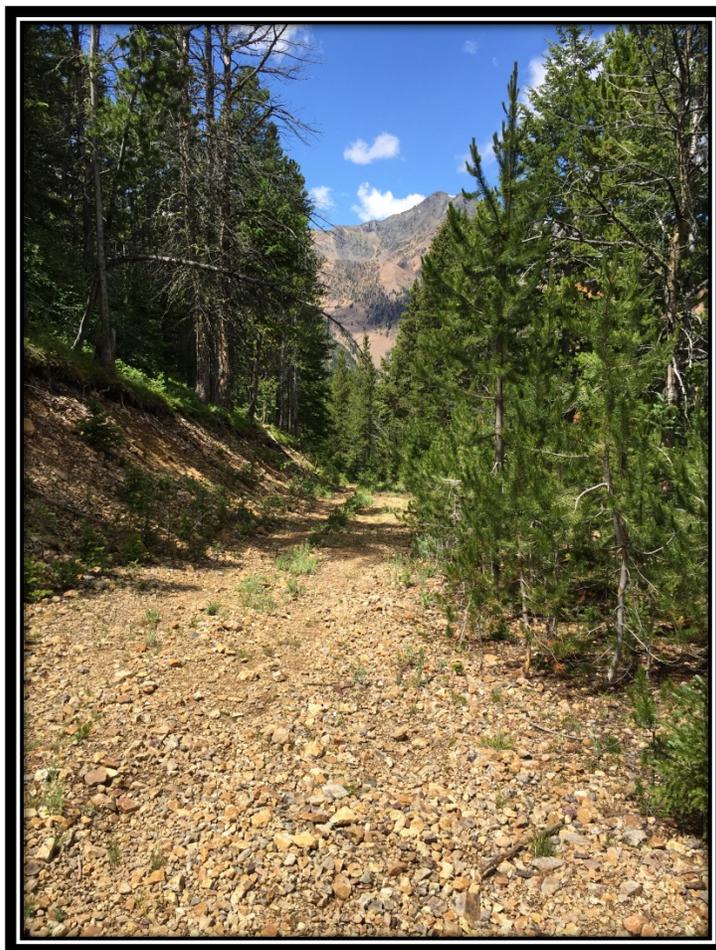


DRAFT ENVIRONMENTAL ASSESSMENT

**Lucky Minerals (Montana), Inc.
Lucky Minerals Project, Park County, MT
Exploration License Application #00795**



Prepared by

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1 PURPOSE AND NEED FOR ACTION

1.1 SUMMARY

This draft environmental assessment (EA) was prepared for the proposed exploration activities of Lucky Minerals (Montana), Inc. (Lucky Minerals) on the western flank of the Absaroka Mountains in Park County, Montana (**Figure 1.3**). On February 17, 2015 Lucky Minerals submitted an exploration license application seeking authorization to conduct exploration activities within its privately-owned patented St. Julian mine claim block (St. Julian Claim Block) located in the Emigrant Mining District approximately 12 miles southeast of Emigrant, Montana. The St. Julian Claim Block consists of nine patented mining claims surrounded by the Custer Gallatin National Forest (CGNF).

The original exploration proposal included CGNF lands in the Plan of Operations (April 2015). As a result, the Department of Environmental Quality (DEQ) partnered with the CGNF to conduct a joint scoping period to receive public comment. The two agencies determined that the intent of both the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA) would be better served by considering the impacts of the two proposals in a single analysis document. On November 30, 2015, Lucky Minerals withdrew its application and resubmitted a revised proposal for exploration on private patented claims only, on the St. Julian Claim Block. As a result, the CGNF suspended work on the project shortly thereafter. The revised application is still a state action under the Metal Mines Reclamation Act (MMRA) which requires DEQ to continue the MEPA analysis. The agency retained the joint scoping document to aid in the environmental review process.

DEQ prepared this draft EA to present the analysis of possible environmental consequences of three exploration alternatives: the No Action Alternative, the Proposed Action, and the Agency-Modified Alternative. The Agency-Modified Alternative includes additional suggested mitigation measures developed by DEQ.

Lucky Minerals proposes to drill up to 46 drill holes from 23 drill pads (2/pad) over two field seasons (**See Figure 1.4**). The total project disturbance area, including access roads, laydown areas, and drill pads within the St. Julian Claim Block, would be approximately 4.8 acres (**See Table 2.1**). In order to keep disturbance to a minimum, all drill holes and associated sumps would be located within the previously disturbed prism of existing roads. The sumps would be used for collection and disposal of wet drill cuttings. Lucky Minerals would use two drills running two ten-hour shifts per day. Lucky Minerals estimates that a maximum of 4 drill sites would be in use at any one time. Results from this preliminary phase of the project would be used to model the subsurface geology and associated mineralization, if any.

1.2 PURPOSE AND NEED

Lucky Minerals proposes exploration for copper/gold/silver/ molybdenum deposits at 23 locations on the St. Julian Claim Block over two field seasons.

The exploration project would be licensed under the Montana Metal Mine Reclamation Act (MMRA), Sections 82-4-331 and 332, Montana Code Annotated (MCA). If an exploration license is issued, Lucky Minerals will also be required to post a reclamation bond in a form and amount as determined by DEQ in accordance with 82-4-338, MCA.

The Montana Environmental Policy Act (MEPA) requires preparation of an environmental impact statement for actions taken by the State of Montana that may significantly affect the quality of the human environment. This EA is being prepared to determine whether Lucky Minerals' proposed exploration activity is a major state action significantly affecting the quality of the human environment.

1.3 HISTORICAL MINING AND PREVIOUS EXPLORATION DISTURBANCE

The Emigrant Mining District has been the site of small scale lode and placer operations since the 1870's. During the period 1864 to 1935 an estimated 40,000 ounces of gold was produced dominantly from placer operations. The most recent phase of modern exploration started in 1990 when Kennecott drilled six helicopter supported core holes on the south flank of DUV Ridge.

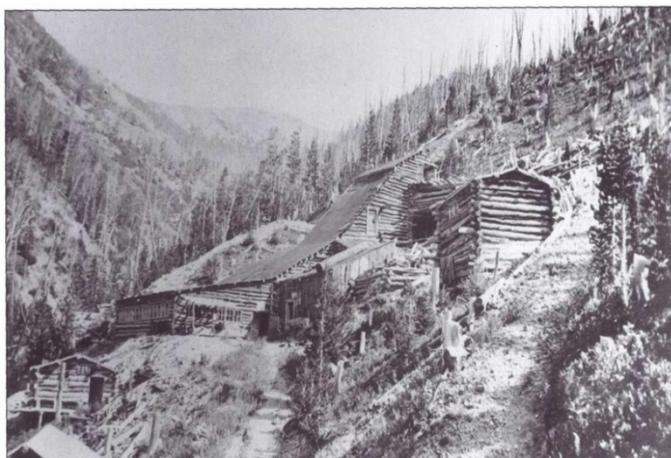


Figure 1.1
St. Julian Mill circa 1906

Emigrant Mining District Chronology (Geologic Systems Ltd., 2015)

- 1864** Placer gold discovered in Emigrant Creek.
- 1885** Lode gold discovered at St. Julian claims, followed by minor production from underground workings.
- 1864 -1930** An estimated 40,000 oz. gold produced principally from placer deposits.
- 1963** American Metal Climax, Inc. (AMAX) drilled one exploration hole on the east side of Emigrant Peak (hole E-1) and another near



Figure 1.2
St. Julian Mill July 2016

the junction of Emigrant Creek and the East Fork of Emigrant Creek (hole E-2).

- 1966** Minerals Exploration, Inc. a subsidiary of Union Oil Corporation sampled the Allison prospect area as part of a regional molybdenum exploration program.
- 1970** Basic Metals, Inc. drilled approximately 15 holes in the Great Eastern (or Base Metals) breccia pipe in Emigrant Creek
- 1971-1973** Duval Corporation explored for Cu-Mo-Au porphyry by drilling 10 core holes (holes MED 1-10) in the Emigrant District about 7 of which were located along the East Fork of Emigrant Creek both north (in the DUV Ridge area) and south (St. Julian area) of the creek; in addition Duval conducted approximately 4 linear miles of induced polarization geophysical surveys.
- 1975** Duval Corporation drilled one additional hole in a joint venture agreement with Gulf Mineral Resources, Inc. in 1975 as part of the same program.
- 1980** Bear Creek Mining Company a subsidiary of Kennecott Copper conducted a copper/molybdenum exploration program on the east flank of Emigrant Peak.
- 1987** Montana Mining and Reclamation (MM&R) began testing placer deposits along Emigrant Creek and consolidated a land position including lode mining claims.
- 1988-1990** Sandhurst Mining NL, in a joint venture with Montana Mining and Reclamation, began a gold exploration program in 1988 which included geologic mapping and sampling of both lode (DUV Ridge and St. Julian target areas) and placer deposits in the Emigrant Creek drainage. The joint venture was terminated in 1990.
- 1990** Kennecott Exploration obtained an option from Montana Mining and Reclamation through Fischer-Watt Gold Company and began a gold exploration program. Before the option was terminated, Kennecott had drilled six core holes on the DUV deposit
- 1991** Harrison Western Environmental Services, Inc., began evaluating the gold placer deposits along the upper part of Emigrant Creek, the East Fork Emigrant Creek, and Huckleberry Gulch; they completed 10 sonic drill holes
- 1991-1993** Pegasus Gold Inc. acquired Kennecott's interest in the MM&R properties and entered a joint venture, also with Fischer-Watt Gold Company; to conduct a gold exploration program in the district on the DUV Ridge Target Area and on patented mining claims in the St. Julian area. Pegasus drilled twenty-six helicopter supported core holes (13,774 feet) and 24 reverse circulation holes with a track mounted drill (9,400 feet) in six target areas. Approximately \$4.8M in work was completed in the district from late 1980's to early 1990's by Kennecott Exploration and Pegasus Gold.
- 2007** NewEdge Gold Corp acquired a lease/option on several properties in the Emigrant District. NewEdge dropped the project in 2008 as a result of collapse in the market.

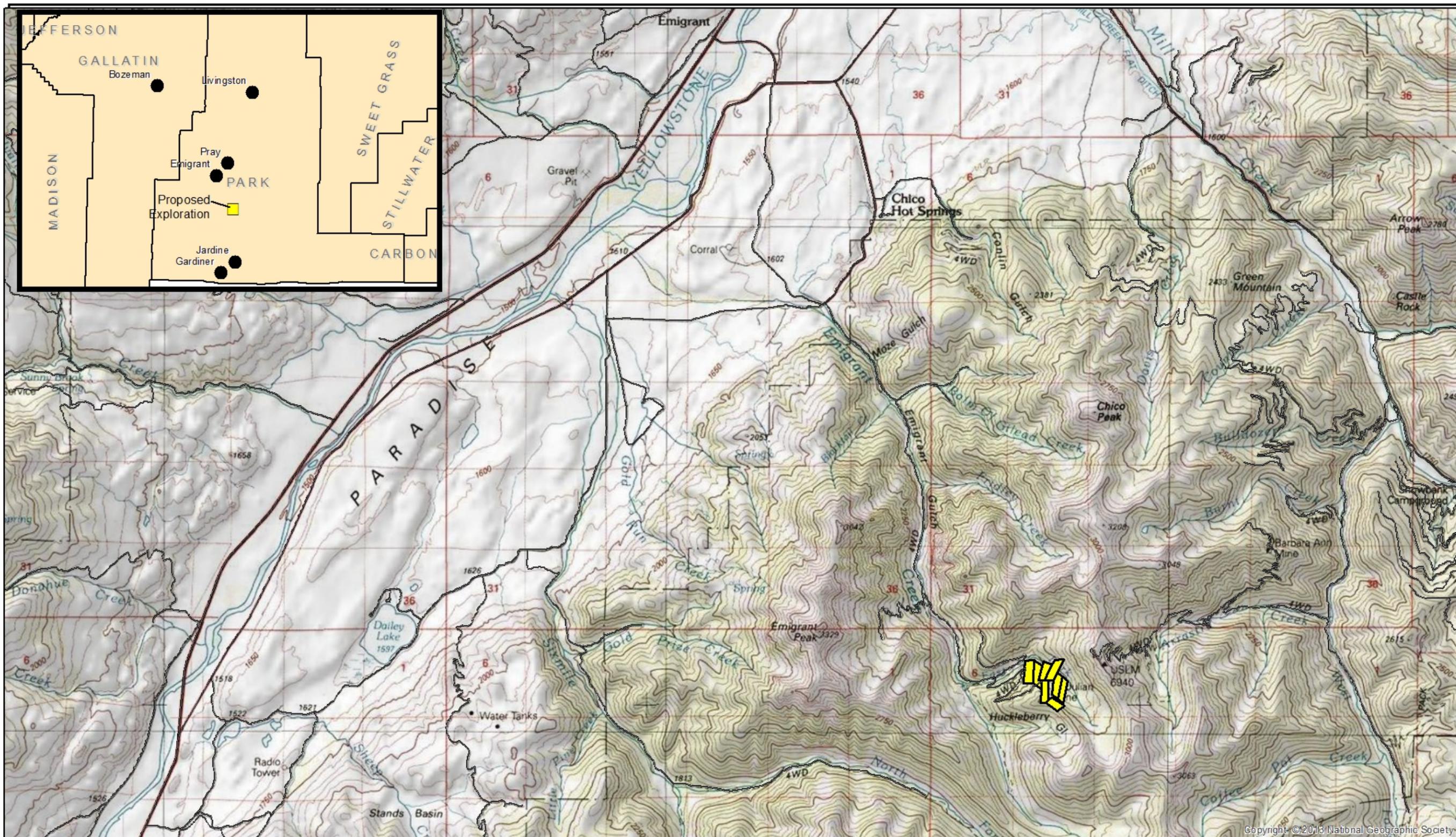
St. Julian Claim Block

The St Julian Claim Block was first identified in 1885 and has a history of sporadic production up until 1903. It is estimated that 395 ounces of gold were produced between 1901 and 1903. The area contains the major mine workings in the Emigrant Mining district. The St. Julian is covered by nine patented mineral claims under option to Lucky Minerals. Underground workings at the St. Julian Claim Block consisted of twelve adits (total length about 1,060 feet) and three shafts.

1.4 PROJECT LOCATION

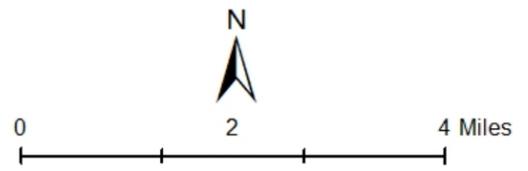
The St. Julian Claim Block is situated in Section 5, Township 7 South, Range 9 East, on private land surrounded by the CGNF in the Emigrant Creek area. The St. Julian Claim Block is approximately 12 miles southeast of the town of Emigrant and 22 miles northeast of Gardiner (See Figure 1.3). Table 1.1 provides a listing of the patented minerals claims in the St. Julian Claim Block, provided by Lucky Minerals. The patented claims are in the process of being transferred and registered to Lucky Minerals, under a purchase agreement.

Mineral Survey	Lot Name	Surface Acres
9015	Copper King	20.3
9015	Bercry	16.3
9015	Bullion	20.0
9015	St. Julian Fraction	7.6
9015	Josephine	16.0
9015	Helen	13.3
6706	St. Julian	16.1
6707	Bottler	11.2
6705	St. Julian Mill	17.7



Legend

 Proposed Exploration Area



Lucky Minerals Exploration Project
Topographic Location
Figure 1.3

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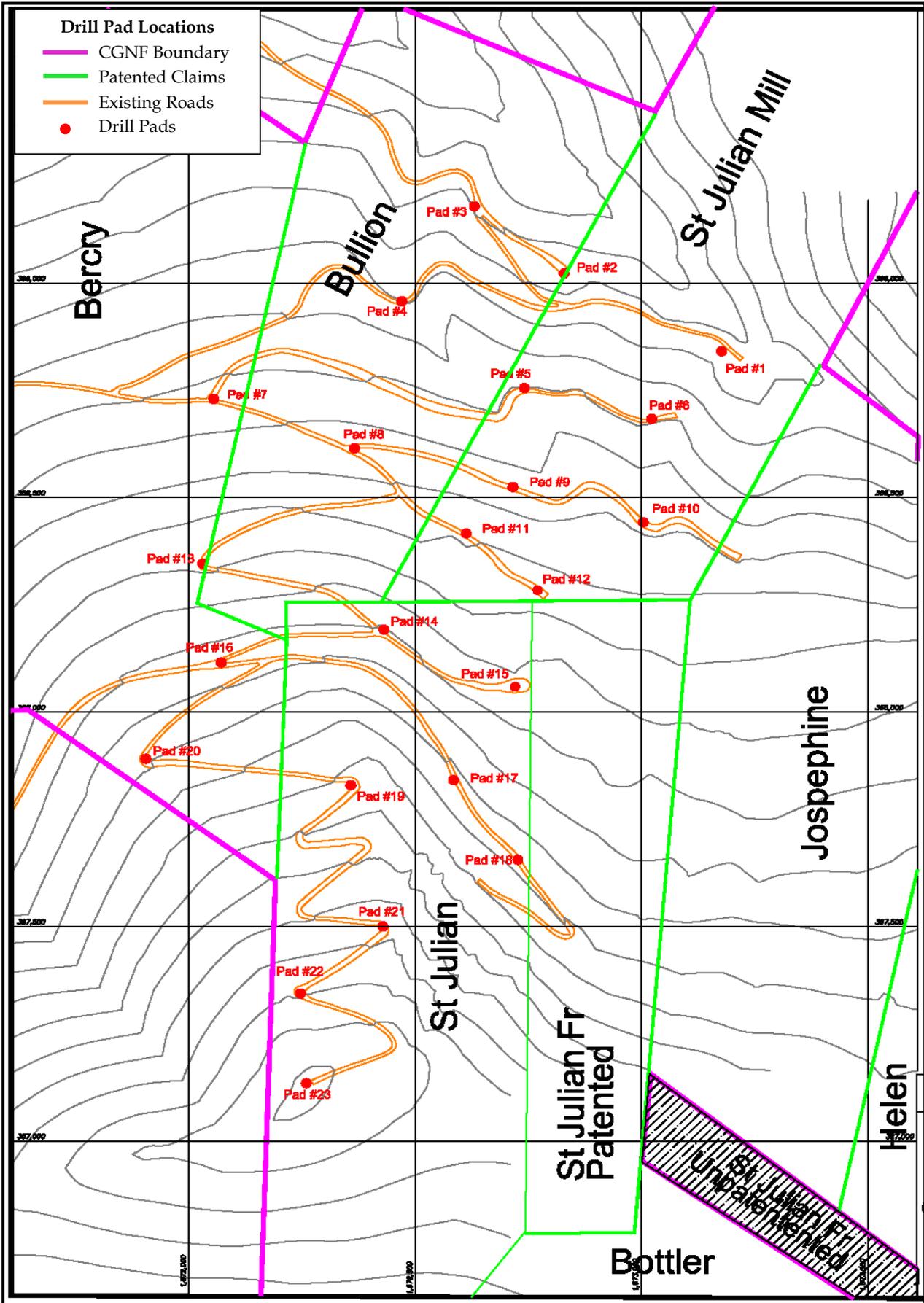


Figure 1.4
Claim Boundary / Drill Locations (Plan of Operations, 2015)
St. Julian Exploration Project, Park County, Montana

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1.5 AUTHORIZING ACTION

DEQ is responsible for issuing exploration licenses under the MMRA. The exploration license application must contain an exploration plan of operations stating the type of exploration techniques that would be used in disturbing the land. It also must include a reclamation plan in sufficient detail to allow DEQ to determine whether reclamation and performance requirements of the MMRA would be satisfied.

DEQ is also responsible for protecting air quality under the Clean Air Act of Montana, and water quality and quantity under the Montana Water Quality Act. The options that DEQ has for decision-making upon completion of the EA are (1) denying the application if the proposed operation would violate MMRA, the Clean Air Act, or the Water Quality Act; (2) approving the application as submitted; (3) approving the application with agency mitigations; or (4) determining the need for further environmental analysis to disclose and analyze potentially significant environmental impacts. **Table 1.2** provides a listing of agencies and their respective permit/authorizing responsibilities.

Action	Regulatory Agency
Exploration License	DEQ-Hard Rock Mining Bureau
318 Stream Permits	DEQ-Water Protection Bureau
Forest Service Road Use Permit and Weed Management	Custer Gallatin National Forest
124 Stream Permit	Montana Fish, Wildlife, and Parks (FWP)
Water Rights	Montana Department of Natural Resources (DNRC)
County Road Access and Maintenance, Land Use, Waste Management, Noxious Weed Plan	Park County

1.6 PUBLIC PARTICIPATION

1.6.1 SCOPING

DEQ considers public participation a crucial component in defining the scope of the environmental analysis process. Consequently, DEQ worked to ensure the public was informed about Lucky Minerals' proposal and the opportunities available for participating in the environmental analysis process.

The original exploration proposal included CGNF lands in the area proposed to be covered by the exploration license (Plan of Operations, April 2015). As a result, DEQ partnered with the CGNF to conduct a joint scoping period to receive public comment. The CGNF first informed the public of the proposal by mailing the project's scoping document to potentially interested or affected persons on June 2, 2015. This document described Lucky Minerals' original proposal, the agencies' responsibilities, and the approval and environmental review process. It also requested scoping comments by July 15, 2015. DEQ received a concurrent proposal from Lucky Minerals to conduct exploration drilling on private lands surrounded by the CGNF. The two

agencies determined that the National Environmental Policy Act (NEPA) and MEPA would be best served by considering the impacts of the two proposals in a single analysis document. Consequently, the agencies informed the public of this in a joint news release that extended the public scoping period until August 20, 2015.

On November 30, 2015, Lucky Minerals withdrew its application and resubmitted a revised proposal for exploration on private patented claims only, called the St. Julian Claim Block. As a result, CGNF suspended work on the project. The revised application is still a State action requiring DEQ to continue the MEPA analysis. DEQ retained the joint scoping document to aid in the development of the environmental review document.

DEQ received approximately 6,250 scoping comments pertaining to Lucky Minerals' Proposed Action. These comments formed the basis of the issues analyzed and alternatives evaluated throughout the document. DEQ reviewed and analyzed the comments received during the scoping process using three steps. First, specific comments were arranged into groups of common concerns. Next, a primary issue statement was prepared for each group of comments. Finally, the issue statements were evaluated for applicability to this MEPA analysis. Overall, there were 18 preliminary issue areas identified in the comments. Eleven of the 18 issues raised in scoping were identified as issues to be studied in detail (**Table 1.3**).

1.7 ISSUES AND CONCERNS

1.7.1 ISSUES STUDIED IN DETAIL

DEQ conducted scoping to identify potential issues and other concerns with the proposed action. A summary of the key issues is provided in **Table 1.3**. This table also provides references to sections of this EA that respond to each issue raised.

<p style="text-align: center;">TABLE 1.3 Scoping Issues Exploration License Application 00795</p>		
Scoping Issue	Concern	Rationale
Air Quality	There is a concern that the Lucky Minerals proposal may create fugitive dust and air borne pollutants (such as exhaust and from drilling activities) that impact air quality and be a nuisance to residents and recreationists in the area.	Impacts to air quality from mineral exploration will be analyzed and disclosed. (See Section 3.11)
Aquatic Species	There is a concern that the Lucky Minerals proposal may degrade water quality and reduce water quantity, thus negatively affecting populations and habitat of fish and aquatic species. The Lucky Minerals proposal may also impact fishing experience down gradient of the St. Julian Claim Block (Yellowstone River).	Impacts to fish and aquatic species from mineral exploration will be analyzed and disclosed. (See Section 3.5)
Cultural / Historical Properties	There is a concern that the St. Julian Claim Block has not been adequately surveyed for cultural and historical resources. The analysis should disclose potential impacts to these resources, and the project must comply with cultural and historical preservation laws.	Impacts to cultural and historical resources from mineral exploration will be analyzed and disclosed. (See Section 3.6)
Cumulative Impacts	There is a concern that the analysis may not address the cumulative impacts of minerals exploration on both public and private lands, and that the analysis may exclude reasonably foreseeable exploration activities.	Cumulative impacts will be included in the environmental review. (See Section 4.1)
Geothermal	There is a concern that mineral drilling and road maintenance/construction proposed by Lucky Minerals may negatively impact geothermal resources, which could impact Chico Hot Springs, Mammoth Hot Springs, Corwin Springs, and the State designated controlled groundwater area.	Impacts to geothermal resources from mineral exploration will be analyzed and disclosed. (See Section 3.7)
Land Use, Recreation, and Noise	There is a concern that the Lucky Minerals proposal may restrict public access through the St. Julian Claim Block for recreationists (including but not limited to hiking, camping, hunting, horseback riding, back country skiing, All Terrain Vehicles (ATVs), and photography). There is a concern that project traffic will negatively affect the recreation experience (solitude, peace, and tranquility) provided by the Absaroka	Impacts from mineral exploration to land use, recreation, and noise will be analyzed and disclosed. (See Section 3.8)

	<p>Beartooth Wilderness and North Absaroka IRA, as well as negatively impact wildlife that use these areas.</p> <p>There is a concern that mineral exploration (including helicopter flights, road construction, and enlargement of existing roads) may impair qualities of the North Absaroka Inventoried Roadless Area (IRA) by diminishing the natural integrity, remoteness, and solitude of the IRA.</p>	
Transportation	<p>There is a concern that increased exploration traffic may create safety hazards for local residents, recreationists and local businesses. There is a concern that increased exploration traffic will create a safety hazard on the Chico Road for guests of Chico Hot Springs.</p> <p>There is a concern that the roads in Emigrant Gulch (particularly Road 3273 on Emigrant Peak) are a safety hazard, and frequently flood (in particular the culvert above White City).</p> <p>There is a concern that the planned road maintenance and improvements, including stream crossings, will be more extensive than what has been described, roads will be widened, and there is no standard for returning roads to their "original condition." Additional information on planned road maintenance should be provided, including stream crossings.</p> <p>There is a concern that vehicles or equipment may fall into Emigrant Creek or its tributaries resulting in spills that could be disastrous to downstream users.</p> <p>There is a concern that the existing roadways and stream crossings (including St. Julian Claim Block and access roads off of Hwy 89) were not constructed to withstand the type of intensive and sustained use from sizeable and heavy drilling and dozing equipment, the increased volume of traffic is likely to damage roads and cattle guards, drive away wildlife, deter hikers, threaten cattle</p>	<p>Impacts to transportation from mineral exploration will be analyzed and disclosed in the Transportation Section. (See Section 3.10)</p>

	grazing areas, and create dust and noise pollution.	
Terrestrial Wildlife	<p>There is a concern that project activities may negatively impact threatened, endangered, or sensitive species including grizzly bear, lynx, and wolverine, and the agency must consult with US Fish and Wildlife Service.</p> <p>There is a concern that the Lucky Minerals proposal may negatively impact numerous species of wildlife and their habitat, including management indicator species, public interest (including commonly hunted) species, and migratory birds.</p>	Impacts to terrestrial wildlife will be analyzed and disclosed. (See Section 3.4)
Vegetation and Soils	<p>There is a concern that the Lucky Minerals proposal will impact sensitive plants and introduce weeds and cause them to spread.</p> <p>There is a concern that the proposal may contaminate soils from spills and reduce soil productivity and cause soil loss.</p>	Impacts to vegetation and soils from mineral exploration will be analyzed and disclosed. (See Sections 3.9)
Water Quality / Quantity (Surface and Groundwater)	<p>There is a concern that the project may impact surface and groundwater quality and quantity in the St. Julian Claim Block. There is a concern that water use by Lucky Minerals may impact others' water use.</p> <p>There is a concern that drilling may cause groundwater contamination through cross contamination with surface and groundwater.</p>	Impacts to water quality / quantity from mineral exploration will be analyzed and disclosed. (See Section 3.7)
Yellowstone National Park	<p>There is a concern that the project's proximity to Yellowstone National Park (YNP) will harm both geothermal and wildlife resources, visitor experience, and the tourist economy.</p> <p>There was a comment that the CGNF and DEQ should identify the National Park Service as a cooperating agency under NEPA given the proximity of the proposed mineral exploration to Yellowstone National Park and its potentially significant impacts on resources within and adjacent to the Park.</p>	<p>Geothermal, wildlife, and recreation are covered in their own issue areas. Socioeconomics is included in Section 1.7.2 and Table 1.4.</p> <p>A Yellowstone National Park representative participated in a site tour conducted by DEQ. The Yellowstone National Park Superintendent also submitted a letter to DEQ during scoping. A copy of the draft EA will be sent to the National Park Service for its review and comment.</p>

1.7.2 ISSUES CONSIDERED BUT DISMISSED

DEQ has identified resources that would not be affected by the Proposed Action and issues that were considered and eliminated from detailed review. A summary of these issues is provided in Table 1.4.

TABLE 1.4 Scoping Issues Considered but Dismissed Exploration License Application 00795		
Scoping Issue	Considered But Dismissed	Rationale
Bonding	<p>There is a concern that the Plan of Operations should include information on project timelines, spill containment, monitoring, proposed bonds, season of use, stream protection, etc.</p> <p>There is a concern that Lucky Minerals does not have adequate financial resources to post an adequate reclamation bond.</p>	Information requested is included within the Plan of Operations. In the event that Lucky Minerals cannot post the reclamation bond, DEQ will not issue the exploration license pursuant to 82-4-322(3), MCA.
Climate Change	There was a comment to disclose impacts of the project on climate change and carbon storage potential.	Environmental reviews under MEPA may not include a review of actual or potential impacts beyond Montana's borders. It may not include actual or potential impacts that are regional, national, or global in nature. Section 75-1-201 (2)(a), MCA.
Helicopters	There is a concern that low level, high frequency or extended duration helicopter flights may disturb and displace grizzly bears and Canada lynx, and impact their habitat, resulting in adverse impacts and take under the Endangered Species Act.	The exploration application does not propose helicopter-supported drilling activities.
Land Designations	There is a concern that the Lucky Minerals proposal may impact future designation of the St. Julian Claim Block as wilderness, or future designation of the Yellowstone River as a Wild and Scenic River.	Future land designations are speculative and beyond the scope of this analysis. This issue will not be analyzed.
Public Involvement Comment Period	There is a concern that the scoping comment period was not adequate to review and comment on the project, nor was the mailing list sufficient to inform interested parties.	The comment period was extended for a total of 80 days. During the Joint Scoping Period with the CGNF and DEQ, the agencies received approximately 6,000 comments. There will be additional opportunity for comment on the environmental review document.
Socioeconomics	There is a concern that the Lucky Minerals proposal will harm the local economy (jobs, recreation and tourism, hunting & guiding, fishing, agriculture,	As described in Section 2.3.4, the proposed exploration activity would only result in a maximum of ten people in a 24 hour period on site, with the project life of two limited

	<p>property values). There is a concern that the Lucky Minerals proposal may impact Paradise Valley communities, disrupting the lives and livelihoods of the community and impacting sense of place.</p>	<p>field seasons. The Emigrant Creek area has had past exploration projects that are similar in potential impacts to the proposed project and these past exploration activities did not cause identifiable socioeconomic impacts to the area. The narrow area of Park County that would be utilized for this project may not notice the negligible impacts of ten temporary workers for a short duration. Since the exploration project would be in short duration with limited amount of temporary jobs and have no measurable impacts on the analysis area the socioeconomic effects of the proposed exploration were not considered in detail.</p>
Right of Way	<p>There is a concern that Lucky Minerals doesn't have legal access through private, patented mining claims.</p> <p>One landowner does not consent to any access or road work on his property. Other commenters questioned whether Park County has authorized maintenance across county maintained roads and if easements were in place through private property.</p>	<p>The access route proposed by Lucky Minerals is described in Section 2.3.1 of this EA. Ownership of the road and whether Lucky Minerals has a right to use the road are legal issues that, should there be a dispute, must be resolved in a civil action between the affected parties. DEQ does not have authority to resolve property disputes.</p>

2 DESCRIPTION OF ALTERNATIVES

2.1 INTRODUCTION

This chapter summarizes alternatives to the proposed plan including the No Action Alternative required by MEPA. Other alternatives required by MEPA include the Proposed Action, and the Agency-Modified Alternative.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples.

2.3 PROPOSED ACTION

Under the Proposed Action, Lucky Minerals would explore the extent of copper, gold, silver, and molybdenum mineralization in the St. Julian Claim Block by drilling and recovering core samples that, when analyzed, will allow modeling of the subsurface geology, reveal any fault structures, and further define any mineralization. The St. Julian Claim Block was first identified in 1885 and has a history of sporadic production up until 1903. It is estimated that 395 ounces of gold were produced between 1901 and 1903. The area contains the major mine workings in the Emigrant Mining district. The St. Julian Claim Block is covered by nine patented mineral claims under option to Lucky Minerals. Underground workings at the St. Julian Claim Block consist of twelve adits (total length is approximately 1,060 feet) and three shafts.

The Proposed Action would consist of a two-year period of exploration-related activities centered on the private patented claims as depicted on Figure 1.4. Total disturbance for the Proposed Action on the St. Julian Claim Block is estimated to be 4.8 acres. This includes 3.48 acres of disturbance on access roads within the St. Julian Claim Block, 0.8 acre for the laydown areas, and 0.52 acre for the drill pads (See Table 2.1). The following subsections describe the Proposed Action in more detail.

Total Disturbance	Approximate Area in Acres
Drill Pads	0.52
Laydown Area	0.8
Access Roads	3.48
Total Disturbance	4.8

2.3.1 ROAD ACCESS AND MAINTENANCE

The project area would be accessed by the county maintained Emigrant Creek Road and then by Forest Service designated Road 3272. Access to the Emigrant Creek Road is from the town of Emigrant by way of the Chico Road (See Figure 3.19). The number of trips to the project following the initial delivery of the drilling equipment would be approximately three, two-way

trips per day. There may be localized disturbances on Emigrant Creek Road and Forest Service Road 3272, the proposed access route to the St. Julian Claim Block, to facilitate mobilization of equipment and to improve safety. Although Lucky Minerals does not anticipate conducting any work or improvements to any of the stream crossings, the company commits to obtaining any permits required by County, State, or Federal agencies.

The Proposed Action does not include any new road construction. Access roads and the existing road network within the St. Julian Claim Block would be maintained through grading as necessary, in order to keep them serviceable for the type of vehicles that would be involved with the Proposed Action. However, the roads would not be made wider. All roads would be cleared of rock and other debris within their original configuration, some of which may require hand picking to ensure safety and minimize disturbance (Dykes, 7/7/2016b). Wherever practicable, the roads will be sloped to enhance drainage and prevent channeling. Flaggers with portable radios would monitor and control traffic along those stretches of road during road cleaning. Flaggers and/or pilot cars would also be used when large equipment is being mobilized and demobilized from the area.

2.3.2 EQUIPMENT AND FIRE SAFETY

In order to protect existing vegetation and to not contribute to additional erosion within the St. Julian Claim Block, Lucky Minerals would confine all wheeled vehicles and equipment to existing roads and trails or other overland travel routes. If crews need to access outcrops or any mineral exposures that are not immediately adjacent to roads, access to these features would be by foot travel. Equipment would not be operated when ground and road conditions are such that excessive damage would occur (i.e.; saturated road or soil conditions).

Proposed Equipment:

- A D-7 type dozer or equivalent to clear roads and work on private land (used about 10% of the time).
- A G-12-14 type grader or equivalent for surface finishing the various roads (used about 5% of the time).
- A JD-50 or equivalent type track mounted excavator or tractor mounted back-hoe to dig mud pits (used about 5% of the time).
- Two LF-70 track mounted diamond drilling machines; used fulltime (**See Figure 2.1**).
- Three diesel- or gas-powered solid displacement “Bean” water pumps for delivering water to the sites using high pressure rubber coated woven steel water hose. Only two pumps would be used at any given time, the third pump would serve as backup.
- Two service trucks and small haulage trailers, used fulltime.
- One 4x4 pickup or similar vehicle for site visits and field work, used fulltime.
- Two ATVs for travelling around the St. Julian Claim Block, used fulltime for short distances.

Lucky Minerals would maintain all equipment operating in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic oil and furnish containers or oil adsorbing mats, for use under all stationary equipment or equipment being serviced to prevent leaking or spilled petroleum-based products from contaminating soil and water resources. Lucky Minerals would cooperate with Park County for the proper disposal of contaminated debris, vehicle oil filters (drained of free flowing oil), batteries, oily rags, and waste oil resulting from use, servicing, repair, or abandonment of equipment.

In order to reduce or eliminate potential for a wildfire associated with the Proposed Action; Lucky Minerals would adhere to current and imposed fire restrictions that are enacted by the Forest Supervisor and Park County. Additionally, Lucky Minerals would ensure that all vehicles are equipped with a functional spark arrestor and baffled muffler, and are equipped with an axe, bucket, shovel, and fire extinguisher. All support or crew transport vehicles would be parked in an area in which the natural vegetation does not directly contact the catalytic converter of the vehicle. Lucky Minerals would comply with CGNF regulations regarding fire rules and/or closures. All pumps/generators and other combustion engines would be placed away from combustibles and be equipped with functional spark arrestors and fire suppression kits.

Warming fires in constructed fire pits would be used at drill sites and laydown areas. Appropriate fire protection equipment (axe, bucket, shovel and fire extinguisher) would be present at such sites. Warming fires would be put out if left unattended. All fire pits would be reclaimed. No green trees would be cut for firewood, but slash and downed wood from site clearing or dead or down trees in the vicinity may be used for warming fires on the St. Julian Claim Block.

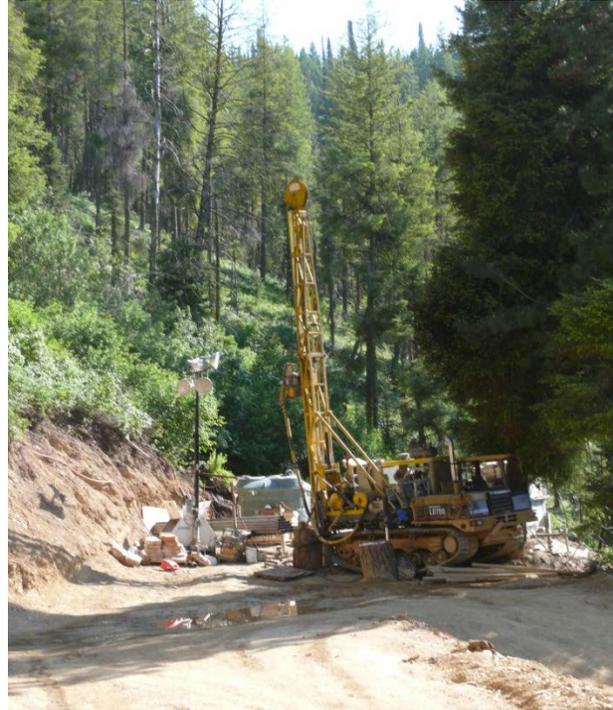


Figure 2.1
Lucky Minerals Drilling Machine (Lucky Minerals, 2016)

2.3.3 DRILL SITE/PAD CONSTRUCTION

Lucky Minerals proposes to construct 23 drill pads along on the existing road network within the St. Julian Claim Block (**See Figure 1.4 and 2.2**). The drill pads would be approximately 50 feet long by 20 feet wide and would be constructed within the existing road prism. A minimum of leveling would be required to make the site safe, accommodate the drill, and provide room for other equipment and vehicles. Drill pads would be located a minimum of 100 feet away from all perennial streams and 50 feet away from other riparian or wetland areas. Drilling operations would include storm water and sediment controls to prevent pollutants or debris from entering streams and wetlands.

Each site would have a sump to contain the drill cuttings. Each sump would be 3 feet long by 2 feet wide and 3 feet deep, and would collect dry to damp drill cuttings as they are separated from fluids, thus creating a closed system. The fluids are recirculated and used as the drilling process continues to cool the bit, lubricate the advancing drill hole, and remove cuttings from the bit face to the surface. The drilling fluids are not just water, but a combination of water and a synthetic, non-toxic biodegradable polymer mud product used to increase the viscosity of the water to get the desired effect, depending on the downhole conditions.

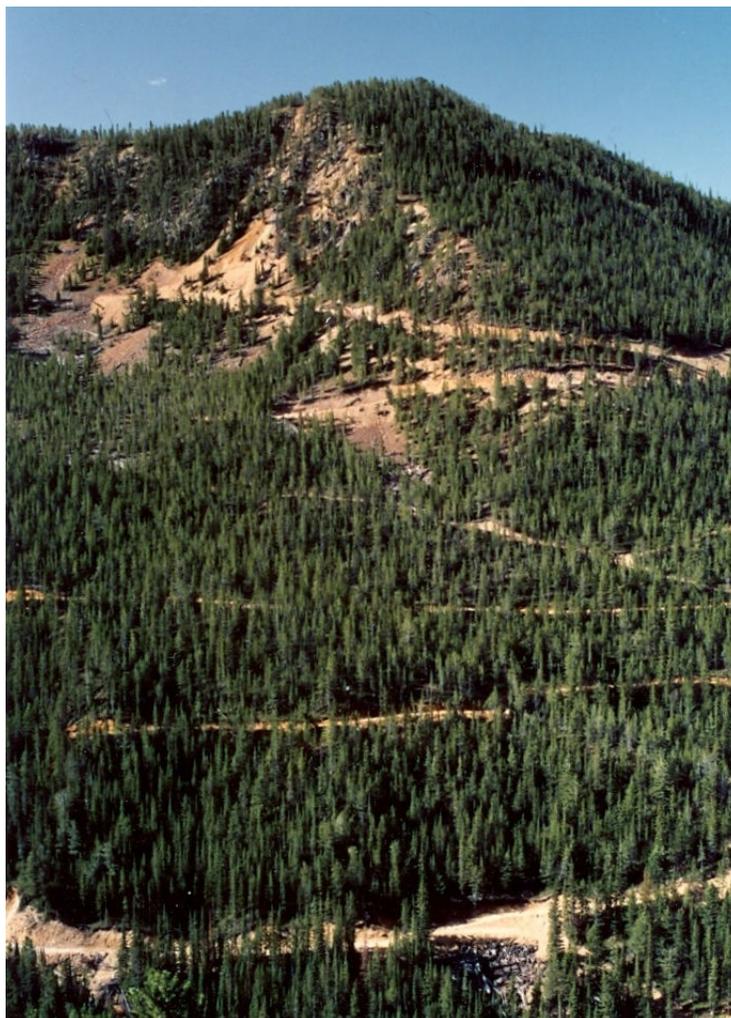


Figure 2.2
Existing St. Julian Claim Block Road Network (Lucky Minerals, 2015)

2.3.4 CORE DRILLING

Lucky Minerals proposes to drill up to 46 drill holes from 23 drill pads (2/pad) over two field seasons on the private land (patented claims). The proposed drill holes would be located on private land within the existing road network of the St. Julian Claim Block (**See Figure 1.4**). The locations of the proposed drill sites are conceptual and may change as new information is acquired. Additional holes may be required on a specific area or direction, as other locations earlier thought practical are found to be not important. Drill holes would be either vertical or angled holes designed to best investigate the subsurface geology. Most of these drill holes are

planned to be angled. However, geologic trends may dictate that vertical drilling may be more effective.

The drill holes would be drilled by track-mounted diamond coring machines. Average depth is expected to be around 1,000 feet, though some holes may be up to 2,000 feet. Upon completion, there would be an effort to pump the remaining drill cuttings down the drill hole before plugging the hole with bentonite and cement. It may not always be possible to completely pump the drill cuttings into the hole, due to rubble or blockages from the sides of the hole. In the event that all of the cuttings cannot be pumped back down the drill hole, there are several options available with respect to the disposal of the cuttings. These options include: burying them in the sump, placing them in underground adits within the St. Julian Claim Block, or taking them to an approved waste disposal site (Dykes, 2016b). Cuttings would be disposed of in compliance with applicable State regulations (ARM 17.24.107) and in consultation with DEQ.

The Proposed Action would use two drills and run them two shifts per day, usually 10 hour shifts with time for shift change and drill maintenance between shifts. Night drilling would require the use of small light plants similar to the ones used by highway construction crews. During drilling operations, Lucky Minerals would have ten workers on the St. Julian Claim Block (Dykes, 2016b).

2.3.5 WATER USE

Lucky Minerals proposes to obtain water for drilling either from existing artesian boreholes or from the East Fork of Emigrant Creek, utilizing the existing water right that is attached to the St. Julian Mine patented claims. The artesian boreholes are located on CGNF administered land and Lucky Minerals would need to obtain permission prior to using that water supply. Spillage containment and clean up kits or materials would be provided for each water pump set-up to handle at least 90 gallons of fuel which is 1.5 times the estimated fuel that would be at that location. The pump itself would be contained within a lined berm to prevent any spillage. The berm would be able to handle at least 1.5 times the volume of fuel contained in the pump (15 gallons) and in the attached 45 gallon drum (1.5 x 60 gallons= 90 gallons). The pump would be located on the existing disturbed ground and set back approximately 5 to 15 feet from the creek (Dykes, 2016b).

2.3.6 NOXIOUS WEEDS

Lucky Minerals proposes to wash all equipment listed in Section 2.3.2 prior to mobilization. Lucky Minerals would be bonded for potential treatment of weeds in the event that noxious weeds are noted within the St. Julian Claim Block the following growing season. Lucky Minerals would commit to annual field inspections of drill sites and laydown areas which are used and occupied by Lucky Minerals under this Plan of Operations to monitor for noxious weed infestations for a 3-year period. In the event that noxious weeds are noted at a site, appropriate weed treatment would be coordinated with CGNF and the Park County Weed Board and the company would be responsible for the treatment of the noxious weeds.

2.3.7 BUILDING STRUCTURES

There would be no permanent physical structures placed or fabricated on the private land within the St. Julian Claim Block. Any temporary camp or laydown structures would be located on private land owned by Lucky Minerals. Cold weather or heavy rain periods may dictate that some sort of temporary shelter be provided for the water pumps. All other temporary structures would also be located on the private land.

2.3.8 RECLAMATION

Reclamation measures would be concurrent with operations and/or begin immediately upon completion of operations at each site. Disturbed areas would be kept to the minimum size necessary to accommodate the exploration operation. If ground-leveling activities are needed or sumps are dug, all suitable on-site organic litter layer, soil, and soil material would be salvaged prior to any other site disturbance (such as drilling or leveling), and either stockpiled or used for immediate reclamation. Felled or cut vegetative material (trees, logs, brush, etc.) would be stockpiled in amounts adequate for reclamation. Lucky Minerals would be responsible for any necessary reclamation resulting from activities of contracted and/or sub-contracted employees.

While completion of final reclamation as soon as possible is preferable, this may not always be possible due to seasonal weather events. In such an event, interim reclamation needs would be completed for the purposes of erosion control on all exploration disturbance areas. This may include draining sumps, erosion control measures such as constructing or installing water bars, scarifying compacted surfaces, placement of woody debris, and interim revegetation.

Each exploration drill hole would be filled with a bentonite-cement mixture and plugged at the surface five to ten feet deep with cement. Drill-hole collar pipe or casing would be removed or cut off below ground level. In the event that all of the cuttings cannot be pumped back down the drill hole, there are several options available with respect to the disposal of the cuttings. These options include: burying them in the sump, placing them in underground adits within the St. Julian Claim Block, or taking them to an approved waste disposal site (Dykes, 2016b).

Non-toxic lubricants in sumps would be allowed to percolate into the ground prior to backfilling. Excavations would be backfilled with excavated spoil material and topped with salvaged organic and soil material. Compacted surfaces created by exploration activities would be loosened and disturbed areas would be recontoured to original condition to the extent possible by reapplying salvaged material over disturbance areas. This includes reapplication of mineral soil, topped with organic soil material, woody debris, and slash. Upon completion of reclamation, any excess salvaged material (rock, soils, slash, woody debris, etc.) would be scattered in the vicinity. Excess rock or soils would not be placed or scattered in streams or wetlands.

2.4 AGENCY-MODIFIED ALTERNATIVE

DEQ developed an Agency-Modified Alternative to address potential impacts identified in the impacts analysis of the Proposed Action. These mitigations are described in the resource subsections below. Some of the mitigations identified in this alternative are not within DEQ's regulatory authority and, therefore, cannot be imposed without the consent of Lucky Minerals.

Lucky Minerals has consented to implement all listed mitigation measures into their Plan of Operations (Dykes, 8/8/2016).

2.4.1 CULTURAL AND HISTORIC

2.4.1.1 *Historic Mining Features*

Same as the Proposed Action, with the exception that all known cultural and historic resources, recorded or identified, would be avoided during the exploration activity. This would include historic mining features within the St. Julian Claim Block.

2.4.2 RECLAMATION

2.4.2.1 *Artesian Boreholes*

Same as described in Section 2.3.5 of the Proposed Action, with the additional requirement that Lucky Minerals would contain flow from artesian boreholes, if those conditions are encountered during drilling. Containment of flow from artesian boreholes would prevent any potential discharge of water or sediment to surface waters or wetlands, prior to plugging and abandoning the drill hole in accordance with ARM 17.24.106.

2.4.2.2 *Vegetation*

Lucky Minerals would include seeding after any road maintenance disturbance to limit invasion by noxious weeds.

2.4.3 TRANSPORTATION

2.4.3.1 *Road Access and Maintenance*

Lucky Minerals would access the St. Julian Claim Block for mobilization and demobilization of exploration equipment using Murphy Road, Old Cemetery Road, Emigrant Creek Road, and Forest Service Road 3272/3272B. Whenever possible, Lucky Minerals would also use this access route for traffic associated with shift changes, however, other routes may be used for incidental travel, i.e., emergencies and personal travel (**See Figure 3.18**).

Travel speeds on all access roads and within the existing road network of the St. Julian Claim Block would be limited to 25 mph to mitigate the risk of collisions with wildlife and reduce fugitive dust.

In addition to posting signs, Lucky Minerals would monitor access and, if needed, install a gate or other type of road barrier at the boundary of the St. Julian Claim Block to restrict public access to the privately-owned roads on the project area.

Road Maintenance would be the same as the Proposed Action; however, Lucky Minerals would provide DEQ with a map identifying potential areas of disturbance along the access road and existing road network within the St. Julian Claim Block proposed in the Agency-Modified Alternative. By identifying the areas that need improvement, the amount of unnecessary disturbance would decrease.

2.4.4 WILDLIFE

2.4.4.1 *Wildlife Awareness Plan*

A wildlife awareness plan would be included in Lucky Minerals' training of its employees. The plan would include the following guidelines:

- Worker Environmental Awareness Program (WEAP) training would be provided to all employees to educate personnel about the existing on-site and surrounding wildlife resources and the measures required to protect these resources. Information on whom to contact if a federally or state listed species or their sign is observed would be provided as part of the WEAP training.
- All project personnel would be educated on being bear aware. This includes storing all food or other bear attractants in properly secured bear-proof containers at all times, abiding by the Forest Service's food storage order (#001-14-11-00-02).
- Lucky Minerals would implement a waste management plan that would minimize refuse to avoid attracting wildlife. All garbage, refuse, and waste would be contained in appropriate bear-proof containers and removed from the site weekly.
- Employees would be prohibited from feeding or harassing wildlife on the site. This would include a recommendation that Lucky Minerals implement a "No Pets" policy in the St. Julian Claim Block.
- Employees would report sightings or sign of Federally and State-listed wildlife to supervisory personnel and record the observation on a wildlife observation form.

2.4.4.2 *Wildlife Avoidance*

Lucky Minerals would conduct preconstruction surveys to identify potential areas of western toad habitat, bat habitat, and nesting birds in areas of new disturbance on drill pads and laydown area.

To avoid disturbing nesting eagles, other raptors, owls, or songbirds, Lucky Minerals would (1) maintain natural forested (or vegetative) buffers around nest trees, and (2) avoid drilling activities near nest trees during the nesting season (February-June). The buffer areas would serve to minimize visual and auditory impacts associated with human activities near nest sites.

If a raptor nest is built or discovered within the St. Julian Claim Block, Lucky Minerals would consult with Montana Fish, Wildlife, and Parks (FWP) to determine avoidance or mitigation measures. To avoid take, as defined by the Migratory Bird Treaty Act (MBTA), Lucky Minerals would refer to the current list of species covered, and those not covered, by the MBTA, prior to initiating project activities (USFWS 2013).

Project design features would consider what lighting is necessary and reduce any unnecessary lighting, both temporally and spatially. Nighttime lighting would be shielded, and directed to

where it is needed to avoid light spillage, and only be bright enough to maintain crew safety. Lucky Minerals would also follow standard bat lighting recommendations.

Standing snags, dead or downed wood, beyond what Project personnel cut during site clearing, would not be cut or removed for use in warming fires.

2.5 ALTERNATIVES CONSIDERED BUT DISMISSED

Additional alternatives were considered, but were dismissed from further study for the reasons listed below.

2.5.1 LIMIT EXPLORATION LICENSE TO ONE DRILLING SEASON

This alternative was not considered further because the applicant has the option for annual renewal. Under 82.4.331, MCA, an exploration license must be issued for a period of one year from the date of issue and is renewable from year to year on application. In addition, restricting the project timeline would not fit the purpose and need. The purpose of the exploration project is for Lucky Minerals to explore for copper/gold/silver/ molybdenum deposits at 23 locations on the St. Julian Claim Block. Restricting the exploration license to one drilling season would limit Lucky Minerals' ability to explore all 23 locations without increasing the number of drill rigs, employees, traffic, and noise. This has the potential to cause additional adverse impacts.

2.5.2 ELIMINATE NIGHT DRILLING

This alternative was not considered further because restricting drilling to daytime only would double the time needed to complete the project, which would increase the potential for long-term impacts to wildlife and recreation. The primary impact from night drilling is lighting, which has been addressed in the Agency-Modified Alternative.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES BY RESOURCE

3.1 INTRODUCTION

The affected environment and potential direct, indirect, and cumulative impacts of the Proposed Action, No Active Alternative, and the Agency-Modified Alternative are described in this section.

3.2 LOCATION DESCRIPTION AND STUDY AREA

The Proposed Action location is confined to private land situated on the St. Julian Claim Block in Section 5, Township 7 South, Range 9 East, accessed through and surrounded by the CGNF. The St. Julian Claim Block is approximately 12 miles southeast of the town of Emigrant and 22 miles northeast of Gardiner (See **Figure 1.3**). The associated study area for the Proposed Action includes all lands and resources in the St. Julian Claim Block, plus those additional areas identified by technical disciplines as "resource analysis areas" that are beyond the St. Julian Claim Block. Resource analysis areas are based on the predicted locations of direct and indirect impacts that could result from the Proposed Action. A detailed description of the Proposed Action is included in Chapter 2.

3.3 GEOLOGY AND MINERALS

3.3.1 ANALYSIS AREA AND METHODS

The analysis area for geology and mineral resources includes the Emigrant Mining District, specifically in the area of the St. Julian Claim Block and the roads that are proposed for site access (**Figure 3.1 and 3.19**). The general geology of Yellowstone National Park was also reviewed and included in the analysis to address public comments about potential impacts to the Yellowstone caldera system. The analysis methods for geology and minerals included reviewing publications from the United States Geological Survey (USGS), Montana Bureau of Mines and Geology (MBMG), and other published research sources, as well as the associated geologic maps and drawings. Historical mining in the area is discussed in further detail in Section 3.6.2.1. Surface geology for the region surrounding the St. Julian Claim Block is shown in **Figure 3.1** (modified from Berg et al., 1999), and the proposed exploration area and access road are highlighted for context. The exploration area is identified to be located within Tertiary granodiorite and dacite porphyry, as well as undivided surficial glacial deposits.

3.3.2 AFFECTED ENVIRONMENT

The Emigrant Mining District occurs along the western edge of the Absaroka Range and the Beartooth Plateau in south-central Montana. This physiographic province is a fault-bounded, northwest-trending structural block of Precambrian basement rock, which was uplifted nearly to its current elevation during the Laramide orogeny (approximately 40 to 70 million years ago). Precambrian crystalline rocks are exposed on most of the Beartooth uplift except for the southwestern and southern areas, which are covered with Paleozoic sedimentary rocks from a

shallow seaway, and Tertiary igneous rocks of the Absaroka-Gallatin volcanic province (Elliott et al., 1983).

The volcanic province consists of deeply eroded andesitic, dacitic, and basaltic volcanoes and the deposits of epiclastically reworked material derived from them, consolidated tuffs, and a variety of related intrusive rocks. These volcanic rocks constitute the main mass of the Absaroka Range, as well as much of the northern Gallatin Range, and are estimated to have formed during the mid- to early-Eocene, 45 to 55 million years ago (Smedes and Prostka, 1972). A more silica-rich, multiphase complex (e.g. granite to quartz monzonite) then intruded into the slightly older volcanic units. Many of the historical mining districts in northwestern Wyoming and south-central Montana are located around these intrusive centers, including the Emigrant Peak, Mill Creek, and Sixmile Creek areas (Elliott et al., 1983).

It is important to note that these volcanic units, intrusive units, and subsequent mineralization events are much older than, and completely unrelated to, the Yellowstone volcanic system. Although there is ongoing debate about the source and mechanism controlling the movement of the Yellowstone mantle plume or "hotspot" (Fouch, 2012), it is clear that the earliest eruption events related to the Yellowstone hotspot occurred in southeastern Oregon/southwestern Idaho between 12 and 15 million years ago. These earlier eruptions, coupled with the slow migration of the North American tectonic plate over this hotspot, have resulted in an elongated volcanic field which is identified as the Snake River Plain in Idaho. The oldest caldera-forming eruption that took place in the current location (northwestern Wyoming) occurred approximately 2.1 million years ago and produced the Huckleberry Ridge Tuff (USGS, 2012). Subsequent eruptions created the Mesa Falls Tuff (1.3 million years ago) and the Lava Creek Tuff (640,000 year ago). The latter eruption formed a 1,500 square mile caldera in the present-day Yellowstone Plateau, and the northern rim of this caldera is located approximately 35 miles south of the Emigrant Mining District.

Extensive deposits of glacially-derived talus and alluvium cover some slopes and canyons in the Emigrant Mining District. To the northwest of the St. Julian Claim Block, the Paradise Valley forms the western margin of the Absaroka Range, Beartooth uplift, and the Emigrant Mining District. This region of Paradise Valley is considered to be a complex, northeast-southwest striking half-graben, bounded on its southeast margin by faults which generally dip to the northwest (Personius, 1982). The Deep Creek fault is the primary fault at this margin, separating the flat surface of the valley floor from the steep western piedmont of the Beartooth uplift. The Luccock Park fault occurs at the valley margin as well, and it likely merges with the Deep Creek fault in the vicinity of Mill Creek, approximately 5 miles to the northeast of Chico Hot Springs and the Emigrant Mining District (Wu, 1995). The valley generally contains deep deposits of eroded volcanics and alluvium from the Yellowstone River channel and floodplain, undivided glacial till, and Pliocene basalt flows. Some gravity data collected near Chico Hot Springs suggest that the bottom of the valley could be as deep as 2.5 miles (Bonini et al., 1972 in Wu, 1995).

Mineralization in the Emigrant Mining District is associated with the dacite-rhyodacite of the Emigrant Stock, with influence from late-stage granitic porphyries. The stock is elongated, trending to the northwest-southeast and is about 4 miles wide and 7 miles long. The associated alteration exhibits a pattern of zoning that is typical of copper-molybdenum porphyry systems.

The metals occurring around the Emigrant Stock are crudely zoned accordingly, with a core of molybdenum with minor copper, an inner zone of copper-gold, and an outer zone of copper-silver-base metals (all from Stotelmeyer et al., 1983). A bounding fault occurs between the older volcanics and the Emigrant Stock, which appears to follow a collapsed and resurgent caldera complex. Subsequent activity produced fracture systems (autobreccias and hydrothermal breccias) that became the hosts for mineralizing fluids, resulting in mineral deposits in the district. These deposits occur as disseminated sulfides and in stockwork and veins in quartz-sericite-pyrite and argillically altered zones. The observed ore minerals vary with zoning but include gold, molybdenite, chalcopyrite, chalcocite, covellite, sphalerite, and galena in a variable gangue of quartz-pyrite veinlets, cementing clasts of silicified and sericitic wall rock, often with disseminated sulfides. The proposed exploration targets are located within the St. Julian Mine zone, where previous exploration work indicated that a coarse, multi-stage breccia is present with moderate to strong argillic alteration. Within certain areas, coarse pyrite has been observed in the siliceous matrix. Minerals of potential economic interest were also identified, replacing some sections of the rhyodacite near high angle faults and shear zones (all from Geologic Systems Ltd., 2015).

Some of the mineralized geologic materials in the Emigrant Mining District are potentially reactive and may produce acid rock drainage or mobilize metals under near-neutral pH conditions. Some water quality samples within the district reflect the reactive nature of the geology (e.g. elevated sulfate and metals concentrations, decreased pH), and in some cases, these reactions occur naturally and are not connected to any type of human disturbance. See the Water and Geothermal Section 3.7 for a more detailed description of the implications of reactive geologic materials on water quality in the area.

The surface geology has been disturbed by construction activities associated with mining and homesteading in the district, including buildings (e.g. mills, offices, houses) and roads. On the southeastern edge of Paradise Valley, the village of Chico was established by 1865 at the mouth of Emigrant Gulch on a placer mining claim. Public access roads to this location still exist, including Chico, Conlin, and Old Cemetery Roads (**See Figure 3.19**), which cut across glacial and alluvial deposits within Paradise Valley. The Chico Road also crosses an exposure of undivided Paleozoic sediments near Chico Hot Springs. From Old Chico, a county road has existed along Emigrant Creek since the 1880s (Stotelmeyer et al., 1983), which follows undivided glacial and alluvial deposits near the stream, all overlying Precambrian metamorphic rocks of the Beartooth uplift and portions of the Absaroka-Gallatin volcanics. Between the Great Western and Great Eastern Mine claims and the St. Julian Claim Block, Forest Service Road 3272 cuts across some steep, unvegetated slopes of very coarse volcanic talus. On the north side of the road, some of the talus slopes show evidence of widespread oxidation on rock surfaces (i.e. red/orange iron crust). On the private land encompassing the St. Julian Mine and Mill area (**Section 3.6.2.1**), the remnants of abandoned structures exist along the access road. The switchback road and the adjoining drill pads that were used during exploration of the St. Julian Claim Block in the 1970s and 1990s are cut into the volcanics and thin glacial deposits.

Subsurface geology and mineral resources have also been disturbed by historical placer and underground mining. Placer mining began in the Emigrant Mining District in the 1860s and continued into the 1940s, while lode mining did not begin until 1885. The mineral potential in the St. Julian Mine area was first identified in 1887 and the area has a history of sporadic

production (**Section 3.6.2.1**). Many of the major mine workings in the district occur around the St. Julian Mine and patent survey plats drawn in 1910 showed at least three shafts and eight adits, with a total estimated length of about 1,060 feet (GLO, 1910; Stotelmeyer et al., 1983). Small waste rock dumps remain at the surface near collapsed adits and shafts. Waste rock and some mill concentrates may also be found in the old mill area (Stotelmeyer et al., 1983), but because a tailings impoundment was never constructed, any tailings that may have been produced at the site were likely disposed of in the nearby East Fork of Emigrant Creek, consistent with the methods of that time period.

There are two collapsed shafts near the top of the hill at the St. Julian Mine area, one of which is reported to be at least 100 feet deep (Stotelmeyer et al., 1983). Rock in one of the associated dumps is likely representative of the material at depth. The dump consists primarily of altered rhyodacite, strongly cut by veins of aphanitic silica to white crystalline quartz. The veins often exhibit voids lined with drusy quartz with occasional pyrite. Many fracture planes host fine quartz with up to 30 percent limonite or hematite, following pyrite oxidation. Along the upper switchback road which leads to the No. 3 adit, the rhyodacite volcanics are dominant, with flow-banded and autobrecciated phases. The nearby waste rock contains examples of finely fragmented pieces of rhyodacite in a siliceous matrix, and a weathered crust of limonite from the oxidation of pyrite within the breccia. The dump is evenly covered in a layer of fine clay, with a light grey or faint blue color, possibly indicating the condition of altered rock at the end of the adit (all from Geologic Systems Ltd., 2015). More recent exploration began in the 1970s, when Duval Corporation drilled five holes and conducted induced polarization geophysical surveys. This work was later followed by Pegasus Gold Corporation, who drilled 22 reverse circulation holes by 1992. Based on data compiled by Lucky Minerals, a total of 14,255 feet of drilling was completed with these 27 holes (Geologic Systems Ltd., 2015).

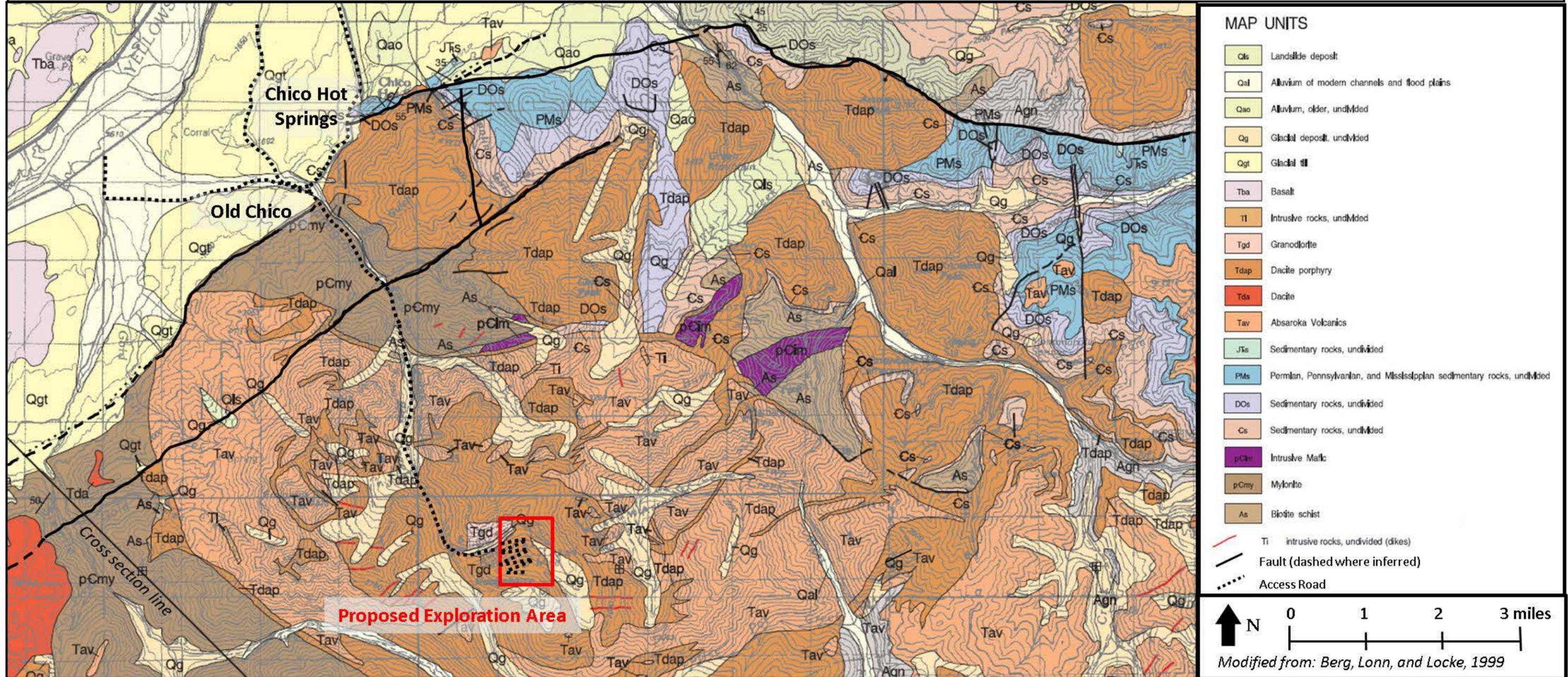
3.3.3 DIRECT AND INDIRECT IMPACTS

3.3.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples.

The geologic materials left on the surface due to erosion or from historical operations may be reactive and mobilize metals under acidic or near-neutral pH conditions, depending on the minerals present. However, even though weathering occurs on the surface of these materials, there is no evidence of continual water discharge from these materials or associated impacts to surface water. In contrast, it appears that groundwater quality is affected by the mineralized rocks that remain in the subsurface, particularly in the area to the north of the East Fork of Emigrant Creek (**Section 3.7**). The natural acid rock drainage that occurs within that slope contributes acidity and metals to the local groundwater and eventually to the stream below. Ferricrete deposits have formed in some places in the channel of the East Fork of Emigrant Creek as a result of this acidic drainage. The reactivity of that slope is likely associated with the locally-intense pyrite alteration noted through historical mining (Hargrave et al., 2000).

Figure 3.1
Surface Geology
 St. Julian Exploration Project, Park County, Montana



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Other groundwater data from the area indicate that this acidic chemical signature is certainly not reflective of all subsurface materials in the East Fork of Emigrant Creek drainage (Section 3.7).

Under the No Action Alternative, no drill pads would be constructed on the road network that currently accesses the St. Julian Claim Block. Therefore, no road grading would be conducted and the roads would exist in their current condition. No drilling would occur under the No Action Alternative, so no drill cuttings would be generated and mud sumps would not be excavated to contain the cuttings, nor would the sumps need to be reclaimed. Any naturally exposed sulfides along talus slopes or waste rock material generated by historical mining and milling would remain exposed at the surface and continue to weather under current conditions. In some areas, groundwater resources would continue to be impacted by local acid rock drainage resulting from subsurface mineralization.

3.3.3.2 *Proposed Action*

Under the Proposed Action, Lucky Minerals would explore the St. Julian Claim Block for the extent of copper, gold, silver, and molybdenum mineralization within the previously described volcanics. This work would involve drilling and recovering core samples that would later be analyzed and used to model subsurface geology, reveal any structural features, and further define the extent of mineralization.

The Proposed Action does not include any new road construction, but the access roads and the existing road network on the privately patented claims would be improved through grading in localized areas, in order to keep them serviceable for the type of vehicles described in the proposed action. All roads would be cleared of loose rock and other debris, but they would not be made wider. The impacts to geology and minerals from over-road transportation and limited grading of existing roads would be consistent with the current condition of those surfaces, and are considered minimal. The geologic materials that could be exposed by surface grading through the Proposed Action are the same materials that were disturbed by the initial construction of the roads, most of which have been in existence for over a century.

There are 23 pad locations proposed and there may be up to two holes drilled at each pad. The drill holes would be either vertical or angled holes that could extend 1,000 to 2,000 feet from the ground surface, depending on the observed geologic trends and the most effective approach to investigate the subsurface at each site. The disturbance at each drill pad would be minimized by conducting drilling operations in the prism of the existing road, within an area approximately 50 feet long by 20 feet wide (1,000 ft²). The potential impacts to geology and minerals from pad surface preparation are minimal and identical to the impacts from general road grading and maintenance.

The core that is extracted from the drill holes would have a diameter less than or equal to 3.5 inches and would be transferred into designated boxes for logging and analysis at a later time. The core samples would be transported away from the site and therefore would not have any potential to impact the area. Even with target depths exceeding 1,000 feet, the amount of rock removed from each drill hole (around 100 cubic feet) would be very small compared to the

volume of the intrusive host rocks (scale of cubic miles). This would be a negligible depletion of the geologic resources in the area.

Each drill pad would have a mud sump constructed near the drill machines for the disposal of dry to damp drill cuttings, and the sump will have an approximate volume of 18 cubic feet or less. Prior to excavating the sump, all suitable subsoil, soil, and organic debris would be salvaged and either stockpiled or used for immediate reclamation. The drill cuttings would be the only solid waste generated from drilling, and would consist of ground rock, with a mixed composition that is representative of the lithology encountered within the drill hole. Following standard drilling practices, the drill fluid would be recirculated at the surface and the cuttings would be separated using cyclone technology, so no fluids would be stored in the sumps.

Upon completion, there would be an effort made to pump the drill cuttings down the drill hole, although it may not always be possible due to blockages within the hole or the rheology of the cuttings. The cuttings that remain in the sumps could be covered and compacted by a dozer and recontoured to match the previous site conditions, placed in underground adits within the St. Julian Claim Block, or taken to an approved waste disposal site (Dykes, 2016b). On-site compaction and burial would include the reapplication of subsoil, topped with soil, organic material, woody debris, and slash. The drill holes would be filled with a bentonite-cement mixture designed to effectively seal and stabilize down-hole conditions, and the surface of the drill hole would be sealed with 5 to 10 feet of cement. These practices are consistent with State requirements for exploration reclamation (ARM 17.24.107) and are designed to limit the reactivity and mobility of minerals within the buried cuttings and sealed borehole walls as well as to prevent cross contamination of aquifers.

3.3.3.3 *Agency-Modified Alternative*

Road maintenance would be the same as the Proposed Action, with the exception that before exploration activities begin, Lucky Minerals would identify and map the areas of localized disturbance that would be expected on the access roads from Emigrant to the St. Julian Claim Block, and on the existing road network within the St. Julian Claim Block. Even though the geologic materials that could be exposed by grading were disturbed by initial road construction and historical mining, the new grading disturbance locations would be minimized to prevent the potential transport of native sediments and historical mine wastes, thus limiting the potential impacts to other resources. Mapping the locations that would receive road maintenance would assist the company in identifying places where grading work should be avoided or limited to reduce potential impacts.

3.3.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, indirect impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. No indirect impacts to geology and mineral resources are predicted.

3.4 WILDLIFE

3.4.1 INTRODUCTION

This section analyzes the potential impacts of the proposed Lucky Minerals exploration project (Project) on Federal and State listed terrestrial wildlife and Gallatin National Forest Plan Management Indicator Species (MIS) occurring or with the potential to occur within the St. Julian Mine patented claims in Park County, Montana.

3.4.1.1 *Key Issues*

The analysis of impacts on terrestrial wildlife was framed around concerns identified during scoping, and considers the effect of the alternatives on these factors. These factors include:

- Exploration activities proposed by Lucky Minerals may affect populations of and habitat for area wildlife, including Federal or State listed species.
- The entire proposed project boundary is within occupied grizzly bear habitat and Canada lynx designated critical habitat. Further, exploratory drilling on the St. Julian Claim Block is close to the current Primary Conservation Area (PCA) boundary for grizzly bear.
- The proposed project may fragment or degrade habitat, resulting in the interruption of normal daily routines, declines in breeding success, and physiological stress responses that can lead to behavioral changes, and even direct mortality.
- The increased human presence, traffic / machinery / drilling, and associated noise of the proposed project may change the way wildlife use the area. Adverse effects may include disruption of migratory corridors and big game security areas.

3.4.1.2 *Regulatory Framework*

Although a variety of sources are used to assess wildlife species and habitat, including historic records, current databases, large-scale assessments, scientific studies, and management recommendations, the regulatory framework providing direction for the protection and management of wildlife and habitat comes from the following principal sources:

- Endangered Species Act of 1973 (ESA)
- Migratory Bird Treaty Act (MBTA)
- The Bald and Golden Eagle Protection Act (BGEPA)
- National Forest Management Act of 1976
- Gallatin National Forest Plan as Amended, 2015 (GNFP)
- Migratory Bird Executive Order
- Conservation Agreements and Strategies

The U.S. Fish and Wildlife Service (USFWS) typically becomes involved in a project when a federal action is being evaluated under the National Environmental Policy Act (NEPA). There is

no federal action invoking NEPA for the Lucky Minerals exploration project. However, the USFWS may still play a role as administrators of the following wildlife laws:

Endangered Species Act

Section 9 of the ESA of 1973 (16 U.S.C. 1531-1544) prohibits individual private parties and Federal agencies, from "taking" endangered or threatened wildlife or plants. "Take" includes "harming" a listed species and "harm" is defined by USFWS to include habitat alteration. Any party engaging in an activity that might incidentally harm a listed species may apply for an "incidental take permit" from the USFWS. Parties may also apply for "enhancement of survival" permits. These are agreements to encourage landowners to take actions to benefit species while providing assurances they would not be subject to additional regulatory restrictions.

Migratory Bird Treaty Act

The MBTA (16 U.S.C. 703-712) declares that it is unlawful to take, kill, or possess migratory birds. The Secretary of the Interior through the USFWS is authorized to determine when, to what extent, and by what means, it is compatible with the terms of the conventions to allow taking or killing of migratory birds. For projects such as exploratory drilling, USFWS would make a determination based on the good faith effort of the project operator to minimize and avoid such take.

Bald and Golden Eagle Protection Act

The BGEPA (16 U.S.C. 668-668d, 54 Stat. 250) as amended, provides for the protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession, and commerce of such birds. This act is enforced by the Secretary of the Interior via the USFWS. In determining the amount of the penalty, the gravity of the violation, and the demonstrated good faith of the person charged shall be considered by the Secretary.

3.4.2 ANALYSIS AREA AND METHODS

The analysis area for direct and indirect impacts on wildlife is defined as the St. Julian Claim Block boundary, and the road corridor along Emigrant Creek. The cumulative impacts area is the broader project region and is defined as the general geographic area up to a 4-mile radius of the St. Julian Claim Block and adjacent private land. The analysis was completed using existing data. No field surveys were completed in support of this EA. The temporal analysis of each alternative would be included as part of the cumulative impacts discussion, as the response of species and populations after a disturbance event is species-specific and could depend on the disturbance type and its impacts to the microsite, and the tolerance of the species to disturbance.

3.4.2.1 *Species Considered*

Although the proposed drilling is to occur on private, patented claims, equipment and personnel must travel through CGNF-managed land. As a result, federally listed threatened and endangered, state sensitive, and Gallatin Forest National Plan MIS species were considered

in the analysis. Current MIS species identified in the Gallatin National Forest Plan include grizzly bear, bald eagle, elk, northern goshawk, and pine marten.

3.4.2.2 *Probability of Occurrence*

Searches of the Montana Natural Heritage Program (MNHP) species occurrence database, and current Forest Service sensitive and MIS species lists reveal a broader assemblage of species than are likely to occur on or near the project. The probability of a species occurring within the St. Julian Claim Block is based on records of species sightings, presence of suitable habitat, and the potential of the area under consideration to provide suitable habitat in the future. Following is an explanation of the categories for probability of occurrence:

No probability of occurrence – No suitable habitat occurs in the area, and/or the area is outside the known range of the species, and there are no recorded observations in or near the area.

Low probability of occurrence – Marginally suitable habitat is limited, isolated, and there are no recorded observations of the species in or near the area.

Moderate probability of occurrence – Suitable habitat exists in the area and it is within the known range of the species, but there are no confirmed observations in or near the resource area.

High probability of occurrence – Suitable habitat is present in the area and/or there have been confirmed observations of the species using similar habitat in or near the resource area.

3.4.3 **AFFECTED ENVIRONMENT**

3.4.3.1 *Existing Environment*

The St. Julian Claim Block is located within the Northern Rocky Mountain physiographic province (McNab and Avers, 1994). The St. Julian Mine claims are approximately 7.2 miles from the Yellowstone River. Emigrant Creek, a tributary to the Yellowstone River, parallels Emigrant Gulch Road from Old Chico to the northern edge of the property (**See Figure 1.3**). Elevations in the St. Julian Claim Block range from 4,960 feet at the intersection of Chico Cemetery Road and East River Road, to approximately 9,069 feet above mean sea level at the end of the developed road on the St. Julian Mine claims. Lower elevations are primarily used for private home sites, cattle grazing, and hay production. Upon entering Emigrant Gulch, the landscape transitions to a narrow v-shaped glacial valley with steep side slopes and rocky outcrops. The slope terrain is rugged, with stands of tree cover interspersed amid broad expanses of exposed scree. The St. Julian Mine claim property is situated on a densely forested north-facing slope. Surrounding the property are treeless, rocky alpine ridgelines, and cirques with short, broad valleys.

Primary habitats in the St. Julian Claim Block are comprised of montane sagebrush steppe, lower montane-foothill riparian woodlands, mixed conifer forests, and subalpine woodland and parklands. Based on these habitat types, the site is expected to provide habitat primarily for species associated with riparian habitats along Emigrant Creek and tributary watercourses;

lodgepole, spruce, and fir dominated forests; and subalpine to alpine exposures. The following is a brief discussion of the habitat components analyzed for sensitive species.

3.4.3.2 *Habitats*

Montane Sagebrush Steppe

This system dominates the montane and subalpine landscape of southwestern Montana from valley bottoms to subalpine ridges. The sagebrush steppe on the flanks of the Yellowstone River valley is generally dominated by mountain big sagebrush. Other co-dominant shrubs include silver sagebrush, subalpine big sagebrush, three-tip sagebrush and antelope bitterbrush. Because of the mesic site conditions, most occurrences of this system support a diverse herbaceous undergrowth of grasses and forbs. Shrub canopy cover is extremely variable, ranging from 10 percent to as high as 40 or 50 percent (MNHP, 2016a). Other shrubs may be present, but usually at low cover values (5–10%). Species include rabbitbrush, wax currant, Woods rose, deerbrush ceanothus, snowberry, and serviceberry. The herbaceous layer is usually well represented. Graminoids can be abundant, and are dominated by fescues and wheatgrasses. Forb diversity is moderate to high. Species may include arrowleaf balsamroot, Indian paintbrush, cinquefoil, fleabane, phlox, milkvetch, prairie smoke, lupine, buckwheat, yarrow, rosy pussytoes, wild strawberry, western sagewort, and prickly pear cactus (MNHP, 2016a). Federal and state-listed wildlife species associated with this habitat type in the project region include grizzly bear, little brown myotis, hoary bat, Townsend's big-eared bat, golden eagle, peregrine falcon, green-tailed towhee, and western toad. Elk are also common.

Lower Montane-Foothills Riparian Woodlands

This ecological system is found throughout the Rocky Mountains, characteristically occurring as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. Riparian systems are dependent on a natural hydrologic regime. Within the project region they are found within the flood zone, cobble bars, and immediate streambanks along Emigrant Creek and its tributaries, and near seeps and springs. Dominant trees may include cottonwood, Douglas-fir, and willow. Dominant shrubs include Rocky Mountain maple, thinleaf alder, river birch, red-osier dogwood, hawthorn, chokecherry, skunkbush, willows, silver buffaloberry, rose, and snowberry. The herbaceous understory usually includes colonizing native forbs such as yarrow, goldenrod, American licorice, and Canada horseweed (MNHP, 2016b). In general, some stands may have a small component of native graminoid species like reedgrasses or wheatgrasses. Exotic grasses such as redtop, Canada bluegrass, Kentucky bluegrass, common timothy, and reed canarygrass can dominate the graminoid layer if this system adjoins cultivated areas or disturbed upland communities (MNHP, 2016b). Federally and state-listed wildlife species associated with this habitat type in the project region include: grizzly bear, little brown myotis, hoary bat, Townsend's big-eared bat, bald eagle, great gray owl, pinyon jay, veery, evening grosbeak, Clark's nutcracker, green-tailed towhee, and western toad. Elk are also common. Wolverines are occasionally associated with this habitat.

Mature Conifer Forests

Many wildlife species occurring in the project region prefer or occur only in mature and old forests. In forest habitats, snags (dead trees), broken-topped live trees, downed logs, and other

woody material are required by a wide variety of species for nesting, denning, roosting, perching, feeding, and cover (Bull et al., 1997). Small mammals and birds use standing and downed dead material for food storage and for hunting. Downed logs and stumps are important for travel, both under the snow in the winter and as cover throughout the year. It is estimated that about one-third of the bird and one-third of the mammal species that live in the forests of the Rocky Mountains use snags for nesting or denning, foraging, roosting, cover, communication, or perching. As down woody material further decays, it plays an important role in nutrient cycling, soil fertility, and erosion control. Although various sizes of snags and down wood are used, larger birds and mammals require larger-diameter downed trees, which provide stable and lasting structures and offer protection from weather extremes (Bull, 2002). Longer down woody pieces provide superior runways, shelter, and under-snow access.

Mixed conifer forests in the project region are often dominated by Douglas-fir forests with lodgepole pine frequent in stands at higher elevations. Engelmann spruce is found in some stands within the upper montane zone (MNHP, 2016c, d). While whitebark pine is found in mixed conifer forests at higher elevations, the understory of mixed conifer forests often supports diverse stands of ericaceous shrubs, such as rusty leaf menziesia, dwarf huckleberry, mountain huckleberry, and mountain heath. Other common shrubs include juniper, Rocky Mountain maple, serviceberry, Utah honeysuckle, ninebark, currant, thimbleberry, birch leaf spiraea, creeping Oregon grape, and common snowberry. Common graminoids may include pinegrass, Ross' sedge, Geyer's sedge, bluebunch wheatgrass and Idaho fescue. Forb diversity varies depending on moisture conditions, and may include baneberry, arnica, pussytoes, wild strawberry, fragrant bedstraw, twinflower, clasp-leaf twisted stalk, and western meadow rue (MNHP, 2016c, d). Federal and state-listed wildlife species associated with this habitat type in the project region include grizzly bear, Canada lynx, wolverine, pine marten, little brown myotis, hoary bat, Townsend's big-eared bat, bald eagle, northern goshawk, great gray owl, brown creeper, Cassin's finch, evening grosbeak, Clark's nutcracker, green-tailed towhee, varied thrush, and western toad. Elk are also common. Veeries are occasionally associated with this habitat.

Subalpine and Alpine Woodlands

This system includes all subalpine and tree-line forest associations of Montana's Rocky Mountains. Found at elevations above 8,800 feet, it is characteristically a high-elevation mosaic of stunted tree clumps, open woodlands, and herb- or dwarf-shrub-dominated openings, occurring above closed forest ecosystems and below alpine communities. The climate is typically cold in winter and dry in summer. Landforms associated with this system in the project region include ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, landslides and rockslides, and cirque headwalls and basins. Characteristic of the habitat are open areas with stands of whitebark pine, subalpine fir, and Engelmann spruce. The understories of subalpine and alpine systems tend to be sparse; moister sites support mats of ericaceous plants, such as tall huckleberry, dwarf bilberry, or most often, grouse whortleberry, while alpine currant, short-fruited willow, planeleaf willow, mountain heath and mountain heather may also be present (MNHP, 2016e). The herbaceous layer is sparse under dense shrub or tree canopies, but may be dense where the shrub canopy is open or absent. Common graminoids include purple mountain hairgrass, Hitchcock's woodrush, alpine bluegrass, Sandberg's bluegrass, alpine timothy, pinegrass, Parry's rush, and sedges. A wide diversity of

forbs is present in open meadows among or adjacent to these forests, and typically include arnica, subalpine wandering daisy, arrowleaf groundsel, aster, sibbaldia, glacier lily, western windflower, and penstemon (MNHP, 2016e). Federal and state-listed wildlife species associated with this habitat type in the project region include grizzly bear, wolverine, pine marten, little brown myotis, hoary bat, golden eagle, peregrine falcon, Cassin's finch, evening grosbeak, Clark's nutcracker, varied thrush, and western toad. Elk are also common. Canada lynx, Townsend's big-eared bat, northern goshawk, great gray owl, brown creeper, and black rosy-finch are occasionally associated with this habitat.

3.4.3.3 *Wildlife*

The St. Julian Claim Block has substantial marten, bobcat, black bear, mountain lion, and grizzly bear populations¹. Based on observation and radio-tracking data, wolverines have also been documented in the vicinity and have potential to use this area. Although lynx have not been observed in the St. Julian Claim Block, there is a potential for them to exist. The St. Julian Claim Block habitat provides cover for an abundant prey base including snowshoe hares, jackrabbits, red squirrels, and small mammals for many forest carnivores. Although the St. Julian Claim Block is generally within reach of nearby wolf packs and dispersing wolves, there has not been a documented pack overlapping with this specific area for over five years. Wolves tend to use more moderately sloped terrain, and likely would not select such a steep area.

The valley bottom, riparian, and forested habitat types, as well as associated edge habitat, collectively provide valuable habitat for a variety of game and nongame birds. Additional species guilds are found within the rocky cliffs and associated high alpine habitat of the proposed area. Overall these collective habitat types provide important nesting, feeding, and/or protective cover for migratory birds, game birds, and a diversity of non-game birds, including owls and a large number of raptors such as red-tailed hawk, Swainson's hawk, ferruginous hawk, foraging peregrine falcons, and wintering rough-legged hawks. These areas support and are of great value for foraging, migrant, and nesting bald eagles and golden eagles. The mosaic structure of the mixed conifer vegetation provides nesting habitat for northern goshawks, sharp-shinned hawks, and Cooper's hawks. Golden eagles, bald eagles and peregrine falcons have been documented nesting near to the St. Julian Claim Block (MNHP, 2016 data, as cited in FWP, 2016).

THREATENED AND ENDANGERED WILDLIFE SPECIES

The ESA was passed to protect threatened and endangered species, and their habitats. Under the ESA, endangered species are defined as species that are likely to become extinct throughout

¹ Montana Fish, Wildlife and Parks noted the St. Julian Claim Block also contains potential habitat for fisher (Gower, pers. comm 2016). However, they have not been documented in the area and have a low probability of occurrence. As a result, they are not considered in this analysis.

all or a large portion of their range. Threatened species include species that are likely to become endangered in the near future. Critical habitat is habitat that is determined to be vital to the survival of endangered or threatened species. A search of the MNHP database revealed three federally listed wildlife species with a moderate to high probability occurrence in the project region.

Species	USFWS	CGNF	Probability of Occurrence on St. Julian Claim Block	Comments
Bald eagle	BGEPA, MBTA, BCC*	Sensitive	High	Federally delisted on June 28, 2007. USFWS monitoring for 5-year intervals after delisting.
Canada lynx	Threatened	Threatened	High	USFWS revised critical habitat for the contiguous United States distinct population segment of Canada lynx, and revised the boundary of the distinct population segment (USFWS 2014).
Grizzly bear	Threatened	Threatened	High	USFWS proposed the removal of the Greater Yellowstone Ecosystem population of grizzly bears from the federal list of endangered and threatened wildlife (USFWS 2016).

* BCC: Bird of Conservation Concern

Bald Eagle

The bald eagle is primarily a species of riparian and lacustrine habitats, frequenting large lakes, reservoirs, and major rivers. Wetlands, rivers, spring spawning streams, ungulate winter ranges and open water areas are important year-round habitat (Bureau of Land Management [BLM], 1986). Wintering habitat may extend from the riparian corridor to upland sites. Nesting sites are generally located within larger forested areas near large lakes and rivers where nests are usually built in older, large-diameter trees. Nesting site selection is dependent upon maximum local food availability and minimum disturbance from human activity (Montana Bald Eagle Working Group, 1994).

The bald eagle was delisted by the USFWS in 2007, but is still protected under the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940. The USFWS (2007) has developed management recommendations for active nests. The Montana Bald Eagle Working Group also developed management guidelines, which are followed by state agencies (MBEWG, 1994).

Bald eagles generally nest in mature or old-growth trees, snags, cliffs, and rock promontories near coastlines, rivers, and large lakes where there is an adequate food supply. In forested areas, bald eagles often select the tallest trees with limbs strong enough to support a nest that can weigh more than 1,000 pounds. Nest sites typically include at least one perch with a clear view of the water, where eagles forage. Bald eagles occur in the project region year-round; however, it is not known if active nests are in or adjacent to the St. Julian Claim Block.

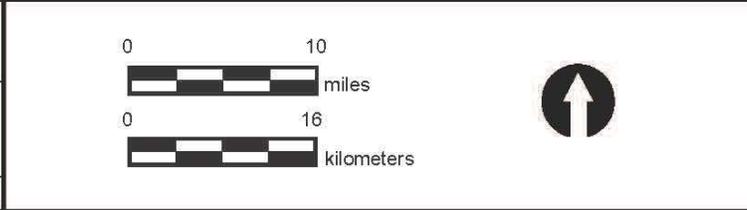
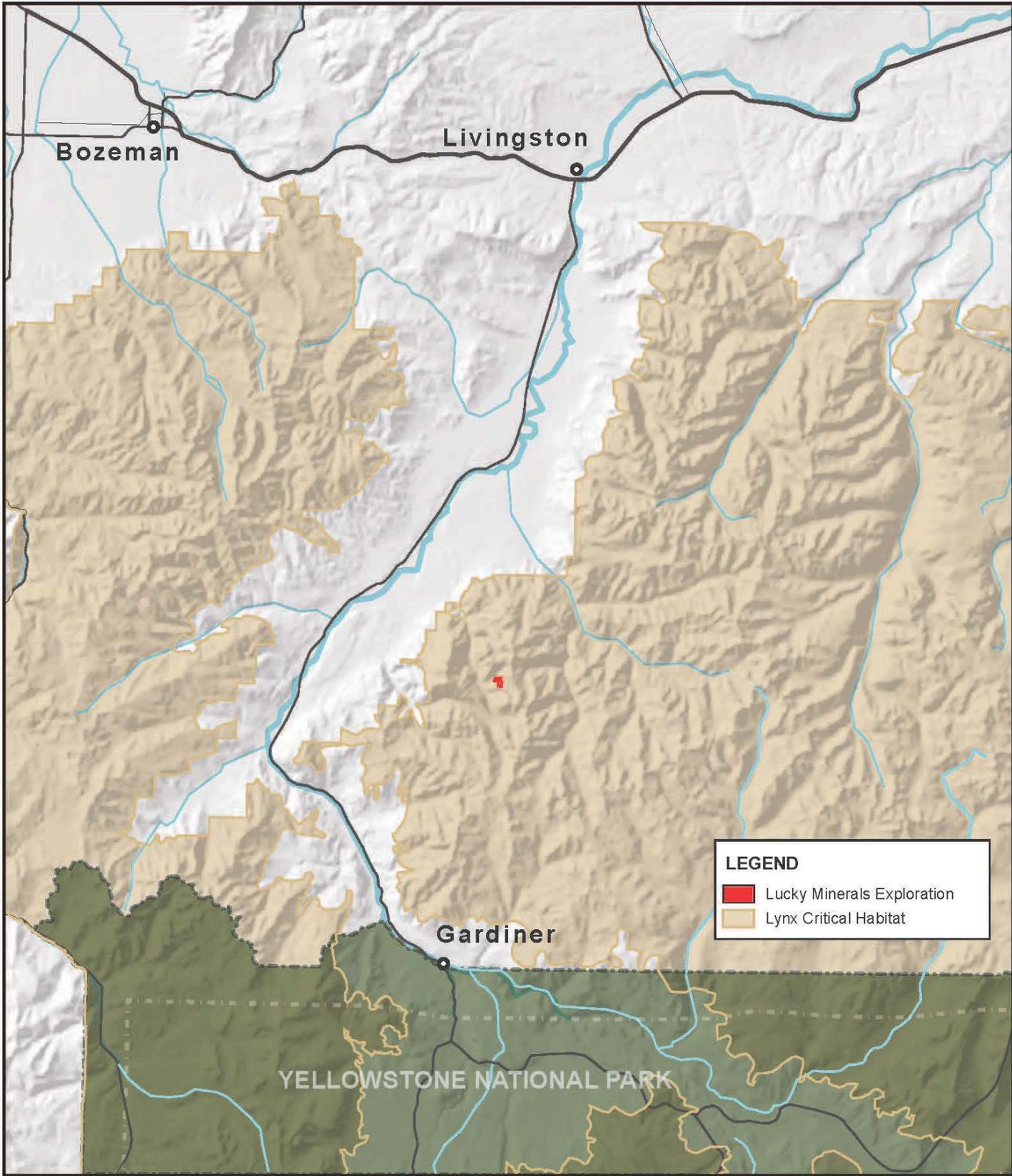
Canada Lynx

Canada lynx are secretive forest carnivores found in the boreal forests of northern latitudes and high mountains. In the northern Rocky Mountains, the majority of lynx occurrences are associated with conifer forests above 4,101 feet (USFWS, 2014). The dominant vegetation types that constitute lynx habitat include dry-mesic subalpine fir-Engelmann spruce forest and woodland, and lodgepole pine forests. Lynx habitat in Montana occurs primarily in the high-elevation mountains associated with conifer forests, from 4,260 to 6,900 feet elevation. Lynx habitat in Montana is primarily the moist subalpine fir vegetation type, which is found above the dry ponderosa pine and Douglas-fir vegetation types, and below the alpine zone, a habitat that occurs in the St. Julian Claim Block and surrounding region. Dominant species include mature Engelmann spruce and subalpine fir trees with lesser components of lodgepole pine, Douglas-fir, and western larch (Interagency Lynx Biology Team, 2013). Lynx habitat in the western U.S. is a mosaic of structurally different forest types occurring at opposite ends of the stand age gradient. Lynx require early successional forests that contain high numbers of prey (especially snowshoe hares) for foraging, and late-successional forests that contain cover for denning and rearing kittens (Koehler and Brittell, 1990, as cited in Koehler and Aubry, 1994).

Intermediate successional stages may serve as travel cover for lynx but function primarily to provide connectivity within a forest landscape. While such habitats are not required by lynx, these intermediate stages "fill in the gaps" between foraging and denning habitat. The common component of natal den sites appears to be large woody debris, either downed logs or root wads (Koehler, 1990). Den sites may be located in older forests, mature forests, or any regenerating stand with large amounts of debris.

As a mid-size carnivore, lynx target smaller prey species that reproduce relatively quickly. Landscapes with high snowshoe hare densities are optimal for lynx survival, reproduction, and population persistence. While they primarily feed upon snowshoe hare, which live in dense thickets of young trees and shrubs, other important alternate prey species include tree squirrels, voles, and mice (Koehler and Aubry, 1994). In Montana, the highest densities of snowshoe hares were found in regenerating forest stands with high sapling density and in uncut, mature multi-story stands with abundant saplings (Interagency Lynx Biology Team, 2013). Lynx often travel long distances during hunts, depending on availability of prey. Documented home ranges of lynx can vary from 3 to 300 square miles, depending on the animal's gender, abundance of prey, the season, and the density of populations (Slough and Mowat, 1996; Poole, 2003).

In 2014, the USFWS designated critical habitat for Canada lynx including portions of the CGNF. The Emigrant Gulch Road corridor and St. Julian Claim Block lie within the bounds of designated lynx critical habitat (**Figure 3.2**). While lynx may be present along the road corridor in Emigrant Gulch, and in the project area, there has been no documented observance on the St. Julian Claim Block. There is anecdotal evidence documenting the presence of a resident female in the Mill Creek drainage between 2003 and 2009. Given their large territory, and the project's proximity to designated wilderness and inventoried roadless areas contiguous with the Mill Creek drainage, it is probable lynx are present in the St. Julian Claim Block.



St. Julian Exploration Project
 Critical Lynx Habitat
Figure 3.2

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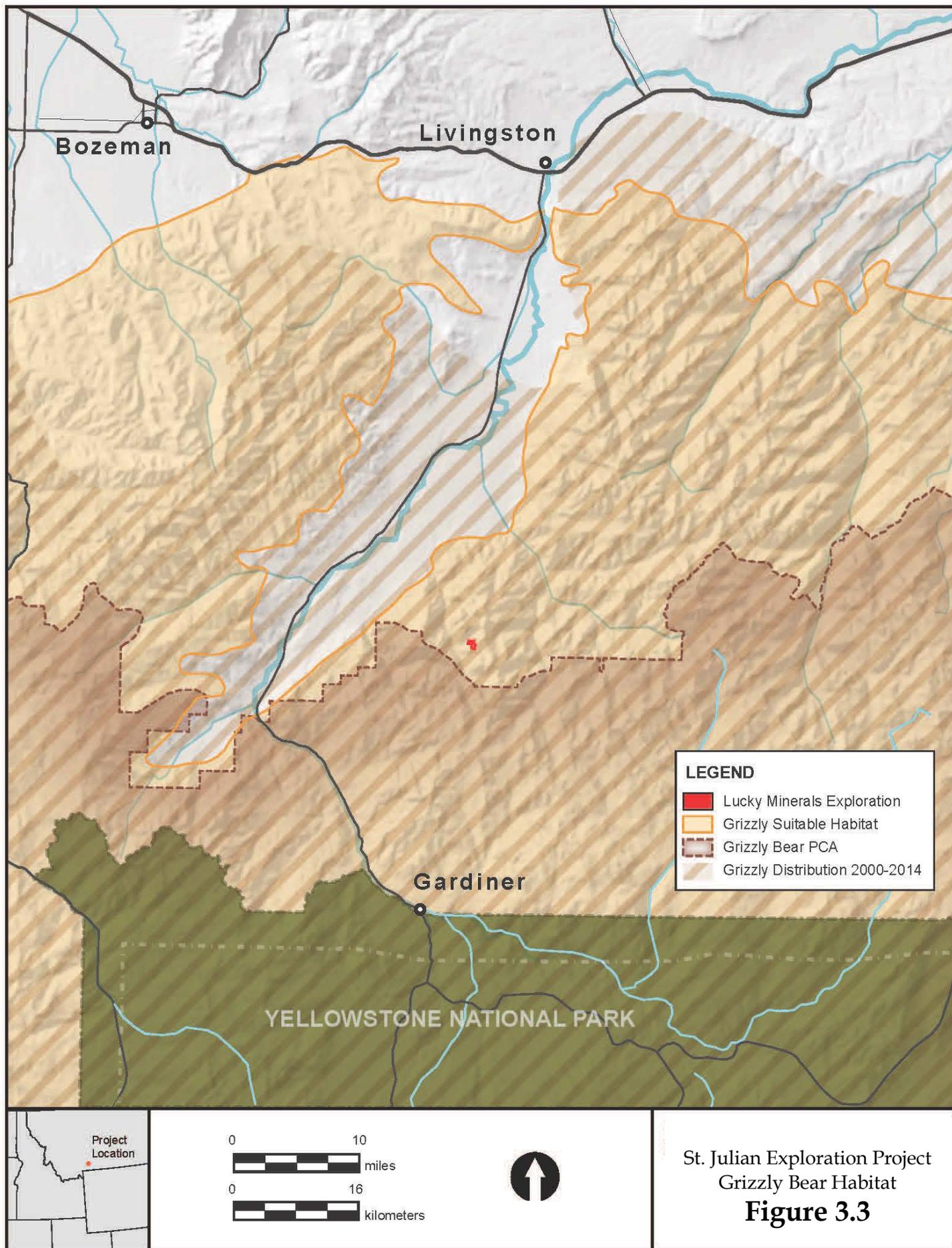
Grizzly Bear

Grizzly bears, a threatened species under the ESA (USFWS, 1975), use a wide variety of habitats, depending on season, local population, and individuals. Home ranges are variable in size (7 to 1,245 square miles) depending on food availability and distribution. A seasonal elevation gradient is often used including low elevation riparian areas, snow chutes, and meadows in spring and fall; and higher elevation habitats such as subalpine forests, alpine tundra, and boulder fields in summer, early fall and winter (Natural Resources Conservation Service, 2011). Typical habitats used for feeding, foraging, and resting include mixed shrub fields, seeps, grasslands, mixed conifer woodland and parkland, and old burns. Dense-timbered habitats are often used for denning and daytime bed sites. In summary, moist open-land habitats in combination with timbered areas are essential for optimum grizzly bear habitat.

On March 11, 2016, the USFWS proposed removing the Greater Yellowstone Ecosystem (GYE) population of grizzly bears from the federal list of endangered and threatened wildlife. The proposed rule change reflects the best available scientific and commercial data, indicating the GYE population of grizzly bears has recovered and no longer meets the definition of an endangered or threatened species under the ESA (USFWS, 2016).

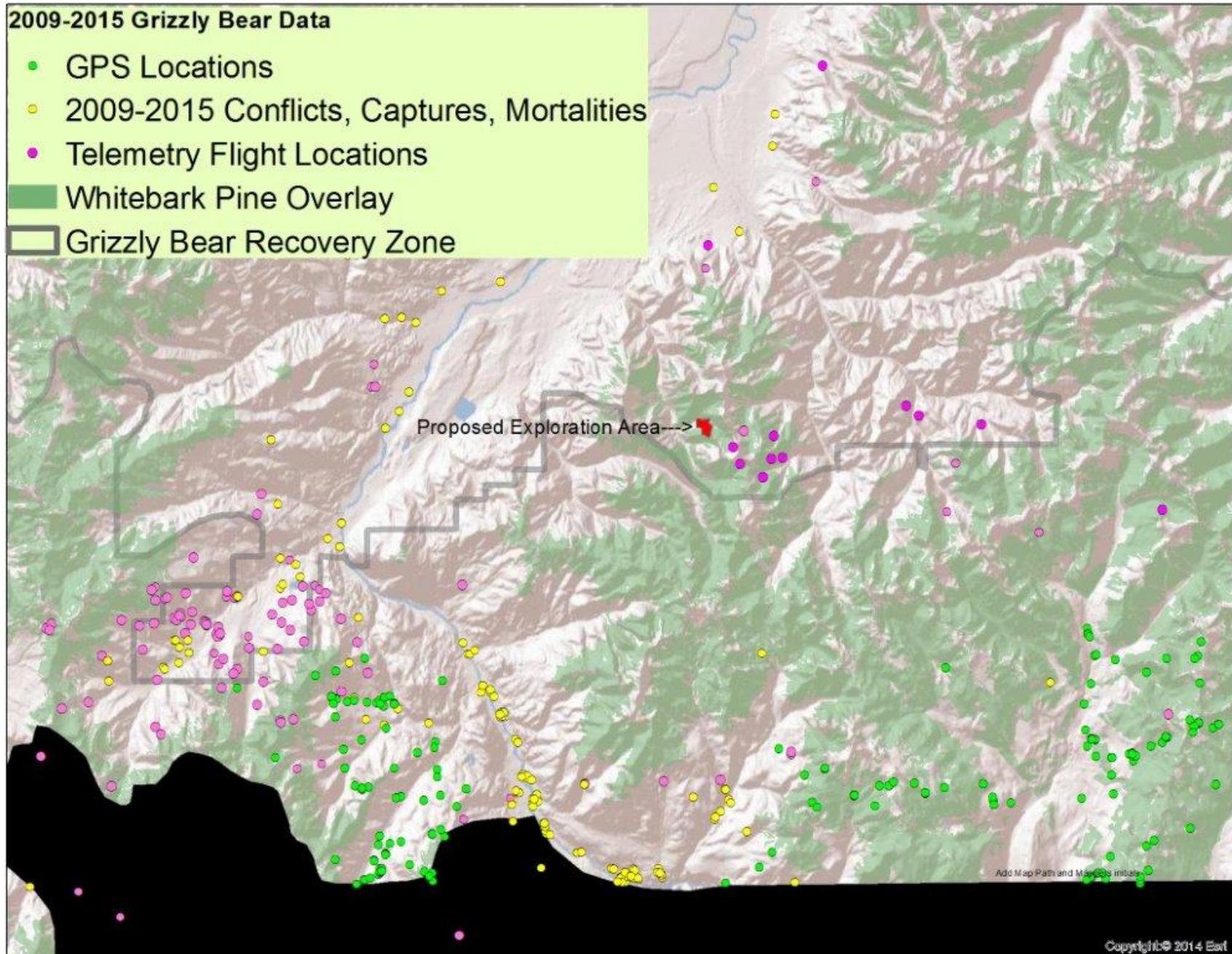
Grizzly bears are opportunistic and adaptable omnivores, adapted to woodlands, forests, alpine meadows, and prairies. In many habitats they prefer riparian areas along rivers and streams. The St. Julian Claim Block lies within fully occupied grizzly bear habitat. While not included in the designated grizzly bear Primary Conservation Area (PCA) for the GYE population, the St. Julian Claim Block is approximately one mile to the east (**See Figure 3.3**). Additionally, the St. Julian Claim Block is within the grizzly bear Demographic Monitoring Area (DMA) in which all conditions of grizzly bear recovery and conservation apply. **Figure 3.4** illustrates the species use of the landscape surrounding the St. Julian Claim Block. The figure depicts recent survey data (2009 -2015) and delineates where grizzly were recorded via GPS, telemetry flights, or through reported human-bear conflicts, capture, or mortality. Included in **Figure 3.4** is an overlay of whitebark pine distribution, an important food source for the species.

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Figure 3.4
St. Julian Exploration Project, Park County, Montana
Courtesy of FWP



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STATE SENSITIVE SPECIES (SPECIES OF CONCERN)

State-listed sensitive wildlife species are those species that may show evidence of a current or predicted downward trend in population numbers or in habitat suitability that could substantially reduce species distribution. The MNHP employs a standardized ranking system to denote a species status. Based on the relative degree of risk to an individual species' viability, species are assigned numeric ranks ranging from 1 (highest risk, greatest concern) to 5 (demonstrably secure, least concern). Species of concern with low or no probability of occurring in the St. Julian Claim Block are not addressed in this EA. Species known to occur, or those with a moderate to high probability of occurrence, are listed in **Table 3.2** below and are addressed in detail.

Species of Concern	State Ranking	Forest Service Sensitive	Probability of Occurrence on St. Julian Claim Block
BIRDS			
Northern goshawk	S3	Sensitive (MIS)	High
Golden eagle	S3		Moderate to High
Veery	S3B		Moderate to High
Brown creeper	S3		Moderate to High
Evening grosbeak	S3		Moderate
Peregrine falcon	S3	Sensitive	Moderate to High
Pinyon jay	S3		Moderate to High
Cassin's finch	S3		Moderate to High
Bald eagle	S4	Sensitive	High
Varied thrush	S3B		Moderate to High
Black rosy-finch	S2		Moderate
Clark's nutcracker	S3		High
Green-tailed towhee	S3B		Moderate to High
Great gray owl	S3		High
Pacific wren	S3		Moderate to High
MAMMALS			
Townsend's big-eared bat	S3	Sensitive	High
Wolverine	S3	Sensitive	High
Hoary bat	S3		High
Canada lynx	S3	Threatened	High
Little brown myotis	S2	Sensitive	High
Grizzly bear	S2S3	Threatened	High
AMPHIBIANS			
Western toad	S2	Sensitive	High
<p>S1 At high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the State.</p> <p>S2 At risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.</p> <p>S3 Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.</p> <p>S4 Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.</p> <p>B Breeding - Rank refers to the breeding population of the species in Montana. Appended to the state rank, e.g., S2B,S5N = At risk during breeding season, but common in the winter.</p> <p>MIS Forest Service Management Indicator Species</p>			

BIRDS

Migratory birds participate in a regular, seasonal movement, often north and south along a flyway, between breeding and wintering grounds. Many species migrate north of Mexico to breed and nest, and then return to Mexico, Central America, or South America to spend the winter. Resident songbirds may only migrate between lower and higher elevations, depending on the season, remaining in the State year round. Within Park County, there are 25 migratory or resident bird species the State has designated as species of concern. These birds are impacted in a variety of ways, including loss of habitat due to agriculture, logging, natural and prescribed fires, and urbanization. Fifteen of the 25 listed bird species have a moderate to high probability of occurrence within the Emigrant Gulch road corridor and St. Julian Claim Block. Changes in habitats that may favor less desirable species or that may lead to fewer of the more desirable species are discussed in a qualitative manner. It must be noted that there are many species of migratory birds for which there are few population or habitat data available, and changes that may benefit one species may, at the same time, have undesirable effects on other species.

Bird species of special concern with the potential to occur in the St. Julian Claim Block utilize a variety of nesting habitats. For example, green-tailed towhee, veery, and varied thrush are most likely to nest at lower elevations along the ecotone of mixed-species shrub communities such as chokecherry, snowberry, serviceberry, and mountain mahogany, as well as the riparian corridor along Emigrant Creek and its tributaries. Pinyon jays would most likely nest in lower elevation ponderosa pine woodlands. Evening grosbeak, brown creeper, Cassin's finch, Pacific wren, great gray owls, and Clark's nutcracker prefer nest sites in the higher elevation mixed conifer forest habitats found in the St. Julian Claim Block. Black rosy-finches are known to nest in crevices in cliffs and talus, while golden eagles and peregrine falcons are cliff nesters. These species would most likely nest along the rocky outcrops along Emigrant Gulch.

Although peregrine falcons are year-round residents in Montana, they do not appear to overwinter in southern Park County. Ideal nesting locations would include undisturbed areas with a wide view, near water, and close to plentiful prey. Golden eagles are year-round residents in Montana. MNHP reports numerous observations of overwintering, nesting, and transient use of Park County, inclusive of the St. Julian Claim Block (MNHP, 2016f). In addition to cliff sites, golden eagles may also nest in mature conifers. Two golden eagle nest sites have been documented near the St. Julian Claim Block in the headwaters of Passage and Arrastra creeks, in the Mill Creek drainage (Gower, pers. comm.). The Passage Creek nest, active in 2010 is approximately 7.2 miles from the St. Julian Mine property. The Arrastra Creek nest, documented in 2005, is located approximately 3.2 miles southeast of the St. Julian Claim Block².

² Nest location records from the MNHP database erroneously noted the Arrastra Creek nest was near Dillon, MT. However, the recorded location in T7S, R10E, S30 is actually in the Mill Creek Drainage in Park County, MT.

MAMMALS

Bats

Nocturnal activity is a major feature of the behavioral pattern of bats with nearly all species resting in dark conditions during the day, and emerging to forage at night. Bats choose a variety of roosts, with each species favoring a particular kind of roost. Outside of the human environment (building crevices, culverts, etc.), many species, such as Townsend's big-eared bat and little brown myotis, prefer isolated or secure roosts such as caves, crevices in cliff faces, the interstices of boulder heaps, tree hollows, or animal burrows. Species such as the hoary bat roost externally on tree trunks or in the branches of trees, under palm-shaped leaves, in unopened tubular leaves, or on the surface of rocks. Bats forage along forest edges, over riparian areas, along forest roads and trails, and in natural forest gaps or harvest-created openings (Taylor, 2006). Feeding strategies vary greatly among forest-dwelling species, with some foraging around ground-level shrubs, while others prefer to forage under, within, or above the tree canopy (Taylor, 2006).

Townsend's big-eared bats and little brown myotis bats are year-round residents in Montana. Female Townsend's big-eared bats form maternity colonies of 20 to 180 individuals during the spring and summer, while both sexes congregate at cooler caverns (called swarming sites) in late summer and early fall (MNHP, 2016g). Townsend's big-eared bat feeds on various nocturnal flying insects near the foliage of trees and shrubs, but appears to specialize on small moths, lacewings, beetles, true flies, and wasps (MNHP, 2016g). Little brown myotis nursery colonies feed over water, while non-reproductive little brown myotis hunt in a wide variety of habitats, including stream and forest borders, cliff faces, meadows, and forests, with favored prey including midges, mayflies, mosquitoes, and caddis flies (Taylor, 2006).

The hoary bat is migratory and only a summer resident in Montana, with records from early June through September. They occur in a broad elevation range in Montana (1,900 to 9,100 feet), though they are probably most common throughout summer at lower elevations (MNHP, 2016h). Hoary bats hunt relatively large insects, mostly moths, in open areas in meadows and parklands, over streams, or above stands of trees at canopy level; they are highly territorial and will return to established feeding sites night after night (Taylor, 2006). The St. Julian Claim Block contains habitat elements preferred by each of the State listed bat species, such as roosting, foraging, and resting areas. Caves are present within the project region that could serve as overwintering hibernacula for little brown myotis and Townsend's big-eared bats.

Wolverine

Wolverines tend to live in remote and inhospitable places away from human populations, preferring coniferous forest-dominated habitats with subalpine parkland/krummholtz at upper elevations. Engelmann spruce and subalpine fir are the dominant species, and lodgepole pine is the common seral tree species. Wolverines have large home ranges with prey resources distributed over large areas, and are known for wide-ranging movements. The mean annual home range of males is 163 square miles in Montana (MNHP, 2016i). Wolverines naturally occur at low densities, and due to their elusive nature, they are rarely and unpredictably encountered where they do occur. Young are born January through April, though mainly in

February or March; maternal den sites may be located among rocks or tree roots, in hollow logs, under fallen trees, or in dense vegetation, including sites under snow (MNHP, 2016i).

The St. Julian Claim Block is within the home range distance for wolverines that have been documented in the area. However, specific knowledge of the importance of the St. Julian Claim Block to the wolverines that use it is not known.

AMPHIBIANS

Western Toad

Adult western toads are largely terrestrial, may travel considerable distances from water, and are found in a variety of habitats from valley bottoms to high elevations. They breed in lakes, ponds, slow streams, and roadside ditches, where they prefer shallow areas with mud bottoms. In Montana, the species has been documented across the mountainous portion of the State west of the Beartooth Plateau at elevations up to 9,500 feet (Maxell, 2000). Toads are less common in heavily forested areas, instead selecting for habitat based on open canopy sites, south-facing slopes, occurrence of water, and proximity to high densities of refugia (downed woody debris, etc.) (McGee and Keinath, 2004). Western toads in the St. Julian Claim Block may breed in temporary and permanent ponds, Emigrant Creek, or shallow, warm water in road ditches.

MANAGEMENT INDICATOR SPECIES

The National Forest Management Act (NMFA) requires that fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species. The concept of MIS was adopted by the Forest Service to serve in part as a barometer for species viability at the forest level. In essence, MIS are species whose presence indicates the presence of a particular habitat or set of other species, and whose absence indicates the lack of the particular habitat or suite of species. The CGNF has identified five species, listed in **Table 3.3**, as MIS because their population changes are believed to indicate the impacts of land management activities on the forest.

Species	Indicative of
Grizzly bear	Threatened and endangered species
Bald eagle	Threatened and endangered species
Elk	Big game species
Goshawk	Mature forest related species
Pine marten	Mature forest related species

Grizzly bear and bald eagle are discussed in the “Threatened and Endangered Species” subsection on page 39. Below are the remaining three listed species.

Elk

Elk are listed as MIS for commonly hunted big game species on the CGNF (USDA, 2016). Meeting the habitat needs for elk indicates that the habitat needs for other commonly hunted

big game species, such as black bear, mountain lion, and moose, would also be met. Habitat needs which each of these species shares include cover (hiding and thermal), forage, and security.

Habitats favored by elk during the summer months include moist parks, meadows, and riparian areas, which offer succulent forage and bedding sites. Elk are also commonly associated with shrub, seedling, and sapling habitats. The elevational range for elk is dictated by food availability and weather conditions—they tend to remain on higher elevation summer ranges until forced down to lower elevations by snow and severe weather. The St. Julian Claim Block lies within the boundary of the Northern Yellowstone Elk Management Unit (EMU). This EMU contains almost 400,000 acres of elk habitat, and approximately 130,000 acres within the EMU is occupied winter range (FWP, 2004). The EMU, which includes the area immediately north of Yellowstone National Park between Cooke City and Gardiner, extending north to the Mill Creek Divide on the east side of the Yellowstone River, supports the northern Yellowstone elk herd.

Northern Goshawk

Throughout their range, northern goshawk (goshawk) nest in mature and old-growth mixed conifer forests with more than 60 percent closed canopy. Goshawks are generalists when it comes to foraging. Goshawks are known to hunt in forests, along riparian corridors, and in more open habitat. These habitat elements are all present in the St. Julian Claim Block. The size of the typical home range and foraging area for goshawk ranges between 1,409 to 8,649 acres, and may vary depending on a number of factors such as age and sex of the bird, prey abundance, prey availability, and local habitat conditions (Kennedy, 2003). In addition to its sensitive species status with the State, the CGNF has designated goshawk as an MIS in their land and resource management plan.

Pine Marten

As discussed in Ruggiero et al., (1994), because martens are shy, inconspicuous, primarily nocturnal, occur at low densities, and are now rarely trapped in the contiguous United States, reliable data on current distribution are often unavailable. Martens in the Rocky Mountains occupy most of their historic range, which includes the St. Julian Claim Block. The apparent patchy distribution of American martens reflects the patchy distribution of forested montane islands and is little changed from its historic pattern (Kucera and Zielinski, 1995). Martens generally avoid habitats that lack overhead cover, and most often travel along forest cover / open area ecotones.

Martens use a variety of structures for their dens, with trees, logs, and rocks accounting for 70 percent of reported den structures; in virtually all cases involving standing trees, logs, and snags, dens were found in large structures that are characteristic of late-successional forests (Ruggiero, in review, as cited by Buskirk and Ruggiero, 1994).

3.4.4 DIRECT AND INDIRECT IMPACTS

3.4.4.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Road maintenance / grading would not occur and access would be by four-wheel drive, ATV, and by foot.

Under the No Action Alternative, the habitats available to wildlife may not change. Disruption and disturbance impacts to wildlife would be temporary and would be the result of increased human presence. Vehicle travel within the St. Julian Claim Block would be limited to existing roads between East River Road and the St. Julian Mine property. Because existing roads are not regularly maintained, travel speeds are limited by current conditions. The potential for collisions with wildlife would be minimal. Bow and rifle hunting opportunities could be reduced in the area if Lucky Minerals extended into the fall ungulate hunting season with activities that do not require an exploration license. The type of activities that do not require an exploration license from the State of Montana would include geologic mapping, claim staking, and sampling.

THREATENED AND ENDANGERED SPECIES

Bald Eagle

The potential for disturbances resulting from the No Action Alternative would be minimal. Impacts from vehicle traffic are expected to be insignificant as project personnel would be travelling existing roads between East River Road and the St. Julian Mine property. It has been observed that vehicular traffic traveling along prescribed routes or within strict spatial limits and at relatively predictable frequencies is least disturbing to bald eagles (Stalmaster 1987, McGarigal et al., 1991). While bald eagles may be present along the road corridor in Emigrant Gulch, and on the St. Julian Mine property, nesting in these areas has not been documented.

Foraging behavior may be disrupted by the presence of Lucky Minerals personnel on site, but any impacts to foraging would be of short duration and similar to other recreational activities in the area. It is unlikely that bald eagle soaring behavior, flight patterns, and use of Emigrant Gulch and the St. Julian Mine property would be adversely affected by the activities that would occur under the No Action Alternative.

Canada Lynx

While increased human presence and activity may be disturbing to sensitive forest species, the likelihood of displacement or mortality to lynx under the No Action Alternative would be temporary and minimal, as it would be similar to other recreational activities in the area. It is likely that lynx would successfully avoid interaction with project personnel while they were on site staking claims, taking samples, and mapping the geology. No road improvements would occur, and there would be no sensory disturbances above vehicle traffic and noise associated with the performance of the activities under the No Action Alternative. Any displacement due

to human presence would revert to baseline conditions at the completion of the activities associated with the No Action Alternative. As a result, there would be no direct impact to Canada lynx or critical habitat. An indirect effect of prohibiting road improvements would be the continued deterioration of the existing road condition, as natural processes reclaim the old roads associated with historic mining operations. The continued deterioration would continue to limit vehicle access to higher elevation, and more remote areas beyond the St. Julian Mine property, reducing human incursions into Canada lynx habitat.

Grizzly Bears

While increased human presence and activity may be disturbing to sensitive forest species, the likelihood of displacement or mortality to grizzly bear under the No Action Alternative would be temporary and minimal, as it would be similar to other recreational activities in the area. It is likely that grizzly bear would successfully avoid interaction with project personnel while they were on site staking claims, taking samples, and mapping the geology. A food storage order is in place on the CGNF. Proper food storage and leaving no trash behind would reduce the potential for some forms of human-bear conflict. No road improvements would occur, and there would be no sensory disturbances above vehicle traffic and noise associated with the performance of activities associated with the No Action Alternative. Any displacement due to human presence would revert to baseline conditions at the completion of the activities associated with the No Action Alternative. As a result, there would be no direct impact to grizzly bear or their habitat. Similar to Lynx, the indirect effect of continued road deterioration would limit vehicle access to higher elevation areas beyond the St. Julian Mine property, reducing human incursions into grizzly bear habitat.

STATE SENSITIVE SPECIES (SPECIES OF CONCERN)

BIRDS

No road improvements along the riparian corridor or on the St. Julian Mine property would occur under the No Action Alternative. Further, there would be no sensory disturbances above vehicle traffic and noise associated with mapping the geology, taking samples, and staking claims. Any displacement due to human presence would be temporary, and conditions would return to baseline once any activities associated with the No Action Alternative are complete. Impacts to nesting birds would be minimized or eliminated if project operations were scheduled outside the breeding and nesting period.

MAMMALS

Bats

All three state-listed sensitive bat species are likely to occur in the St. Julian Claim Block. The No Action Alternative is not expected to have any direct impacts to bats or their habitat. Activities associated with the No Action Alternative would all be performed during daylight hours. Travel to and from the St. Julian Mine property may occur during crepuscular hours, but collisions with vehicle traffic are unlikely.

Wolverine

The impacts of land-use activities on wolverines are likely similar to those on grizzly bears, as both species are most affected by activities that fragment and supplant habitat, such as human settlement, extensive logging, oil and gas development, mining, recreational developments, and the accompanying access (Jalkotzy et al., 1997). It is assumed that due to the project site elevation, the activities associated with the No Action Alternative would not occur during the winter months. Under the No Action Alternative, no road improvements would occur. Disturbances would be limited to vehicle traffic and the sight and sounds of humans during the life of the project. Any displacement due to human presence would revert to pre-project conditions at the completion of the activities. As a result, there would be no direct impact to wolverine or their habitat. As with Canada lynx and grizzly bear, the indirect effect of continued road deterioration would limit vehicle access to higher elevation areas beyond the St. Julian Mine property, reducing human incursions into wolverine habitat.

AMPHIBIANS

Western Toad

Under the No Action Alternative, no western toad habitat alteration from road maintenance, grading and drill pad development would occur. Accessing the St. Julian Mine property to stake claims, map the geology, and take samples would result in an increase in human use of the St. Julian Claim Block. Mortality to dispersing toads from vehicles is possible under the No Action Alternative.

Western toads tend to be active during the day and night; juveniles are largely diurnal while adults tend to be nocturnal except in spring (Maxell, 2000). The active period begins in April or May and extends to September or October, depending on elevation and latitude (Werner et al., 2004). Western toads are especially vulnerable to disturbances during the period from breeding to metamorphosis (May-September); during this time period larvae and eggs can be destroyed by direct disturbance of wetland habitats or changes in the hydrology which may cause breeding ponds to dry up before larvae mature (McGee and Keinath, 2004). The availability of breeding seeps and streams in the St. Julian Claim Block has remained reasonably constant but is generally limited due to the dry nature of the area. Avoidance of breeding areas, and preventing disturbances to wet areas and land adjacent to the wet areas, which are important to the western toad would minimize any impact to the species.

MANAGEMENT INDICATOR SPECIES

Elk

Little or no impacts to elk are anticipated under the No Action Alternative. Elk may disperse when project personnel access the St. Julian Mine property to stake claims, map the geology, and take samples, but this impact would be temporary, and would not be adverse. There would be no changes in habitat or security areas under this alternative. The No Action Alternative would have no direct or indirect effect.

An indirect effect of prohibiting road improvements would be the continued deterioration of the existing road condition, as natural processes reclaim the old roads associated with historic mining operations. The continued deterioration would continue to limit vehicle access to higher elevation, and more remote areas beyond the St. Julian Mine property, reducing human incursions into elk habitat.

Northern Goshawk

No road improvements along the riparian corridor or on the St. Julian Mine property would occur under the No Action Alternative. Further, there would be no sensory disturbances above vehicle traffic and noise associated with mapping the geology, taking samples, and staking claims. Any displacement due to human presence would be temporary, and conditions would return to pre-project levels once the activities are complete. No direct impacts to northern goshawk or their habitat are anticipated as a project activity. Goshawks are protected under the MBTA. If an active nest is built or discovered within the St. Julian Claim Block, Lucky Minerals would consult with FWP to determine avoidance or mitigation measures.

Pine Marten

No road improvements along the riparian corridor or on the St. Julian Mine property would occur under the No Action Alternative. Further, there would be no sensory disturbances above vehicle traffic and noise associated with mapping the geology, taking samples, and staking claims. Any displacement due to human presence would be temporary, and conditions would return to pre-project levels once the activities are complete. No direct impacts to pine martens or their habitat are anticipated.

3.4.4.2 Proposed Action

Under the Proposed Action, Lucky Minerals would engage in a two-year period of exploration-related activities centered on the St. Julian Mine property. Initial project components would include road grading and maintenance and mobilization of heavy equipment along Emigrant Gulch Road and on to the area of exploration. No new roads would be constructed. As a result, there would be no net increase in road densities within the St. Julian Claim Block. Core drilling would take place on drill pads in the road prisms after site leveling / clearing has taken place. It is anticipated that less than 0.3 acre of new ground disturbance would be associated with road maintenance and drill pad site preparations. Reclamation measures would be concurrent with operations and/or begin immediately upon completion of operations at each site. Disturbed areas would be kept to the minimum size necessary to accommodate the exploration operation.

Wildlife species may be negatively affected by project activities associated with the proposed action. Sensory disturbances to local wildlife as the result of heavy equipment / vehicle use, road grading / maintenance, pad development, core drilling, and associated human activity would primarily be auditory but disturbances may also include olfactory (i.e., smell) as well as visual (i.e., light) and tactile (i.e., vibration) disturbances. Within a certain zone of influence, sensory disturbance may result in the loss or alteration of available habitat due to displacement or avoidance, or decreased or less effective use of preferred habitats.

Vehicle travel within the St. Julian Claim Block would be limited to existing roads between East River Road and the St. Julian Mine property. Localized improvements to existing roads may

facilitate higher travel speeds than allowed by the unmaintained current conditions; however, the potential for collisions with wildlife would be minimal.

Water used for drilling would be pumped either from existing artesian wells existing on the private land or Emigrant Creek utilizing the existing water right on the creek that is attached to the St. Julian Mine patented claims. Lucky Minerals proposes two 10-hour shifts per day during the field season. It is reasonable to assume there may be a continuous human presence on the St. Julian Mine property. Fuel used in the water pump, and vehicle / equipment maintenance fluids could spill and contaminate soil, vegetation, and water, coolants could be lethal if accessed by wildlife. Spillage and cleanup kits would be readily available for use to minimize any impact. Sump pits and drilling mud could also pose a risk to wildlife. Lucky Minerals proposes digging sumps 3 feet deep. This depth could entrap small mammals if no escape mechanism is provided. Lucky Minerals indicates the synthetic polymer product used to increase viscosity of the drilling water is non-toxic and biodegradable.

Given the remoteness of the surrounding CGNF lands encompassing the St. Julian Claim Block, the Proposed Action would represent a higher level of disturbance than normal in this area. Habitat in the St. Julian Claim Block currently provides wildlife with cover (hiding and thermal), forage, and security. Improvements to the roads would lead to easier vehicle and human access to higher elevations and more remote habitat. Wildlife populations that are subjected to hunting and trapping may sustain higher mortalities as a result of better access (Jalkotzy et al., 1997). However, bow and rifle hunting opportunities could be reduced in the area during the two-year field season if Lucky Minerals operations extended into the fall ungulate hunting season. Further, because of the increased human presence under the Proposed Action, the harassment or poaching of wildlife may also increase.

In general, disturbance to wildlife would be greater under the Proposed Action than under the No Action Alternative. Disturbance to wildlife would primarily be the result of an adverse response to auditory, visual, olfactory, and tactile sensory stimuli. In response to activities associated with the Project, species of concern may avoid the area.

THREATENED AND ENDANGERED SPECIES

Bald Eagle

As with the No Action Alternative, the potential for disturbances resulting from the Proposed Action are most likely occur to eagles nesting or foraging along the Yellowstone River, and along the valley floor. Their sensitivity to humans varies seasonally, and is often influenced by courtship and nest building, egg laying, incubation and hatching, early nestling period, and late nestling periods. Eagles appear most sensitive to human disturbance during the courtship and nest-building phase, but their response is often site, pair, and activity-specific, and is a function of the type, intensity, and proximity of the human disturbance (MBEWG, 1994). Some pairs, for example, nest successfully near human activity, while others abandon nest sites in response to activities much farther away. This variability in sensitivity may be related to a number of factors, including the visibility of the activity, its duration and noise level, the extent of the area affected by the activity, and the nesting pair's prior experiences with and tolerance of humans. While bald eagles may be present along the road corridor in Emigrant Gulch, and on the St. Julian Mine property, nesting in these areas has not been documented. If a bald eagle nest is

built or discovered within the St. Julian Claim Block, Lucky Minerals would consult with USFWS to determine avoidance or mitigation measures.

Foraging behavior may be disrupted by the presence of Lucky Minerals personnel on site, and may lead to avoidance of the St. Julian Mine property. It is unlikely that bald eagle soaring behavior, flight patterns, and use of Emigrant Gulch and the St. Julian Mine property would be adversely affected. The response is often site, pair, and activity specific and is a function of type, intensity, and proximity of the disturbance (MBEWG, 1994). Individuals would most likely avoid the St. Julian Claim Block during the field season.

Canada Lynx

It is likely that lynx would successfully avoid interaction with project personnel. The activity and noise associated with road construction, maintenance, and drilling rigs is likely to cause displacement and disturbance. The use of lights during nighttime drilling may also disrupt lynx use of the area. Sensory disturbance is expected to be temporary, and should not result in permanent avoidance of the area.

The likelihood of permanent displacement or mortality to lynx under the Proposed Action alternative would be minimal.

Grizzly Bears

The local abundance of grizzly bears is likely to be reduced for the duration of the Proposed Action. The activity and noise associated with road construction, maintenance, and drilling rigs is likely to cause displacement and disturbance. The use of lights during nighttime drilling may also disrupt grizzly bear use of the area. Sensory disturbance is expected to be temporary, and should not result in permanent avoidance of the area. Ceasing operations prior to November would minimize impacts to bears during the fall season, as grizzly prepare for winter denning.

Grizzly bears are unlikely to habituate due to the infrequent vehicle and human access currently visiting Emigrant Gulch, St. Julian Mine property, and the surrounding area. However, the Proposed Action increases the potential for human / bear conflicts to occur, leading to injury, harm, direct, or indirect mortality of grizzly bears—as well as risks to human safety, particularly during the critical fall season. Regular spacing (temporal) of vehicles is likely to contribute more toward habituation than the same volume of traffic concentrated in a brief period (Jalkotzy et al., 1997). Habituation may allow bears to continue to use desired habitats near roadsides.

In early 2016, the USFWS proposed a rule to consider delisting the Greater Yellowstone Ecosystem grizzly bear population. Reducing human-caused management actions that may lead to grizzly bear mortalities has been one of the criteria required to achieve recovery, and will be necessary to maintain delisted status if delisting should occur. Increased human activity would increase the potential for human-bear conflict. The presence of project personnel on the site may contribute to habituation. However, because of its likelihood of contributing to negative bear-human interactions, habituation in general is not beneficial to bears. A food storage order is in place on the CGNF. Good housekeeping and proper food storage could reduce the potential for some forms of human-bear conflict.

STATE SENSITIVE SPECIES

BIRDS

The activity and noise associated with road construction, maintenance, and drilling rigs is likely to cause displacement and disturbance of resident and migratory birds. The use of lights during nighttime drilling may also disrupt bird use of the area. Any displacement is expected to be temporary, and conditions would return to baseline once the project was complete. While the St. Julian Claim Block can be considered prime golden eagle habitat, both recorded golden eagle nests are too far away to be directly impacted by the Project. If a peregrine falcon, eagle, or great gray owl nest is built or discovered within the St. Julian Claim Block, Lucky Minerals would consult with FWP to determine avoidance or mitigation measures. Nests of other breeding birds would be avoided.

Many bird species avoid human disturbance (habitat avoidance). Individual disruption of birds often involves disturbing individuals at nesting sites, resulting in birds temporarily leaving their nest sites. When birds are disturbed at nest sites, parental care of young, feeding efficiencies, and feeding frequency may be affected (Jalkotzy et al., 1997). Virtually all species appear to be susceptible to this type of disturbance.

Direct impacts to migratory birds during road clearing and grading, drill pad construction, and core drilling may include mortality or injury from collisions with construction vehicles and machinery. Songbirds could also be killed or injured when machinery disturbs ground vegetation, and mortality is likely to be higher if construction occurs in spring during nesting season.

MAMMALS

Bats

All three state-listed sensitive bat species are likely to occur in the St. Julian Claim Block. Travel to and from the St. Julian Mine property may occur during crepuscular hours, but collisions with vehicle traffic are unlikely. Little or no bat mortality is expected during road clearing and grading, drill pad construction, or reclamation operations. Bats would likely be able to avoid non-moving objects such as parked vehicles.

The Proposed Action would use two drills and run them two shifts per day. Night drilling would require the use of small lights similar to the ones used by highway crews. Nocturnal activity is a major feature of the behavioral pattern of bats. Many species of bats are known to sample the light levels before emerging from their roost; only emerging for their night's hunting when the light intensity outside reaches a critical level after sunset (Swift, 1980). Direct impacts to bats from the use of lights during nighttime drilling would likely be manifested through potential changes in distribution, migration, and foraging behavior. The London Biodiversity Project (LBP, 2016) found the use of lights could disrupt the normal 24-hour pattern of light and dark, potentially affecting the natural behavior of bats. Artificial light near a roost access point may delay bats from emerging and shorten the amount of time available to them for foraging, and directly illuminating a bat roost may cause the bats to desert the roost (LBP, 2016). Bright light may reduce social flight activity and cause bats to move away from the light area to an

alternative dark area (LBP 2016). Bat strikes to drill rigs are possible if bats are drawn to forage on insects attracted to the artificial light source. These strikes could lead to injury or death.

Impacts could be minimized by the number and types of lighting used. Lucky Minerals would carefully consider what lighting is necessary and reduce any unnecessary lighting, both temporally and spatially. When in use, lighting would be directed to where it is needed to avoid light spillage, and only be bright enough to maintain crew safety. Drill rigs in operation would be spaced far enough apart to separate the influence of lighting. Two smaller “islands” of light would be less of a barrier to foraging than one large island.

Wolverine

The impacts of land-use activities on wolverines are likely similar to those on grizzly bears, as both species are most affected by activities that fragment and supplant habitat. The local abundance of wolverines is likely to be reduced for the duration of project. The activity and noise associated with road construction, maintenance, and drilling rigs is likely to cause displacement and disturbance. The use of lights during nighttime drilling may also disrupt wolverine use of the area. Sensory disturbance is expected to be temporary and should not result in permanent avoidance of the area.

The Proposed Action would represent a disturbance to wolverines and likely would deter wolverines from using the area. While individual sensitivity to disruptions is not well documented in the literature, a radio-telemetry study in Idaho raised the possibility that human disturbance at natal den sites may cause den abandonment (Copeland, 1996). Copeland (1996) documented three instances when a female and her kits abandoned an area after researchers disturbed wolverines at maternal den sites. Given the low reproductive potential of wolverines (Weaver et.al., 1996), the impacts of improved access to more remote areas may be detrimental to regional populations. Females use secluded high-elevation cirque basins for natal den sites, and an increase in human disturbance may cause den abandonment (Copeland, 1996).

Lucky Minerals has proposed cutting slash and downed wood for warming fires. If wood cutting extends to standing snags, dead or downed wood beyond what is cut for site clearing purposes, the project may impact wolverine habitat. Improvements to the existing roads would facilitate an increase in motorized access and hunter access into higher, more remote areas in the drainage.

AMPHIBIANS

Western Toad

Habitat alteration from road maintenance, grading and drill pad development would occur, potentially impacting western toad habitat. Project activities on the St. Julian Mine property would result in an increase in human use of the St. Julian Claim Block. Activities associated with drill pad construction and road maintenance could result in direct mortality of individual toads. However, it is likely any mortality to dispersing toads from vehicles would occur under any alternative. Sump pits could entrap western toads unless an escape route is provided. Entrapment could lead to increased predation. Spent drilling fluid may have an adverse effect on western toads.

Lucky Minerals has proposed cutting slash and downed wood for warming fires. If wood cutting extends to standing snags, dead or downed wood beyond what is cut for site clearing purposes, the project may impact western toad habitat. Disturbance to wet areas may also increase as a result of the Proposed Action. Project activities are not projected to damage or destroy montane wetland habitats and would not have the potential to displace western toads or cause local populations to become extinct. Similar to the No Action Alternative, avoidance of breeding areas, and minimizing any disturbance to wet areas, and land adjacent to the wet areas would minimize any impact to the species.

MANAGEMENT INDICATOR SPECIES

Elk

Habitat alteration from road maintenance, grading, and drill pad development may occur, potentially impacting elk habitat and security. Elk may disperse, or avoid the St. Julian Claim Block during the field season. The local abundance and availability of elk is likely to be reduced for the duration of the project. The activity and noise associated with road construction, maintenance, and drilling rigs is likely to cause displacement and disturbance to elk. The Proposed Action would increase motorized travel in the St. Julian Claim Block, and increase human presence. If project operations continue into fall, elk security may be affected. Hillis et al., (1991) cautioned security is that combination of variables that provides protection for vulnerable animals during the hunting season, with the foremost factor influencing vulnerability being road access. The Proposed Action may increase motorized access to, and facilitate hunter access into higher, more remote areas in the drainage affecting the existing elk security. Wildlife populations that are subjected to hunting and trapping sustain higher mortalities as a result of better access (Jalkotzy et al., 1997).

The Proposed Action would not likely influence elk calving areas. Elk calve in areas of low snowpack or activity during calving season (mid-May to mid-June). It is anticipated that the Lucky Minerals field season would be between June and early October. Due to the inherent vulnerability of calves, elk would most likely calve away from the St. Julian Claim Block due to human presence and project activity. Displacement and disturbance of elk could have negative consequences to local herds. Human activity has been documented to stress animals, affecting available energy reserves.

The St. Julian Claim Block and surrounding land is popular for deer and elk hunting during the archery and general rifle seasons (September – November), and provides for mountain lion hunting opportunities during December through April. The proposed action could impact wildlife use of the surrounding area and in turn could impact hunting opportunity in the area. Bow and rifle hunting opportunities could be reduced in the area during the two-year field season if Lucky Minerals operations extended into the fall ungulate hunting season.

Northern Goshawk

Road improvements along the Emigrant Creek riparian corridor and on the St. Julian Mine property would occur under the Proposed Action. Sensory disturbances from heavy machinery, increased human presence (not only in numbers but duration, and use of lights during night drilling) could directly impact northern goshawks. These disturbances may also impact their

prey base. Raptor avoidance of human disturbance is particularly well-documented. Sensory disturbance is expected to result in the displacement of non-breeding individuals. Any displacement is expected to be temporary, and goshawk occupancy would return to pre-project levels once the project is complete.

Non-breeding goshawks do not appear to tolerate human disturbance and may avoid areas of human activity. Although otherwise secretive, goshawks can be fierce and vocal when defending their nest and young, and will attack human intruders and kill neighboring raptors, including owls and hawks, they perceive as threats (Squires and Reynolds, 1997). Disturbance of nesting goshawks, particularly during incubation, can cause nest failure. For example, heavy equipment operation within 330 feet of a nest has been shown to result in the adults abandoning the nest area, even with 20-day old nestlings present (Squires and Kennedy, 2006). If adults abandon a nest with eggs or nestlings present, the eggs or nestlings may die from exposure, starvation, and/or predation (Brewer et al., 2009).

Pine Marten

Given the wide range in possible avoidance behavior, it is possible that the local pine marten population may be reduced within the zone of impacts from sensory disturbance, and would likely remain at reduced levels for the duration of road maintenance and exploratory drilling activities. Any displacement due to human presence is expected to be temporary, and pine marten occupancy would return to pre-project levels once the project is complete.

Martens use a variety of structures for their dens, with trees, logs, and rocks accounting for 70% of reported den structures. Lucky Minerals has proposed cutting slash and downed wood for warming fires. If wood cutting extends to standing snags, dead or downed wood beyond what is cut for site clearing purposes, the project may impact the marten.

Improvements to the road corridor into the St. Julian Mine property could result in an increase in human use. Wildlife populations that are subjected to hunting and trapping sustain higher mortalities as a result of better access (Jalkotzy et al., 1997).

3.4.4.3 Agency-Modified Alternative

WILDLIFE

A wildlife awareness plan would be included in Lucky Minerals' training of its employees. The plan would include the following guidelines:

- Worker Environmental Awareness Program (WEAP) training would be provided to all employees to educate personnel about the existing on-site and surrounding wildlife resources and the measures required to protect these resources. Information on whom to contact if a federally or state listed species or their sign is observed would be provided as part of the WEAP training.
- All project personnel would be educated on being bear aware. This includes storing all food or other bear attractants in properly secured bear-proof containers at all times, abiding by the Forest Service's food storage order (#001-14-11-00-02).

- Lucky Minerals would implement a waste management plan that would minimize refuse to avoid attracting wildlife. All garbage, refuse, and waste would be contained in appropriate bear-proof containers and removed from the site weekly.
- Employees would be prohibited from feeding or harassing wildlife on the site. This would include a recommendation that Lucky Minerals implement a “No Pets” policy in the St. Julian Claim Block.
- Employees would report sightings or sign of Federal and State-listed wildlife to supervisory personnel and record the observation on a wildlife observation form.

WILDLIFE AVOIDANCE

Lucky Minerals would conduct preconstruction surveys to identify potential areas of western toad habitat, bat habitat, and nesting birds in areas of new disturbance on drill pads and laydown area.

To avoid disturbing nesting eagles, other raptors, owls, or songbirds, Lucky Minerals would (1) maintain natural forested (or vegetative) buffers around nest trees, and (2) avoid drilling activities near nest trees during the nesting season (February-June). The buffer areas would serve to minimize visual and auditory impacts associated with human activities near nest sites.

If a raptor nest is built or discovered within the St. Julian Claim Block, Lucky Minerals would consult with Montana Fish, Wildlife, and Parks (FWP) to determine avoidance or mitigation measures. To avoid take, as defined by the Migratory Bird Treaty Act (MBTA), Lucky Minerals would refer to the current list of species covered, and those not covered, by the MBTA, prior to initiating project activities (USFWS 2013).

Project design features would consider what lighting is necessary and reduce any unnecessary lighting, both temporally and spatially. Nighttime lighting would be shielded, and directed to where it is needed to avoid light spillage, and only be bright enough to maintain crew safety. Lucky Minerals would also follow standard bat lighting recommendations.

Standing snags, dead or downed wood beyond what Project personnel cut during site clearing would not be cut or removed for use in warming fires.

3.4.4.4 *Indirect Impacts*

Based on the MEPA model rules definition, indirect impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. The only identified indirect impact to wildlife resources from the Proposed Action would be associated with improved access for future recreational users. The road improvements described in the Proposed Action have the potential to increase recreation access in the area which may contribute to future stress on wildlife.

3.5 FISH AND AQUATIC INSECTS

3.5.1 ANALYSIS AREA AND METHODS

The analysis area includes Emigrant Creek and the East Fork of Emigrant Creek (East Fork). Baseline data for fish and aquatic insects are limited within this area, but electrofishing surveys were conducted on multiple stream reaches by the CGNF in 2013 and 2015 (See Figure 3.5). The survey reaches on Emigrant Creek were located near the Great Western Mine claim boundary (T6S, R8E, S36). The upper survey reach on the East Fork was located directly below the slope of the Proposed Action area, and the other East Fork reach was below the upper stream crossing and approximately 2,000 feet downstream from the upper reach (See Figure 3.5). The analysis methods included reviewing the field sheets generated during the electrofishing surveys and interpreting those results along with the available water quality data.

3.5.2 AFFECTED ENVIRONMENT

In 2013, one reach of Emigrant Creek (265 feet) was surveyed near the boundary of the Great Western Mine claim and CGNF land. A longer reach (584 feet) was surveyed across this same area of Emigrant Creek in 2015, and both reaches are upstream from the point where the access road crosses the stream (See Figure 3.5). No fish were observed or sampled during either of these two surveys, and a waterfall in Emigrant Creek was noted near the Great Western Mine claim boundary. This waterfall acts as a physical barrier that effectively prevents the upstream migration of fish within Emigrant Creek. Very few small mayflies and caddisflies were present in this reach, but a quantitative measurement of insects or other macroinvertebrates was not conducted. The surveys also noted some iron staining on the stream substrate.

Over one mile upstream of the fish barrier, there were two reaches along the East Fork that were also surveyed in 2015 (See Figure 3.5). No fish were observed or sampled from either of the locations on the East Fork, likely a result of the physical barrier located on Emigrant Creek. The elevated metals concentrations in Emigrant Creek and the East Fork may also inhibit fish populations, even if fish were able to seasonally navigate beyond the lower physical barrier (Section 3.7.2). One reach (426 feet) was located near a former placer mining operation, midway between the Emigrant Creek confluence and the St. Julian Mine claim area (T7S, R9E, S6). This reach is located within the area that is impacted by acidic groundwater from the northern slope (Section 3.7.2.4), and the survey noted “white and orange sludge” mineralization along the bank and the formation of ferricrete on the stream substrate. The banks were also described as unconsolidated and unstable, spawning gravel is limited, and pronounced incision was noted along this reach. There were no aquatic insects or other macroinvertebrates noted on the CGNF field sheet for this reach.

The second survey reach from 2015 (272 feet) was located on the East Fork directly at the base of the slope of the St. Julian Claim Block, upstream from the point where the access road crosses the stream (See Figure 3.5). Minor iron staining on the substrate and unconsolidated banks were also noted in this location, but to a lesser degree than at the previous survey reach. This upper reach also contained abundant mayflies and a few caddisflies, but a quantitative measurement of insects or other macroinvertebrates was not conducted. In addition to the absence of fish, the upper reach was also noted for steep topography and the presence of step

pools. Wood and other debris were observed along the banks, likely remnants from previous flooding events.

3.5.3 DIRECT AND INDIRECT IMPACTS

3.5.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Road maintenance / grading would not occur and access would be by four-wheel drive, ATV, and by foot.

With no mechanized exploration taking place, any potential impacts from sedimentation or contamination of the streams, therefore impacting the fish and aquatic insect populations, would not occur. However, the existing conditions of upper Emigrant Creek and the East Fork are likely to continue. The existing conditions include the physical fish barrier near the Great Western Mine claim; no fish population supported in either stream, and elevated metals concentrations in some reaches of both streams (Section 3.7.2.2). There are two stream crossings within the analysis area, which consist of coarse, angular rock (**See Figure 3.5**). The potential for turbidity to briefly increase from public traffic-related disturbances will continue. Short-term changes in existing water quality resulting from ordinary and everyday activities do not require permits. Any potential for erosion to occur along the access road and deposit sediment in the streams will also continue.

3.5.3.2 *Proposed Action*

The Proposed Action would increase the traffic along the access road and stream crossings, and therefore increase the potential for brief turbidity and suspended solid load impacts to the streams. Potential sediment transport at the two stream crossings should be addressed with BMPs developed in a 318 Authorization, taking the coarse nature of the underlying material into account, while limiting the impacts to aquatic macroinvertebrates. Any improvements or mitigation measures that are developed through that permit would likely lessen the impacts from public traffic as well.

The Proposed Action would include storm water and sediment controls on the access road and drill pads, decreasing the potential for stream sedimentation from the existing road conditions. To decrease the potential for water contamination, drill pads would also be located at least 100 feet away from all streams, and 50 feet away from other ponds or wetland areas. There would be no changes made to the physical fish barrier located on Emigrant Creek, and there would be no impact on the fish population in the East Fork or upper Emigrant Creek, which appears to be non-existent.

3.5.3.3 *Agency-Modified Alternative*

Same as the Proposed Action.

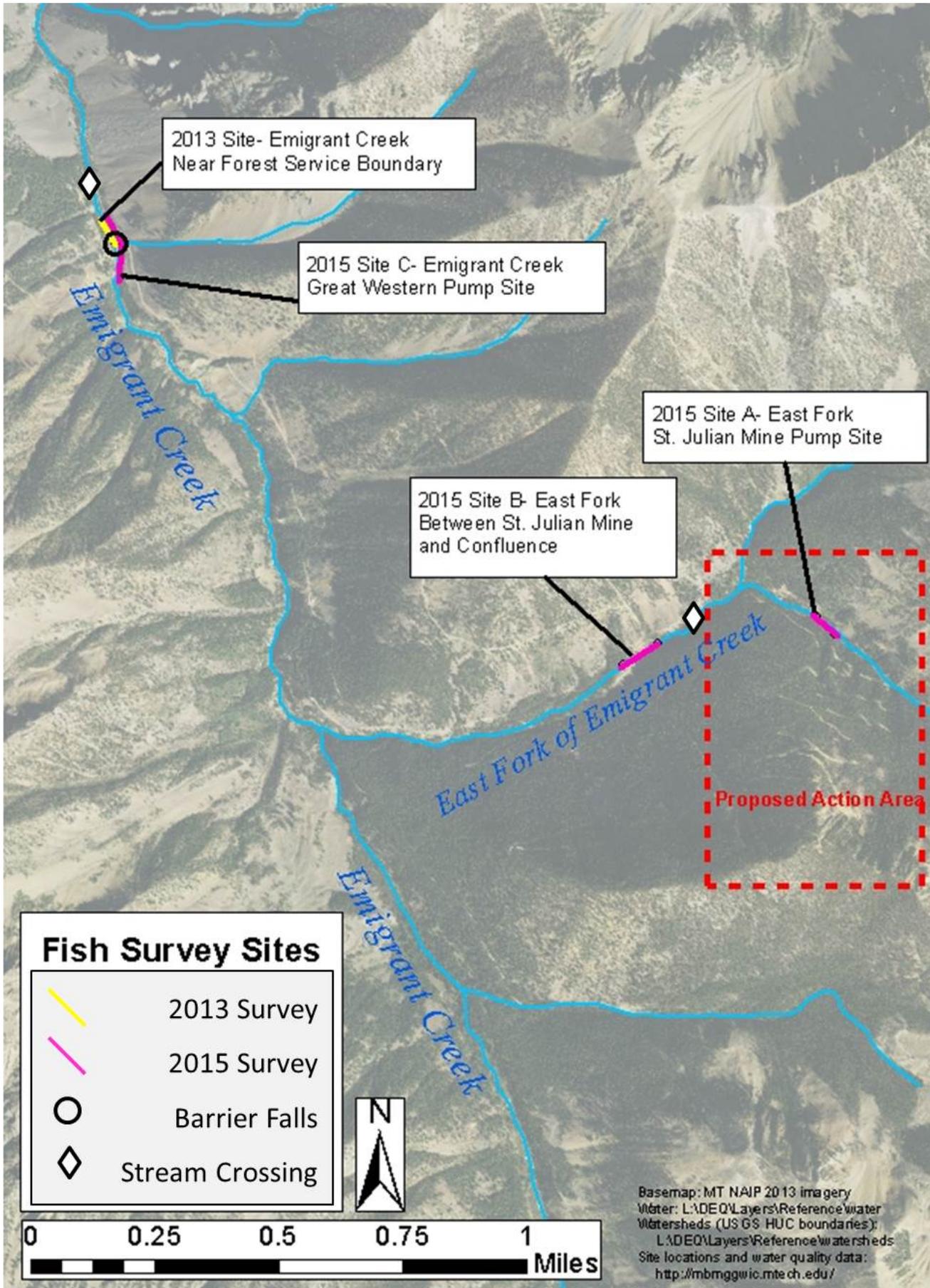


Figure 3.5

Fish and Aquatic Insects
 St. Julian Exploration Project, Park County, Montana

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3.5.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, indirect impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. No indirect impacts to fish and aquatic resources are predicted.

3.6 CULTURAL AND HISTORICAL RESOURCES

3.6.1 ANALYSIS AREA AND METHODS

The area of potential effect (APE) for cultural resources for the Proposed Action begins at the location of Old Chico, and follows the Emigrant Gulch road south, into the St. Julian Mine property. The St. Julian Claim Block is located in the prehistoric cultural subarea known as the Northwestern Plains. Analysis methods used included consultation with SHPO and review of existing information.

3.6.2 AFFECTED ENVIRONMENT

3.6.2.1 *Existing Environment*

The Northwestern Plains stretch from central Alberta to southern Wyoming and from western North Dakota to western Montana. Throughout the last 12,000 years, inhabitants of the Northwestern Plains have practiced a semi-nomadic hunting and gathering economy. Initially, the large and now extinct Pleistocene fauna were the principal subsistence focus. By around 10,000 years ago, the modern bison had replaced the larger Pleistocene forms as the main prey species. Although a single economic adaptation persists throughout prehistory, slightly different environmental adaptations and different tool types do serve to differentiate cultural periods and phases. The prehistory of Montana can be divided into four major traditions. These traditions include Early, Middle, and Late Prehistoric periods, as well as the Protohistoric period. The historic period begins with the introduction of early Euro-American explorers and written documentation.

EARLY PERIOD (PALEOINDIAN)

Paleoindian groups existed during the Pre-Boreal and Boreal climatic episodes. These post-glacial periods are commonly characterized as cool, moist, and conducive to the proliferation and expansion of the forests (Bryson et al., 1970; Reeves, 1969). The earliest defined group, Clovis, hunted a variety of now extinct fauna, including woolly mammoth. Later groups generally relied on early forms of bison as a subsistence base.

Near the current St. Julian Claim Block, a now famous Clovis burial site named the Anzick Site (AKA Myers-Hindman Site, 24PA504) included a Clovis child burial with a large number of stone, bone, and antler artifacts with a date of 10,680 Radio Carbon Years before Present (RCYBP). In 2014, a DNA study of the human remains from Anzick was reported in *Nature* (Rasmussen et al., 2014). The results found that the Anzick child was a boy, and he (and thus Clovis people in general) is closely related to Native American groups from Central and South America, but not to later migrations of Canadian and Arctic groups.

Paleoindian point styles are rarely found on the upland prairie and usually occur as isolates, likely representing ephemeral occupations rather than occupations of an extended duration (Deaver, 1987). Frison (1991) notes the differences that existed between the foothill-mountain sites and sites located in the open plains and intermontane basins prior to the Altithermal. The dichotomy is based on projectile point types, subsistence strategies, and settlement patterns. Complexes found in the Paleo-Indian tradition include Clovis, Goshen, Folsom, Hell Gap-Agate Basin, Cody, Parallel Oblique Flaked, and Pryor Stemmed.

MIDDLE PERIOD (PLAINS ARCHAIC)

In the Northern Plains, the Plains Archaic is commonly broken down further into three smaller periods: Early Middle, Middle Middle, and Late Middle. The early part of the Middle period occurred roughly 8,500 years ago, during a relatively dry climatic episode (Atlantic, Hypsithermal or Altithermal). Groups of people were generally concentrated in protected and humid locations such as mountains, foothills, and major river valleys during the Atlantic climatic episode (Husted 1969). The Middle period is defined by a noticeable change in subsistence economies. Projectile points of this age include the Bitterroot / Mummy Cave complex, characterized by large side notched points. Local lithic materials were emphasized, with evidence of more recycling and conservation than during the Early period. Less attention was given to fine, aesthetic craftsmanship, and evidence indicates less travel and trade (Reeves, 1990).

During the middle part of the Middle period, groups began to adopt increasingly specialized subsistence and settlement strategies. The McKean complex (4,500-3,100 BP) roughly corresponds with the cool and moist Sub-Boreal climatic episode (fundamentally modern conditions). These improved climatic conditions likely led to increased resource availability, which in turn probably led to two distinguishing McKean complex characteristics: a rather dramatic increase in the number of sites (Deaver and Deaver, 1988; Frison, 1991; Gregg, 1985) and an expansion in geographic distribution. Topographically, these sites are found in foothill-mountain areas, river valleys (Davis, 1976), intermontane basins, and the open plains / prairies (Deaver and Aaberg, 1977). Artifacts of this age, Oxbow, McKean, and Duncan / Hanna points, have been recovered in greater numbers than Early or early Middle types (Deaver and Deaver, 1988).

The final part of the Middle period is marked by further adaptations toward upland living and the exploitation of open prairie resources. Groups continued to occupy river valley and foothill settings while also devoting greater time and attention to the prairies. This change of focus is illustrated by their utilization of new cooperative hunting techniques and the development of the tipi, a specialized structure suited for open plains habitation. Complexes identified include Pelican Lake and Sandy Creek.

LATE PREHISTORIC (LATE HUNTERS)

The Late Prehistoric period is characterized by an increasing specialization toward upland living and the utilization of open prairie resources, most importantly bison. The vast majority of Late Prehistoric sites occur in open prairies rather than in protected hills or river valleys. The major complexes associated with the Late Prehistoric are Besant, Avonlea, and Old Women's.

Besant peoples were the most sophisticated pedestrian bison hunters to occupy the Northwestern Plains (Frison et al., 1996). Besant sites are ubiquitous across the Northern Plains. Based on the number of kill sites on the open prairie, Besant populations clearly favored this environment for killing bison. Besant people were not restricted to the open prairie; they also exploited the more varied resources of foothill and forested areas (Deaver and Deaver, 1988).

During the Avonlea period, use of the bow and arrow became widespread, as did an increased focus on bison as a primary resource (Reeves, 1990). Thinness, extreme symmetry and high degree of craftsmanship characterize the Avonlea projectile point. The workmanship apparent in Avonlea tool assemblages is considered the finest since the Early period, with only a small amount of variation in shape (Reeves, 1990).

The final complex associated with the Late Prehistoric period is Old Women's. Most of the sites investigated from this complex reflect bison procurement or processing activities. The subsistence practice of Old Women's groups was a highly specialized form of communal hunting with bison continuing to be the primary focus of hunting activities. The jump and corral methods continued to be employed through most of this complex, although the jump may have been the preferred method. The diagnostic projectile points of the phase are the Prairie side-notched and Plains side-notched points (MacNeish, 1958; Kehoe, 1973).

PROTOHISTORIC PERIOD

The Protohistoric (Equestrian Nomadic tradition) marks the transition between the Prehistoric period and the Historic period. The Protohistoric is distinguished by the introduction of Euro-American trade goods (glass beads, brass pendants, musket balls and metal projectile points [Deaver and Deaver, 1988; Duke, 1991]) and adaptations within Native American lifeways. Of all trade items, the introduction of the horse had the greatest impact on native cultures. Prior to the horse, jumps and corrals were utilized to kill bison. After the introduction of the horse, these methods were generally abandoned; the bison were chased down and killed from horseback. However, it should be noted that abandonment of the practice was not universal. Near the St. Julian Claim Block at a location known as the Emigrant Buffalo Jump complex (24PA0711, 24PA308, 24PA0309, 24PA0630, and 24PA0381), the location was known by the Crow as "Where Buffaloes Are Driven Over Cliffs at Long Ridge," suggesting that at least in tribal memory, the practice was still known into recent times (Medicine Crow, 1992). Utilization of the horse, in combination with the bow and arrow, resulted in efficiency in bison killing previously unseen on the plains.

The appearance of guns on the Northwestern Plains occurred by the early 1700s as a result of the trading posts set up along many of the major northern rivers (Ewers, 1958). These early guns could be used for both warfare and hunting. However, a muzzle loading firearm was difficult to reload on horseback. Consequently, the bow and arrow was often used instead (Ewers, 1958). During this time, metal points slowly replaced projectile points made from stone. Protohistoric sites are not commonly found on the Northwestern Plains. Although the use of the horse has been documented by early trappers and explorers; little can be discerned about this tradition from the archaeological record.

HISTORIC PERIOD

Park County was created by the territorial legislature on February 23, 1887. The County takes its name from the proximity to Yellowstone National Park. Though Lewis and Clark were the first Europeans in the area, Jim Bridger was the first to the Emigrant area when he wintered with the Crow in 1844-45 (Romans and Romans, 2016).

The Treaty of 1825 promised the Crow the friendship and protection of the United States in return for Crow acknowledgment of the supremacy of the federal government (Smith, 1986; Hoxie, 1995). The wording of the treaty, however, was vague, and the federal military presence in the area was virtually non-existent at the time. Thus, the treaty had little effect on the Crow. With the acceleration of westward settlement following the discovery of gold in California in the late 1840s, it was merely a matter of time before increased pressure was placed upon the Crow for more substantive treaties. In 1851, the federal government negotiated the first in a series of land tenure treaties with the Crow Indians. Signed at Fort Laramie in what is now Wyoming, the Treaty of 1851 set aside 38.5 million acres of land for the Crow nation (Smith 1896:28). This treaty remained in place until the late 1860s, when increasing Euro-American settlement in Montana territory prompted further land negotiations with the Crow.

The Emigrant Mining District is the oldest mining district in Park County. When Thomas B. Curry and his two companions discovered placer gold deposits in the area in the summer of 1863, they were the first miners to visit the area. The three men were preparing to start work in the gulch when they were interrupted [attacked] by a party of Crows who ordered them off the land (Brown, 1969). Curry and his companions left the gulch and spent the winter at Virginia City. They returned in the spring and were joined by a party of thirty men from a wagon train that Jim Bridger was guiding up the Yellowstone River. Early in the same year, Sam Word and N.P. Langford obtained a charter for a stage and telegraph line between Virginia City and Emigrant Gulch, and when this news got abroad, more men stampeded to the diggings. Their effort produced little gold although mining continued steadily until 1880. The production for that period was estimated at about \$340,000. Development of copper-silver lodes began in 1885. Lode mining has been unimportant, but placer mining continued up to the 1940s with significant activity in 1931-1932 (Sahinen, 1935; Lyden, 1948).

Yellowstone City was the first camp set up in the mining district, and was already active by 1864. The town consisted of tents, dugouts, and a few cabins, but the 36 residents had already organized as the Curry Mining District, elected a justice of the peace, and drawn up a code of laws. The placers at the mouth of the gulch were nearly worked out by the fall of 1865, and Indian attacks became more prevalent. The camp was gradually abandoned. By August 1866, the camp was deserted (Wolle, 1963).

As Yellowstone City began to wane in 1865, a new, more strategic townsite called Chico began to grow (now known as Old Chico). This allowed exploration farther up Emigrant Gulch, and greater protection from the Crow. Albert Hall started a ranch on Giesdorf Creek and raised wheat and other crops to sell to the miners. With settlement and federal pressure mounting, under the Treaty of 1868, the Crow agreed to settle permanently on a reservation approximately 8.5 million acres in size, ceding the other 30 million acres of their 1851 treaty land to the federal government. The first Crow Agency was established along Mission Creek in 1870, and became

known to the Crow as “Where They Laid down Yellow Blankets” (Bradley, 1991; Voget, 1984; Medicine Crow, 1992). Ironically, the agency itself became a target of hostilities from other tribes, suffering from weekly attacks from Blackfoot, Sioux, and Cheyenne aggressors (Marquis, 1974).

In 1870 or 1871, two men, Cone and Trout, struck paydirt at bedrock at the mouth of Emigrant Gulch, and gradually opened a placer strip 400 feet wide and nine miles long. Cone reported taking about \$8,000 in gold in 1880. By 1877, Old Chico boasted one general store, two boarding houses, a schoolhouse, no saloons, and a population of 60 to 70 miners. Old Chico reached its peak in population by 1900. Hydraulic operations outside of Old Chico ceased by the early 1930s (Wolle, 1963). Notably, in 1872, the US Congress created the nation’s first national park in the nearby Yellowstone National Park. In the early 1880s, the Northern Pacific Railroad completed its connections through the State, and up toward Yellowstone National Park, resulting in a boom in population and overall access.

Though mining activity continued in the area, it wasn’t until several decades later that significant production resumed. In 1932, six operators reported a production of \$6,209. Much of the gold prior to 1941 was recovered by drift mining, using hydraulic giants, or ground sluicing. These operations generally accounted for one-half to two-thirds of the annual production of placer gold in the county. The district reported continuous production between 1901 and 1947, treating a total of 1,320 tons of ore and producing 395 ounces of lode gold; 15,592 ounces of placer gold; and 2,592 ounces of silver for a total value in 1950 of \$536,192 (Dingman, 1932; Sahinen, 1935; Lyden, 1948; Reed, 1950; Wolle, 1963).

In 1942, the Emigrant Dredging Company assembled a Yuba connected-bucket dredge on Emigrant Creek that is reported to have cost about \$600,000 and was claimed to be the largest and most expensive dredge of its kind ever used in Montana. There were 110 buckets, and each held 10 cubic feet of material. In comparison, the last electric dredge in Alder Gulch had 80 buckets, each with a 16 cubic foot capacity. The dredge worked almost continuously from August 15, 1941 to October 15, 1942, when operations were suspended due to government restrictions on gold mining. During 1942, the company recovered 4,352 fine ounces of gold, representing more than one-third of the total production for the entire county between 1904 and 1942. In April of 1946 operations were resumed, but a \$13,329 loss was reported during the first five months of operation. In November 1947, the properties on Emigrant Gulch were abandoned and the dredge was sold to Nechi Consolidated Dredging Company, Ltd, of Vancouver, British Columbia for \$400,000 (Lyden, 1948).

Among the numerous underground mines in the Emigrant Mining District, the Great Eastern mining claim group is located along Emigrant Creek, midway between Old Chico and the St. Julian Mine claims. Water resources around this site are discussed in Section 3.7. The Great Eastern mining claim group consists of the patented Great Eastern and Great Western claims and a block of about 54 unpatented claims (Stotelmeyer et al., 1983), located along Emigrant Creek. The Great Eastern and Great Western mining claims were located in 1882, and the main period of their operation was between 1885 and 1901, by the National Park Mining Company. Patent survey plats drawn in 1900 show underground workings consisting of four adits and a shaft. The total length of the adits exceeded 300 feet. The shaft was at least 50 feet deep, but the collar has since been covered. All mine entrances have been obliterated by floods, snowslides,

and bulldozing activities, but several tons of mineralized rock are scattered on the associated drill road (Stotelmeyer et al., 1983). The deposit consists of a brecciated porphyry, in which fine-grained molybdenite is associated with pyrite in the matrix and permeates the fragments of brecciated material (Horton, 1916). In 1974, drilling was conducted on the Great Western claim near Emigrant Creek. The upper drill road was being extended south in that area, near one of two holes that the Climax Molybdenum Co. drilled in 1963. It is likely that most drilling in the area extended below 1,200 feet from ground surface, and collars of several drill holes were also found along the creek, near the road and stream crossing (Stotelmeyer et al., 1983).

THE ST. JULIAN MINE

The St. Julian Claim Block consists of eleven patented and unpatented claims, and was discovered in 1887 by D.C. Lilly. The ore was assayed as high as \$368 in gold and \$40 in silver per ton. A ten-stamp gravity concentration mill operated as late as 1902. Despite promising assays, the mine's development was slow due to lack of capital (Wolle, 1963). Whithorn (2002) documented the stamp mill and concentrating equipment extant on the site as late as 1980.

Other important mines in the district include the Alice C., Barbara Anne, Emigrant Gulch Molybdenite, Galena Queen, Great Eastern, and the Mt. Cowan Molybdenite, Nancy, and North Star. There is also a rumored "lost mine" near Emigrant Peak. The mine was first discovered in 1866 by Davis B. Weaver. Samples from the lode assayed \$5,000 in gold to the ton. Two years after discovery, two men who had accompanied Weaver tried for months to relocate the lode but to no avail (Wolle, 1963).

BOUNDARIES OF THE EMIGRANT MINING DISTRICT

Sahinen (1935) places the district as a station on the Northern Pacific Railroad (NPRR) about 25 miles south of Livingston. Emigrant Creek flows into the Yellowstone River a few miles above the town. Dingman (1932) locates the district four miles south of Emigrant, a station on the NPRR. Sahinen and Dingman generally are focusing on placer operations.

Most of the lode mines in the district are at the headwaters of Emigrant Gulch and Mill Creek but the placer operations, although centered along Emigrant Gulch, were active along both Mill and Sixmile Creek. **Figure 1.3** shows the district as defined by the AMRB (1994) with a smaller area focused on Emigrant Gulch (Dingman, 1932).

The district is also known as the Chico, Curry, Shorthill, and/or Mill Creek Mining District, some of which were smaller defined areas now included in the larger Emigrant Mining District. The Curry Mining District was apparently the first placer mining district and probably included the area of Emigrant Gulch near the mouth of the Yellowstone River below Chico. Some of the others may be placer districts similar in size. Although the placers were by far the most significant producers in the district, several quartz lodes, primarily on Mineral Mountain, were also productive.

PREVIOUS RESEARCH

A file search was conducted with the Montana State Historic Preservation Office (SHPO) on February 18, 2016. The results indicated that there have been nine cultural resource

investigations within or near the St. Julian Claim Block. These reports are summarized in **Table 3.4**. In addition, a total of nine previously recorded sites have been identified and are summarized in **Table 3.5**. All of the previously recorded sites have either unresolved, or undetermined status in regards to their individual National Register of Historic Places (NRHP) status. It should be noted that one site, 24PA0307, is a Buffalo kill/processing/pound site that may be associated with an area significant to the Crow, the Emigrant Buffalo Jump complex (Medicine Crow, 1992).

Author	Report Date	Area	Results
Walker-Kuntz	1998	810 acres	11 Sites and one isolated find
Allen	2000, 2009	NA	Annual Report
Lahren	2015	NA	Class I report, no inventory.
Bailey	1981	1 acre	No cultural material identified
Allen and Ballard	2006	NA	Annual Report
Allen	2008	300	10 sites and 7 isolates documented
Allen	1999	100	No cultural material identified
Allen	2005	250	18 sites and 20 isolates documented
Ryan et al.	1987	3 acres	No cultural material identified

Site Number	TR:S	Site Type	Owner	NRHP Status
24PA1133	T6SR8E: 11	Rock Cairn	Private	Unresolved
24PA1135	T6SR8E: 11, 12	Irrigation Ditch	Private	Unresolved
24PA1263	T6SR8E: 13	Historic Mining	CGNF	Undetermined
24PA1264	T6SR8E: 13	Historic Mining	CGNF	Undetermined
24PA0396	T6SR8E: 14	Lithic Material	Private	Undetermined
24PA0307	T6SR8E: 14	Buffalo Pound/Kill	Private	Undetermined
24PA1393	T6SR8E: 14	Historic Road	Combination	Undetermined
24PA1265	T6SR8E: 25	Historic Mining	Combination	Undetermined
24PA1267	T7SR9E: 6	Historic Mining	CGNF	Undetermined

ADDITIONAL RESEARCH

On September 22, 2015, DEQ archaeologist James Strait accompanied a group of interested parties, including Halcyon LaPoint, CGNF archaeologist, to examine the Lucky Minerals project area. During this visit, a number of historic structures and features were observed that represent historic mining activity. In addition, a total of 18 features related to historic mining in the area were identified through a desktop exercise with the use of ArcMap and existing BLM GLO records (**Table 3.6**). DEQ recommends that in absence of fully recording and documenting these features, they should at a minimum, be avoided during drilling activities.

Feature ID	TR:S	Ownership	Associated Lode
Shaft No 2	T7SR9E: Sec. PB5	Private	Bottler Lode
Shaft No 3	T7SR9E: Sec. PB5	Private	St. Julian
Shaft No 2	T7SR9E: Sec. PB5	Private	St. Julian
Discovery Shaft	T7SR9E: Sec. PB5	Private	St. Julian
Mill	T7SR9E: Sec. PB5	Private	Mill
Boarding House	T7SR9E: Sec. PB5	Private	Mill
Tunnel No 2	T7SR9E: Sec. PB5	Private	Mill
No 3 Tunnel	T7SR9E: Sec. PB5	Private	Bullion
Boarding House	T7SR9E: Sec. PB5	Private	Bullion
Cabin	T7SR9E: Sec. PB5	Private	Bullion
Barn	T7SR9E: Sec. PB5	Private	Bullion
Office	T7SR9E: Sec. PB5	Private	Bullion
No 4 Tunnel with drift	T7SR9E: Sec. PB5	Private	Mill
Tunnel	T7SR9E: Sec. PB5	Private	Mill
No 2 tunnel with drift	T7SR9E: Sec. PB5	Private	Josephine
Discovery Tunnel	T7SR9E: Sec. PB5	CGNF	St. Julian Fraction
No 2 Tunnel	T7SR9E: Sec. PB5	Private	Copper King
Discovery Tunnel	T7SR9E: Sec. PB5	Private	Copper King

3.6.3 DIRECT AND INDIRECT IMPACTS

3.6.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Road maintenance / grading would not occur and access would be by four-wheel drive, ATV, and by foot.

The current condition of cultural resources would remain as they are. However, without proper historic preservation measures, including but not limited to documentation and stabilization, some resources may be at risk for continued degradation of historical integrity from both natural and human influenced actions unrelated to the proposed project.

3.6.3.2 *Proposed Action*

None of the identified cultural resources have been fully evaluated for eligibility to the NRHP, therefore all of the sites are by default considered eligible for the NRHP in regards to potential impacts. Based on the Proposed Action, no impacts to cultural resources are expected. The activity proposed is temporary in nature and would not comprise any ground disturbance in or near any previously identified cultural resources. In addition, it is anticipated that any potential indirect or visual impacts would have no adverse impact.

The State has no authority on private lands to require pedestrian survey to record or evaluate any undocumented or undiscovered cultural sites. Further, Montana DEQ has no authority to impose regulation regarding the impacts on cultural resources on private land.

3.6.3.3 *Agency-Modified Alternative*

Same as the Proposed Action, with the exception that all known cultural and historic resources, recorded or identified, would be avoided during the exploration activity. This would include historic mining features within the St. Julian Claim Block.

3.6.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. Increased ease of access resulting from road improvements may lead to trespassing and cause indirect impacts to these historic mining features.

3.7 WATER AND GEOTHERMAL

3.7.1 ANALYSIS AREA AND METHODS

The analysis area for water resources focuses on the hydrologic unit which encompasses the Emigrant Mining District, with additional consideration given to geothermal systems in the region. This primary hydrologic unit is designated as the Emigrant Creek subwatershed and is identified with a 12 digit number in the Hydrologic Unit Code (HUC) system established by the USGS (#100700020206). This indicates that the Emigrant Creek subwatershed is at the top of the drainage system for this region of the Absaroka-Gallatin volcanics (**Figure 3.6**). The climate of the area typically consists of warm summers and cold winters, with an average annual temperature of 35 °F (1.6 °C). The area receives 25 to 35 inches of precipitation annually, mainly in the form of snow (PRISM Climate Group). The Emigrant Creek subwatershed covers an area of 13,360 acres, and is one of nine subunits within the Big Creek-Yellowstone River watershed (HUC 10; 212,940 acres).

The analysis methods for water and geothermal resources included reviewing publications by the USGS and MBMG, primarily derived from fieldwork conducted in the area in 2015 by DEQ, CGNF, and MBMG (LaFave, 2016), water quality data in the Groundwater Information Center (GWIC) database, and any associated maps and figures. **Figure 3.6** shows the location of all water resource sites that were considered during this analysis. These sites occur in two general clusters, one around Old Chico and the other around upper Emigrant Creek and East Fork of Emigrant Creek. The water resource sites can be categorized as streams, cold springs and seeps, hot springs and seeps (>77 °F or 25°C), private wells, existing boreholes, and drainage related to mining. The most recent data collected include: flow measurements from streams, springs, seeps, and flowing boreholes; dissolved ion and metal concentrations from most sites; and field chemical parameters from all sites (LaFave, 2016). In some cases, well logs and water quality data from the 1970s and 1990s are available in the GWIC database, but the site locations may be inaccurate and the analysis suites are relatively limited. These site data are useful for historical context, but may not be directly comparable to the current environmental conditions.

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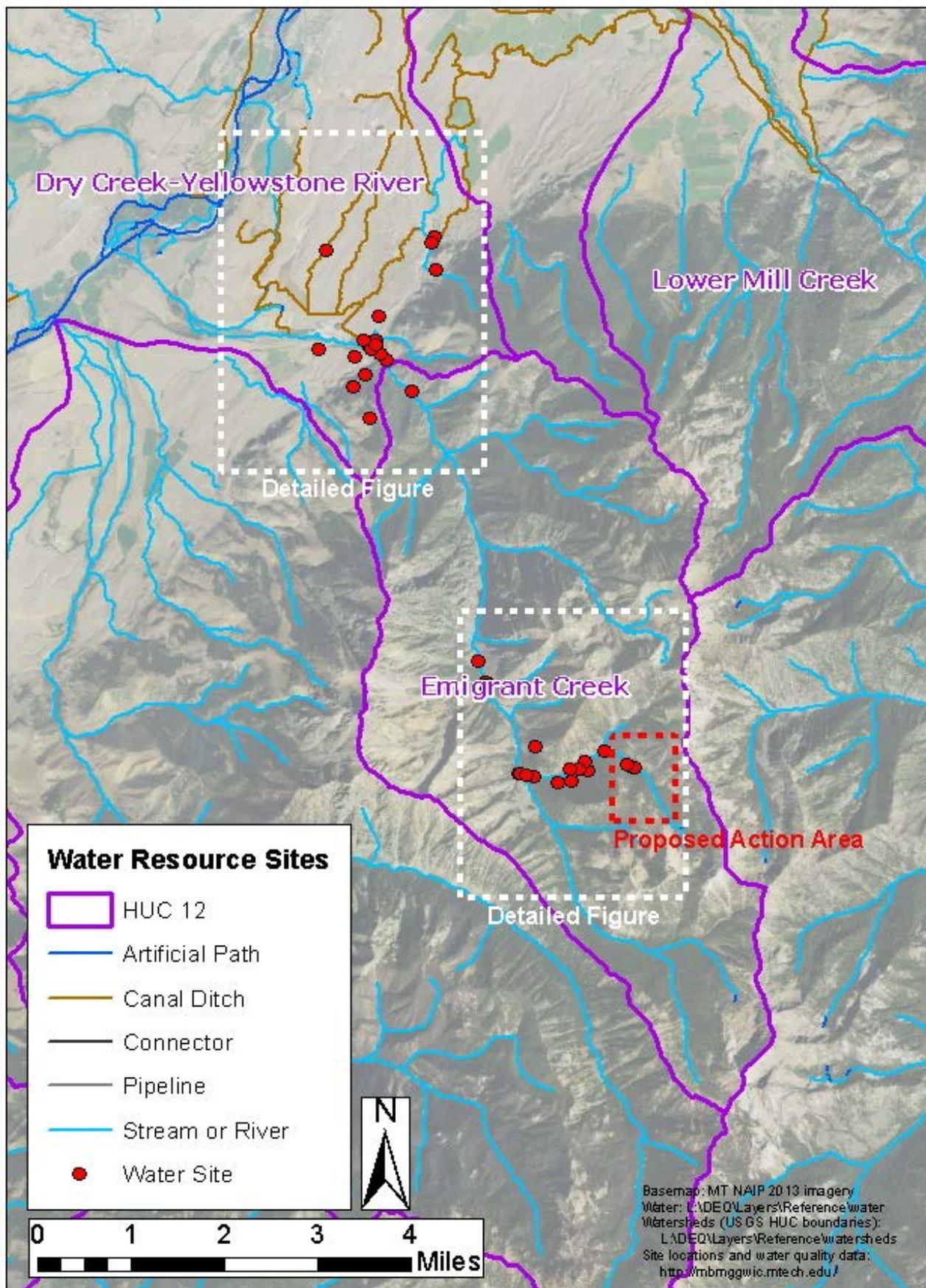


Figure 3.6
St. Julian Exploration Project, Park County, Montana

(All water resource monitoring sites in the analysis area, shown with Hydrologic Unit Code (HUC) 12 boundaries, the Proposed Action area, detailed views are shown in Figures 3.7 and 3.8)

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3.7.2 AFFECTED ENVIRONMENT

3.7.2.1 *Stream Hydrology*

The analysis of potential impacts to surface water was prioritized to follow the primary drainage pathway, and focused on the areas adjacent to the Proposed Action site (i.e. East Fork of Emigrant Creek and Emigrant Creek above Old Chico). The headwaters for Emigrant Creek begin at high elevations (near 9,200 to 9,600 feet above mean sea level- amsl) on the western face of the Mineral Mountain ridge, located to the southeast of the St. Julian Mine area. From these meteorically derived sources, Emigrant Creek flows to the northwest for almost 3 miles before receiving flow from the Huckleberry Gulch drainage, and another mile before combining with the East Fork of Emigrant Creek (East Fork). This East Fork confluence is located approximately two miles to the east of Emigrant Peak, at an approximate elevation of 7,275 feet amsl. During baseflow conditions in 2015, the flow in Emigrant Creek was measured at 3.01 cubic feet per second (cfs) above the confluence with the East Fork, and increased to 4.21 cfs below the confluence (LaFave, 2016).

To the east above that confluence, the East Fork flows from east to west for approximately two miles, draining the cirque valley where the St. Julian Mine area (Proposed Action sites) is located on the southern slope of the valley. The head of the stream begins at a pond within the cirque, located near 8,950 feet amsl, approximately one mile up-gradient from the St. Julian Mine. The East Fork flows along the valley floor, roughly followed by the access road through the old St. Julian Mill area. Access to the St. Julian Claim Block would follow the road along the East Fork at the base of the mountain, before climbing switchbacks to the drill pads which would be situated up to 1,000 feet above the elevation of the East Fork. In 2015, two sites were visited on the East Fork that are located up-gradient and down-gradient of the St. Julian Mine. The flow was measured at 0.8 cfs at the site below the mine, but flow was not measured at the upper site (LaFave, 2016). There are a number of springs along the drainage to the west of the St. Julian Mine, which contribute to the higher flow that was measured in the East Fork directly above the confluence with Emigrant Creek (1.42 cfs; LaFave, 2016).

Below the East Fork confluence, Emigrant Creek flows northwest for an additional five miles before reaching the mouth of Emigrant Gulch at Old Chico. Along that reach of the stream, a number of springs were identified in the vicinity of the Great Western and Great Eastern mine claims (T06S, R08E, S36), a molybdenite property located one mile north of the East Fork confluence. Although the general location matches the description of exploration targets provided by Stotelmeyer et al. (1983), it is unclear if those springs discharge naturally through fissures, or if the water emanates from former drill holes or mining-related disturbances. Above the influence from these springs, the flow in Emigrant Creek was measured at 5.43 cfs.

Between the Great Western area and Old Chico, there are three main tributaries, Fridley Creek and Balm of Gilead Creek from the east and Blacktail Creek from the west, as well as inputs from multiple small, unnamed drainages. Flow in Emigrant Creek was then measured at a private bridge near Old Chico (14.41 cfs), representing the northern-most point on Emigrant Creek within the subwatershed and incorporating all of the tributaries north of the Great Western and Great Eastern claims. The Emigrant Creek flow that reaches Old Chico is slightly more than 10 times the total flow that exits the East Fork drainage, indicating the dominance of

the other tributaries and groundwater sources on the hydrology and chemistry of Emigrant Creek.

Near Old Chico, Emigrant Creek continues to flow to the west-northwest and enters the Dry Creek-Yellowstone River subwatershed. Before Emigrant Creek reaches the Yellowstone River, it flows through and around substantial piles of dredge tailings from historical placer operations. These dredge waste piles cover an estimated area of 18 acres. There are also a number of ditches that divert water out of Emigrant Creek, across the arid valley benches. Although the mouth of Emigrant Gulch is only two miles from the Yellowstone River, more investigation would be needed to determine what fraction of Emigrant Creek actually reaches the Yellowstone River and what fraction is lost to irrigation, infiltration, or evaporation.

All of the field measurements taken by the MBMG in the fall of 2015 indicate steadily increasing flows in Emigrant Creek as it continues down-gradient through the subwatershed, without any significant losses being measured. The increasing flows within Emigrant Gulch can be attributed to the cumulative inputs from the surface tributaries and from shallow groundwater flow. Insufficient data exist to separate and estimate the contributions from each tributary drainage or groundwater source, but the MBMG measured flow and water quality from a number of springs and seeps in the vicinity of East Fork and Emigrant Creeks. The presence of these spring sites indicates that the steep topography directs shallow groundwater toward topographic lows (i.e. streams in the valley bottoms), rather than to deeper bedrock flowpaths.

3.7.2.2 *Stream Water Quality*

Water quality samples from Emigrant Creek and the East Fork were collected in October 2015 at many of the same sites where flows were measured. Even if samples were not collected for detailed laboratory analysis, general chemical parameters were measured in the field at each location (e.g. temperature, pH, specific conductivity (SC), reduction potential (redox), and dissolved oxygen concentration). The water resource sites in the area of the Proposed Action are shown as the southern group in **Figure 3.6**, and are shown with more detail in **Figure 3.7**. Summarized water chemistry results are given in **Appendix A**, and complete water analysis results are on file at DEQ.

The waters in Emigrant Creek and the East Fork have chemical characteristics that are typical of high elevation streams that are influenced by a small degree of mineral weathering. All of the stream sample locations had cold temperatures (<41 °F, 5 °C), slightly acidic to neutral field pH values (6.00 to 7.78), low total dissolved solids (TDS <90 mg/L), high dissolved oxygen concentrations (>9 mg/L), and ion loads dominated by calcium, magnesium, bicarbonate, and sulfate. At every stream site that was sampled, the total nitrate/nitrite and phosphorous concentrations were below the laboratory detection limits (<0.20 mg/L and <0.020 mg/L, respectively). The concentrations of these nutrients were also below the base numeric standards that were established for the Absaroka-Gallatin Volcanic Mountains (Ecoregion 17i, level IV), with total nitrogen at 0.250 mg/L and total phosphorous at 0.105 mg/L. However, these criteria only apply during the period between July 1 and September 30 (DEQ-12A).

The uppermost sample from Emigrant Creek was collected directly above the confluence with the East Fork (GWIC #284999). A summary of water chemistry is provided in **Table A.1**, and the chronic aquatic life standards for aluminum and cadmium were exceeded at this location (DEQ-7). It should be noted that the comparison to the low cadmium standard is problematic,

because although the measured value is considered detectable, it is below the analytical reporting limit that is indicated by MBMG laboratory.

Within the East Fork at the base of the St. Julian Mine area, few changes were noted in water chemistry between the up-gradient and down-gradient sites (GWIC #285007 and 285009). Within this 2,000 feet section of stream, the pH increased from 6.00 to 6.51 and the SC increased from 84 to 93 $\mu\text{S}/\text{cm}$, indicating a minor increase in alkalinity and dissolved ion load at the lower site. At the upper site, there were no exceedances of the established human health or aquatic life standards for water quality. Both of these sites are located up-gradient from a small northern tributary, as well as from the point where the access road crosses through the stream channel for approximately 10 feet (**Figure 3.7**). Although the stream crossing consists of coarse, angular rock, there is potential for turbidity and suspended solid loads to increase briefly at that point in the stream as a result of any traffic-related disturbance on the road. The degree of sedimentation or turbidity was not quantified during recent field work.

Another 0.8 mile to the west towards the confluence with Emigrant Creek, water quality in the East Fork degrades along the gulch. This is primarily due to inputs from groundwater, and surface discharge from springs and seeps, particularly from the north side of the stream. Approximately 500 feet above the Emigrant Creek confluence (GWIC #284926), the pH decreased, while the TDS, sulfate, and metal concentrations increased. Four metals exceeded the acute and/or chronic aquatic life standards at this location: aluminum, cadmium, copper, and zinc (DEQ-7).

Directly below the East Fork-Emigrant Creek confluence (GWIC #284998), the pH increased and dilution moderated the dissolved ion concentrations coming from both streams. At this site, only cadmium and zinc exceeded the chronic aquatic life standards. Again, this low cadmium concentration is considered detectable, but it is below the analytical reporting limit that is indicated by MBMG laboratory. One mile to the north, another sample was taken from Emigrant Creek directly up-gradient from the Great Western and Great Eastern molybdenite claims (GWIC #284991). Corresponding to increasing flow in this reach, there was an increase in pH and a slight decrease in most dissolved ion concentrations. With a corresponding decrease in hardness, the chronic aquatic life standards were exceeded for copper and cadmium, with this cadmium concentration also falling below the MBMG reporting limit. Within the Great Western claim, there is another point where the access road crosses through the stream channel for approximately 90 feet. Although the stream crossing consists of coarse, angular rock, there is potential for turbidity and suspended solid loads to increase briefly at that point in the stream as a result of any traffic-related disturbance on the road. The degree of sedimentation or turbidity was not quantified during recent field work.

The northern-most sample collected from Emigrant Creek was taken at a private bridge near Old Chico (GWIC #284996). This represents the furthest down-gradient stream site within the subwatershed and incorporates all of the surface and groundwater flow contributions north of the Great Western and Great Eastern claims. Between the two lower monitoring sites, the flow in Emigrant Creek more than doubled. As a result, this site had the highest concentrations of most major ions, but trace metal concentrations generally decreased. There were no metal concentrations that exceeded aquatic life standards at this location.

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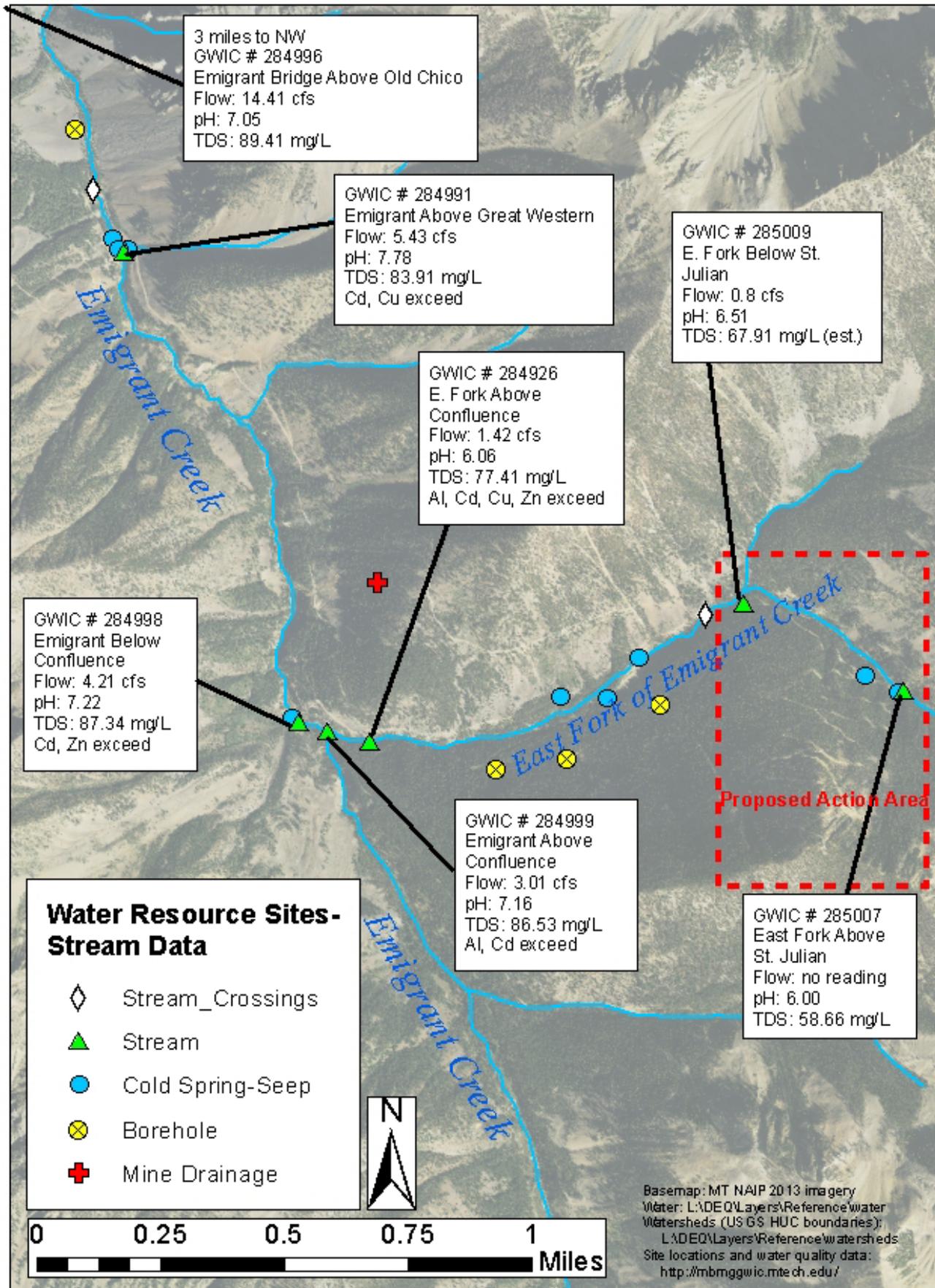


Figure 3.7
 St. Julian Exploration Project, Park County, Montana

Detail map near the East Fork and Emigrant Creek confluence. Stream sites are shown with selected parameters, including flow, pH, TDS, and any water quality standard exceedance

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3.7.2.3 *Groundwater Hydrology*

Groundwater information for the Emigrant Creek subwatershed is limited due to the lack of permanent wells in the area. Based on the known geology of the area, it is assumed that groundwater flow occurs in the glacial and alluvial deposits on the surface of slopes and gulches, as a result of meteoric water infiltration. In general, bedrock groundwater flow in alpine watersheds dominantly occurs in shallow, high-permeability (active) zones that overlie deeper, low-permeability (inactive) zones that host little flow (Manning and Caine, 2008). The higher permeability in the shallower zone is generally attributed to a greater degree of weathering and/or fracturing. The groundwater resource sites in the area of the Proposed Action are shown as the southern group in **Figure 3.6**, and are shown with more detail in **Figure 3.8**.

Some information about groundwater is available from four flowing boreholes that remain from previous exploration drilling; three are located to the west of the St. Julian Mine claims (Duval Corporation holes; T7S, R9E, S6) and the other is located on the Great Western claim area. However, the depths of the boreholes and the nature of the altered volcanics that were encountered are unknown. Although there may be slight seasonal variations, three of the four boreholes produced water under artesian pressure at very low flow rates, estimated to be between 0.25 and 2 gpm. The lower Duval Corporation borehole (GWIC #171924) was not flowing during 2015 field work, and there appeared to be an obstruction within the hole preventing water level measurements. Iron staining around the hole suggested relatively recent flow, and although a sample was not taken at this site, field parameters were measured from a small volume of water remaining within the hole. It is important to note that these holes were drilled in the 1970s, prior to the passage of regulations for the reclamation of exploration sites (ARM 17.24.107).

At the other Duval Corporation holes, the impacts at the surface are extremely localized and the “immediate, saturated area where the water is flowing is devoid of vegetation but the surrounding vegetation is healthy and appears unaffected by the water” (Hargrave et al., 2000). Some of this water flows down the road that connects the borehole sites, before infiltrating back into the ground. Much of the water infiltrates into the coarse surface material surrounding the holes. Under these circumstances, it is more appropriate to compare water quality data from the boreholes to the established groundwater standards in DEQ-7, even though the data also meet aquatic life criteria.

The other groundwater data that exist come from springs and seeps that occur along steep slopes in close proximity to the East Fork and Emigrant Creek. In the St. Julian Mine area, there were two water resource sites identified on the slope where the Proposed Action drill sites are located. One was a seep which occurs at the base of the mountain, on the east end of the first switchback (GWIC #285001). A small pool was noted below the head of the seep, which had an estimated flow of 5 gpm. This site is located approximately 10 feet above the access road, and nearly 60 feet to the west of the upper-most East Fork sampling site. To the west of this seep, the second seep was identified in the road which leads up to the other proposed drilling sites (GWIC #285011).

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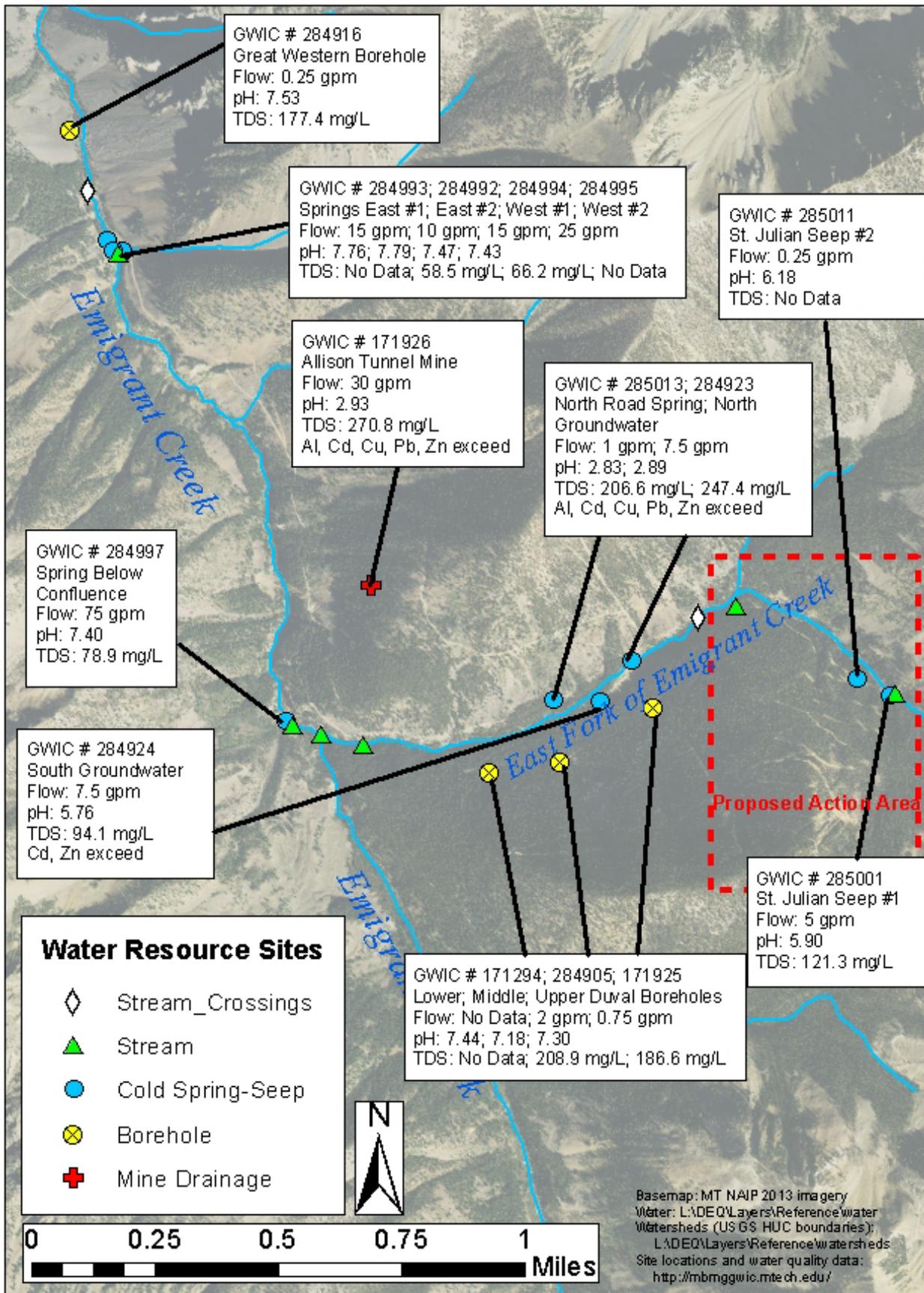


Figure 3.8

St. Julian Exploration Project, Park County, Montana

(Detail map near the East Fork and Emigrant Creek confluence. Groundwater sites are shown with selected parameters, including flow, pH, TDS, and any water quality standard exceedance)

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This seep had a much lower flow, estimated at 0.25 gpm. Given the location in the road and the circular nature of the seep, this feature could be a historical drill hole, or possibly associated with a mine adit or shaft. It is unclear if the water from both of these seeps reaches the stream below, as there were no direct discharge points observed. The surface seepage likely infiltrates temporarily into the ground before any potential discharge, but the contribution to flow in that reach of the East Fork would likely not be measureable.

This seep had a much lower flow, estimated at 0.25 gpm. The water from both of these sources likely reaches the stream below, but there were no direct discharge points observed. The surface seepage may temporarily infiltrate into the ground before discharge, but the contribution to flow in that reach of the East Fork is likely not measureable.

The other springs which occur in the proximity of the East Fork are located above the confluence with Emigrant Creek, generally situated at the base of the mountain below the Duval Corporation boreholes. There are two springs that occur on the north side of the East Fork, which represent the groundwater contributions from that south-facing slope. One spring was identified within a zone of ferricrete and was estimated to flow at 7.5 gpm directly into the East Fork (GWIC #284923). The other spring was located to the west within the footprint of the access road (GWIC #285013), but the small volume of water there appeared to infiltrate back into the ground within a short distance (estimated at 1 gpm). One other spring was identified in this reach of the East Fork, but it was located on the southern bank (GWIC #284924), and had an estimated flow of 7.5 gpm.

To the north of the East Fork and Emigrant Creek confluence, abandoned mine drainage has been observed from the Allison Tunnel (GWIC #171926; T07S, R09E, S06) at an elevation of 7,650 feet amsl. The Allison Tunnel was driven in the early 1900s to explore for gold, silver, copper, and molybdenum, and it likely focused on the contact between Tertiary dacite and granodiorite porphyries. The tunnel encountered an area of strong pyrite alteration (Stotelmeyer et al., 1983; Hargrave et al., 2000), likely within an ore-bearing breccia pipe. The adit has now entirely collapsed, but the flow was estimated to be 30 gpm. Much of the area near the Allison Tunnel has been stained with precipitated iron minerals, but the mine discharge infiltrates back into the ground and does not directly reach Emigrant Creek.

Directly below the East Fork and Emigrant Creek confluence, a spring was identified on the south side of the stream that had an estimated flow of 75 gpm (GWIC #284997). As noted in the previous section, the flow in Emigrant Creek increased by 1.2 cfs through this stretch before reaching the Great Eastern and Great Western mine claims. Down-gradient of the stream monitoring point, four springs were identified near the Great Western claim. Two springs occur on the east side of the stream and had estimated flows of 15 gpm (GWIC #284993) and 10 gpm (GWIC #284992). The other springs were located on the west side of the stream and had estimated flows of 15 gpm (GWIC #284994) and 25 gpm (GWIC #284995) (all from LaFave, 2016). These sites are likely representative of the groundwater contribution to flow in this stretch of Emigrant Gulch, but as stated previously, it is unclear if these springs emanate from natural fissures or from former drill holes. No other springs were noted or sampled between the Great Western area and the northernmost stream site near the mouth of Emigrant Gulch, but groundwater likely contributes to the increasing flow in Emigrant Creek along that reach.

Further to the northwest, there are many private wells drilled in the Old Chico and Chico Hot Springs areas, located within the Big Creek-Yellowstone River subwatershed. There is insufficient information in the GWIC database to create potentiometric surface maps for groundwater along the margin of the valley. Many of the site locations in GWIC are unreliable due to historic or incomplete surveys, and oftentimes the ground surface elevations and/or groundwater elevations are unavailable. Some of the more reliable locations for private wells in this area and the Chico Hot Springs are shown in **Figure 3.9**.

The majority of private wells in the valley are completed in glacial and alluvial deposits, with a mixed lithology of clay, sand, gravel, and boulders. Two wells (GWIC #217260 and 217261) are completed in semi-fractured volcanic and intrusive rocks, described in the well logs as granite with intermittent clay zones. Many of the private wells are relatively shallow, ranging in depth from 40 to 140 feet. A few of the wells are open-bottomed, while most are screened over the bottom 10-20 feet. In some cases, the water elevations were recorded at the time the wells were drilled. These water levels ranged from 28 to 75 feet below ground surface, indicating some degree of head pressure from the lower screened depths. For the wells which received air development, the reported flow rates ranged from 20 to 40 gpm (all from GWIC).

There are also five private wells that intercept a deeper productive zone, with depths ranging from 230 to 1,600 feet. These wells are located predominantly to the west and southwest of Old Chico, and are also completed in similar glacial and alluvial deposits. Development data are limited, but these wells appear to produce only half as much water as the shallow neighboring wells (10-15 gpm) and static water elevations range from 50 to 250 feet below ground surface (all from GWIC)

The hydrogeological evidence does not suggest there is a direct connection between groundwater in the Emigrant Creek subwatershed and the system feeding Chico Hot Springs (LaFave, 2016). As noted before, bedrock groundwater flow in alpine watersheds occurs primarily in shallow “active zones,” while the deeper “inactive zones” host little flow and exhibit decreasing permeability with depth (Manning and Caine, 2008). This is observed in the analysis area, where the steep topography directs shallow groundwater toward topographic lows (i.e. streams in the valley bottoms). The abundance of streamside springs and the presence of low-flow artesian boreholes at lower elevations on valley slopes support this conceptual model. The flows measured in the East Fork and Emigrant Creek increase steadily, indicating contributions from surface tributaries and groundwater without measurable losses to a deeper flow system. This also suggests that the deep, inactive zones in the bedrock are unlikely environments to generate geothermal water, lacking sufficient circulation and heating at depth.

3.7.2.4 *Groundwater Quality*

Water quality samples were collected from the majority of groundwater sites that are discussed in the previous section. Even if samples were not collected for detailed laboratory analysis, basic chemical parameters were measured in the field at each location (e.g. temperature, pH, SC, redox, dissolved oxygen concentration). The water resource sites in the area of the Proposed Action are shown as the southern group in **Figure 3.6**, and are shown with more detail in **Figure 3.8**. Abbreviated water chemistry results are given in **Tables A.2 and A.3**, but complete water analysis results are provided in water chemistry technical report on file at DEQ. None of the

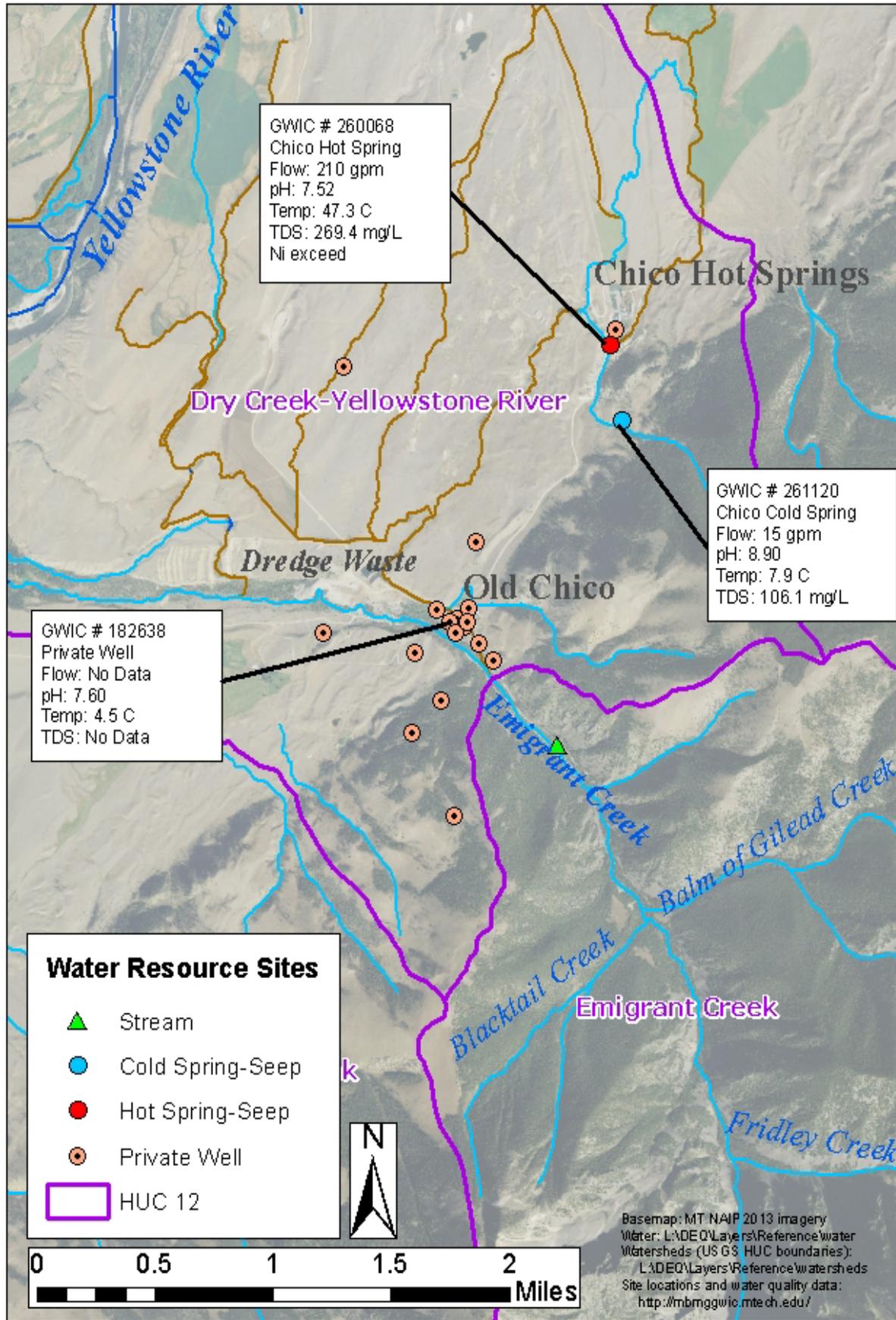


Figure 3.9
 St. Julian Exploration Project, Park County, Montana

(Detail map around Old Chico area. Stream and groundwater analysis sites are shown with selected parameters, including flow, pH, TDS, and any water quality standard exceedance)

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identified springs or seeps had temperatures greater than 43 °F (6 °C), indicating no direct geothermal influence. Compared to the stream sites that were sampled concurrently, the seeps, springs, and flowing boreholes in the Emigrant Creek subwatershed show greater variability in water chemistry.

The sites that occur in the East Fork drainage can be divided into two general groups based on water quality data and location relative to the stream. Three sites represent the groundwater flowing on the north-northwest side of the East Fork: the Allison Tunnel mine drainage (GWIC # 171926), the ferricrete spring which discharges directly to the stream (GWIC #284923), and the low-flow seep which infiltrates back into the access road (GWIC #285013). As shown in **Table A.2** and found in water chemistry technical report, these three sites had low pH values (<4.5), no measurable alkalinity, and significantly elevated concentrations of TDS and sulfate. A variety of metals also exceeded the acute and chronic aquatic life standards but not the human health standards (e.g. aluminum, cadmium, copper, lead, and zinc). The Allison Tunnel also had elevated iron and manganese concentrations that were both above 5 mg/L. Based on these chemical characteristics and the intense alteration known to occur in the volcanic host rocks, it is clear that these three water resource sites are impacted by pyrite oxidation and acid rock drainage (ARD). Coupled with the stream site water quality data, it is also clear that groundwater from this part of the drainage is predominantly responsible for the elevated concentrations of aluminum, cadmium, copper, and zinc in the adjacent reach of the East Fork and portions of Emigrant Creek.

On the south side of the East Fork, there is variability between the two sites located within the St. Julian Mine area, and the streamside spring and flowing Duval Corporation boreholes located further to the west. The St. Julian Seep #1 (GWIC #285001) had a slightly acidic pH (5.90) and elevated TDS (121.3 mg/L), but there were no exceedances of water quality standards (**Table A.2**). Complete samples were not collected from the nearby St. Julian Seep #2 (GWIC #285011), but field parameters indicate a higher pH (6.18), higher SC, and a lower oxygen concentration. To the west, the spring which flows along the south bank of the East Fork (GWIC #284924) had a similarly acidic pH (5.76) and elevated TDS concentration. The cadmium and zinc concentrations exceeded the respective aquatic life standards, but again, the cadmium concentration was detectable but below the analytical reporting limit for MBMG laboratory.

Directly south and up-gradient from the East Fork, the water quality data from the Duval Corp. boreholes stand out with elevated pH values (7.18-7.44), low oxygen concentrations, and high alkalinities. The lower borehole (GWIC #171924) was not flowing during the 2015 field visit and complete samples were not collected, but field parameters were measured and were similar to the other two holes. Additionally, the middle borehole (GWIC # 284905) and upper borehole (GWIC #171925) had moderate TDS and sulfate concentrations, and there were no water quality standard exceedances. In addition to the St. Julian Mine area seeps, the flowing Duval Corporation boreholes represent what is known about the groundwater flowing mid-slope on the south side of the East Fork.

Below the Emigrant Creek and East Fork confluence, a 75 gpm spring occurs on the south side of the bank (GWIC #284997) (**Table A.3**). The water quality measured in this spring was very similar to the springs encountered up-gradient from the Great Western/Great Eastern claims area (GWIC #284992, 284993, 284994, and 284995). All of these springs had slightly alkaline pH

values (7.40 - 7.79), high oxygen concentrations (>9.0 mg/L), and moderate TDS and sulfate concentrations. There were no water quality exceedances measured, and most metal concentrations were near or below analytical detection limits. The low-flow, artesian borehole at the Great Western claim (GWIC #284916) had similar water quality as the springs, with the exception of a low oxygen concentration and reduction potential. In addition, no water quality standard exceedances were noted for the Great Western claim borehole.

As discussed in the previous section, there are a number of private wells completed in valley sediments outside of the Emigrant Creek subwatershed. However, detailed water quality data are not available in the GWIC database for any of these sites. There is one private well (GWIC # 182638) where field parameters were measured in 2000, but a completion depth and well log are not reported (**Figure 3.9**). The approximate location appears to be between the mouth of Emigrant Gulch and Chico Hot Springs. The limited field data include a temperature of 43 °F (6 °C), a pH of 7.60, and a moderate SC of 153 µS/cm. Although the lack of data prevents other conclusions from being made, by comparing this site to the field parameters collected at Chico Hot Springs, it seems clear that there is no direct geothermal influence at this well location. More detailed information for Chico Hot Springs is available in the GWIC database, and will be discussed further in the following section.

3.7.2.5 *Geothermal Resources*

CHICO HOT SPRINGS

As discussed in the Geology and Minerals section, the Paradise Valley forms the western margin of the Absaroka Range, Beartooth uplift, and the Emigrant Mining District. This region of Paradise Valley is bounded on its southeast margin by faults which generally dip to the northwest (Personius, 1982). The Deep Creek fault (also known as the Emigrant fault) is the primary fault at this margin. Some gravity data suggest that the valley fill sediments could extend more than 2 miles in depth (Bonini et al., 1972 in Wu, 1995). These valley margin faults can often provide a pathway and discharge point for water that is circulated and heated at depth.

As shown in geologic maps (**Figure 3.1 and 3.10**), the hot springs at the Chico Hot Springs Resort are located one mile to the northeast of Emigrant Gulch and emanate from Paleozoic sedimentary rocks (e.g. Madison Limestone) that occur along the Deep Creek/Emigrant fault. This fault zone extends to the east-northeast where it connects with other surface exposures of Paleozoic units at higher elevations in the Beartooth uplift. These permeable units are likely recharged with meteoric water at high elevation, and then provide a pathway for deep fluid circulation and discharge to the lower elevation surfaces under hydrostatic pressure. These geothermal circulation systems are relatively common along other valley-bounding faults in western Montana, and are not dependent upon proximity to Yellowstone National Park (YNP) (Sonderegger, 1984). An average geothermal gradient of 138 °F/mile (30 °C/km) was estimated from a survey of many Montana hot springs, though there can be deviations in the temperature gradient between different water-bearing structures (Sonderegger, 1984).

The hot springs at Chico are located directly south of the parking lot at the resort, and occur at the surface as multiple steaming pools, no more than a few feet in diameter. During a MBMG site investigation in 2011, the temperatures of the spring pools ranged from 111.8–117.1 °F (44.3–

47.3 °C), and the total flow was estimated to be 210 gpm, based on the reported filling rate for the resort swimming pool (unpublished MBMG data). A previous investigation reported similar results, and categorized Chico Hot Springs as a low-discharge high-temperature system, with a temperature of 113 °F (45 °C) and a flow of 320 gpm (Sonderegger, 1984). Deep reservoir temperatures were estimated to be between 125–154°F (52 – 68°C), with an average of 142°F (61°C), based on dissolved ion concentrations and geothermometry calculations (Metesh, 2000; MBMG unpublished data). Coupled with the average geothermal gradient, this indicates a circulation depth that is greater than one mile, which generally agrees with geophysical data. During the 2011 MBMG sampling, resort staff members reported that periodic earthquakes can cause fluctuations in temperature and flow, as well as the load of sediment and algae coming from the hot springs. These impacts to the springs are likely caused by changing permeability and rock surface disturbance from movement within the fault zone, and not from human activity elsewhere in the watershed.

Water chemistry for the hot spring pool with the highest temperature is summarized in **Table A.3**. In addition to an elevated temperature, there are a number of parameters that make the Chico Hot Spring water chemically distinct when compared to the groundwater sites in the Emigrant Creek subwatershed. The TDS concentration is elevated (269.4 mg/L), but as shown in **Figure 3.11**, the ratios of major dissolved ions are also different, with Chico Hot Springs having higher concentrations of sodium, potassium, and bicarbonate than the other sites. The trilinear Piper diagram indicates that groundwater and stream sites around the East Fork and Emigrant Creek drainages are generally dominated by the same dissolved ions, with varying concentrations of calcium, magnesium, and bicarbonate. The acidic water from the north of the East Fork (i.e. Allison Tunnel and north-side springs) forms a separate group with lower calcium and higher sulfate concentrations.

The trace element signature of the hot spring is also unique, with elevated concentrations of arsenic, boron, cesium, lithium, nickel, and tungsten (**Table A.3**). These elements occur in low or non-detectable concentrations in the other water resource sites. Conversely, the metal contaminant concentrations which are elevated in the East Fork and Emigrant Creek drainages (e.g. cadmium, copper, lead, zinc) occur in low or non-detectable concentrations in the hot spring water. It is also noted that Chico Hot Springs is the only site that exceeds the chronic aquatic life and human health water quality standards for nickel (at 0.192 mg/L). This stands out as one component of the unique chemical signature for Chico Hot Springs, as nickel was measured at concentrations less than 0.00725 mg/L (or below detection limit) at all other water resource sites in the analysis area.

The Chico Hot Springs Resort also utilizes a cold spring that is located 0.5 mile south of the hot spring, located within the Dry Creek-Yellowstone River subwatershed. The data from the cold spring were collected in 2000, and the site is classified in GWIC as a public water supply. The data indicate a much lower flow (15 gpm) and lower temperature (46 °F, 7.9 °C) than the nearby hot spring. In addition to a much higher pH value (8.90), the dissolved ion and metal concentrations are quite different than the hot spring, and indicate that the cold spring is not connected to the geothermal system. The cold spring emanates from fractures within shallow porphyritic dacite, which is recharged by the infiltration of surface water through the thin colluvium that occurs immediately above the spring (Rose, 2002). The public water supply

study also indicated that a pond which is located northeast of the spring could also potentially supply recharge to the shallow fractured rock.

The water quality data suggest that the groundwater in the Emigrant Creek subwatershed is geochemically distinct from the groundwater system feeding Chico Hot Springs (LaFave, 2016). Additionally, the requisite hydrogeological evidence to suggest these systems are connected does not exist. The prominent fault orientation in the area near Chico trends to the northeast, which is perpendicular to the profile of the Emigrant Creek subwatershed (i.e. non-conductive). Additionally, there are no sedimentary rock units identified along Emigrant Gulch, which would be necessary to serve as a conduit for the fault-bounded, sedimentary rock-sourced hot spring. Rather, it is more likely that the similarly faulted Paleozoic sediments (e.g. Madison Limestone) that are located to the east on the Beartooth Plateau act as recharge zones for the Chico Hot Springs (Figure 3.1 and Figure 3.10).

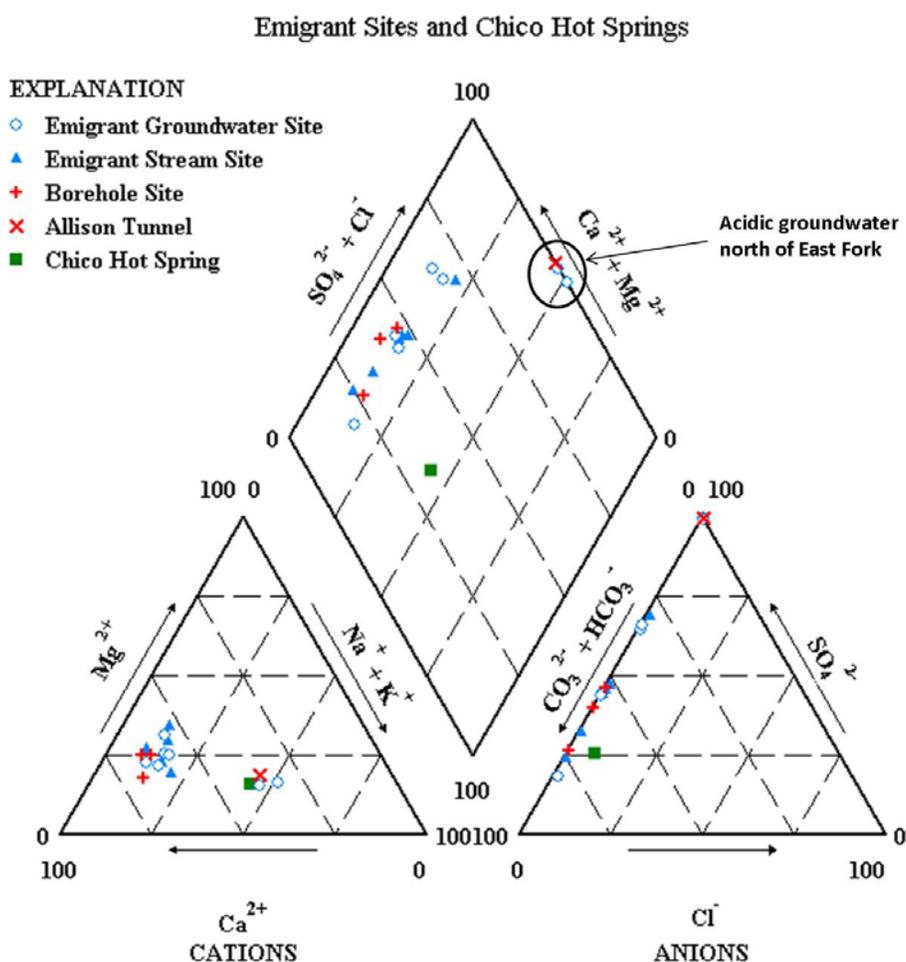


Figure 3.11: Ratios of major dissolved ions (in % composition) are shown for Chico Hot Springs and the major water resource sites around Emigrant Creek and the East Fork. The bottom left triangle shows dominant cations, the bottom right triangle shows dominant anions. The central diamond is a composite of the two datasets and is used to categorize water types based on all major ions. Data taken from GWIC database (<http://mbmaggwic.mtech.edu/>)

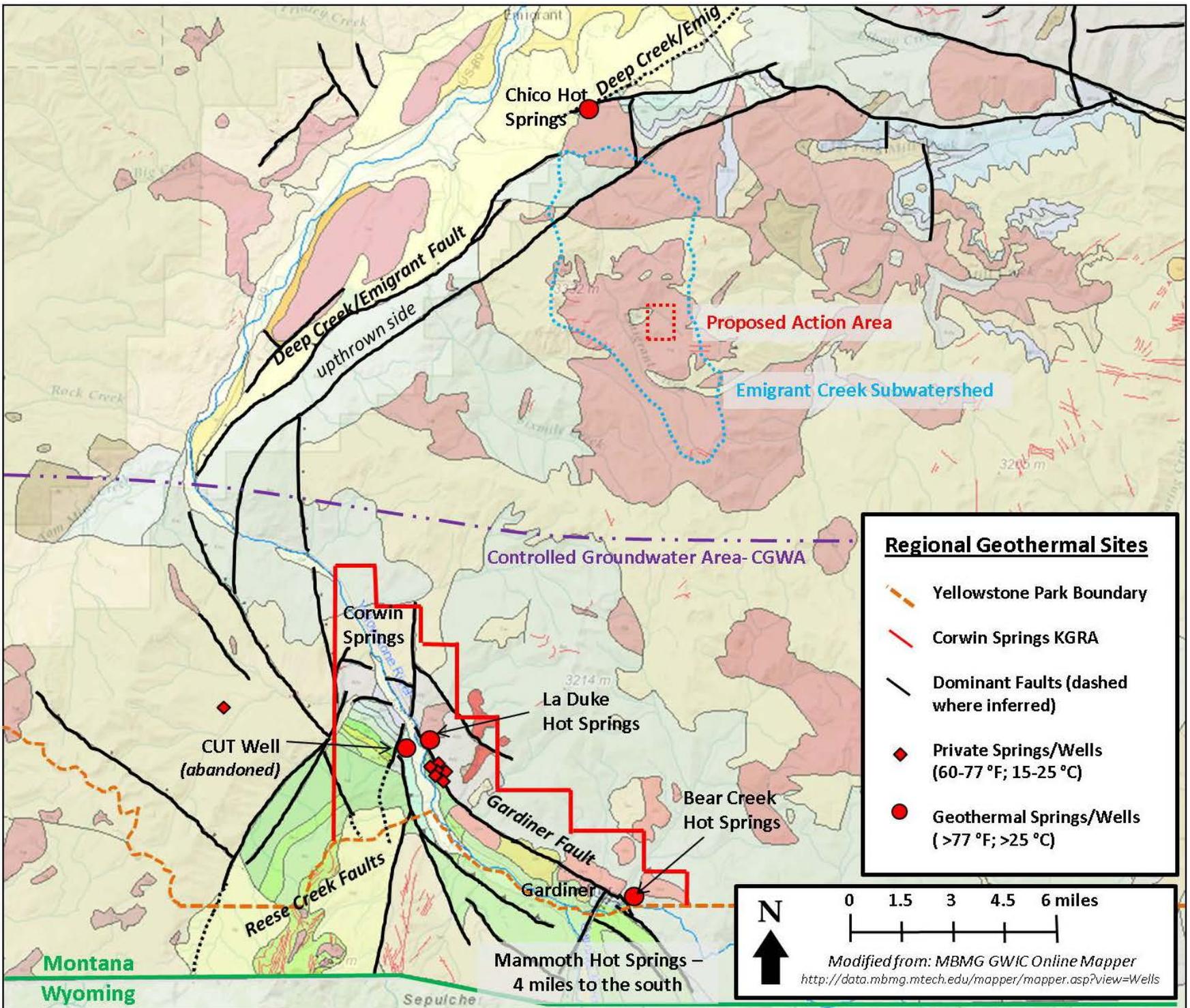


Figure 3.10

St. Julian Exploration Project, Park County, Montana

Regional geothermal features, shown with major geologic faults, state boundary, and boundaries for Yellowstone National Park, the Controlled Groundwater Area, and the Corwin Springs Known Geothermal Resources Area

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YELLOWSTONE AREA HOT SPRINGS

There are a series of hot springs located approximately 12 to 15 miles southwest of Chico Hot Springs and the Emigrant Mining District, within a region known as the Corwin Springs Known Geothermal Resources Area (KGRA). The KGRA is contiguous to the northern boundary of YNP, and it includes the towns of Gardiner and Corwin Springs, Montana (**Figure 3.10**). The hot springs which discharge into the Yellowstone River within the KGRA are found at La Duke and Bear Creek springs, located at opposite ends of a two square mile Pleistocene travertine deposit along the Gardiner Fault (Struhsacker, 1976).

There are a number of private wells and springs within the area that have temperatures elevated above background, but these temperatures range from 60–72.5 °F (16–22.5 °C) and are considerably lower than those recently measured at La Duke (147.7 °F, 64.3 °C) and Bear Creek springs (90.7 °F, 32.6 °C). The private wells and springs also occur along the Gardiner fault, but the temperatures and water chemistry data suggest some degree of dilution, as most of the private sites have TDS concentrations below 600 mg/L (**Figure 3.10**). In contrast, the TDS concentrations at La Duke and Bear Creek springs exceed 1,900 mg/L. The nearest known hot springs within YNP are located at Mammoth Hot Springs in Wyoming (average temperature = 143.5 °F, 62 °C), approximately 4 miles south of Gardiner.

Geothermal leasing activities were suspended in the KGRA in 1988, with an amendment to the Geothermal Steam Act of 1970 (30 U.S.C. 1001). This was prompted by a geothermal production well that was installed by the Church Universal and Triumphant (CUT) in 1986. This well was drilled over 450 feet deep, at a location less than 1,000 feet from La Duke Hot Springs. The well was pumped at nearly 400 gpm for a 13-hour period, which significantly reduced the flow from La Duke Hot Springs for that time period (Sorey, 1991). No production of geothermal fluids has occurred in the KGRA since that time and the CUT well was eventually sealed and abandoned in 2008. In 1997, a Controlled Groundwater Area (CGWA) was also established around this region by the Montana Department of Natural Resources (DNRC) in order to “provide for the preservation of the hydrothermal system and features by allowing no impact to them within the reserved land of YNP.” The development of groundwater wells is not prohibited within the area, but different levels of permitting are required before use, based upon the water temperature and the proposed usage rate (DNRC, 1997). The Proposed Action area is located outside of both the CGWA and Corwin Springs KGRA boundaries (**Figure 3.10**).

Hydrogeologic investigations were conducted in the KGRA by the USGS and other scientists between 1988 and 1990, following a mandate by the U.S. Congress. These investigations were centered on the Norris-Mammoth corridor within YNP, and were meant to determine the hydrogeological connections and any potential impacts to the Park from withdrawing thermal water within the KGRA (Sorey, 1991). General descriptions of the primary geothermal springs inside and outside of the Park are provided below, followed by a discussion of water chemistry results and comparisons to sites within the Emigrant Creek subwatershed.

In 2015, the MBMG visited La Duke Hot Springs and measured a flow of 124 gpm, a temperature of 147.7 °F (64.3 °C), a pH reading of 6.93, and a TDS concentration of 2,159 mg/L

(GWIC #171215). There are other small seeps in the vicinity that have similar field parameters, and it appears that this spring system is aligned along segments of the Reese Creek fault network (**Figure 3.10**). These north-trending faults intersect the Gardiner fault, and are important in localizing and transmitting upward flow through the sediments on the valley margin (Pierce et al., 1991). The Gardiner fault is a high-angle reverse fault, which bounds the Precambrian crystalline rocks of the Beartooth uplift. More than 10,000 feet of Paleozoic and Mesozoic sedimentary rocks are preserved within the footwall. From a structural high within YNP, the sedimentary units dip into the Gardiner fault zone, where they are dragged up and overturned into an asymmetrical syncline (Struhsacker, 1976). These structural relationships suggest that groundwater flows down permeable Paleozoic sedimentary units from the Yellowstone upland to great depth under the Gardiner fault zone. The reservoir temperature for La Duke Hot Springs was estimated to be near 175 °F (80°C), indicating a circulation depth of at least 1.5 miles (Kharaka et al., 1991).

To the south of La Duke Hot Springs near Gardiner, the Bear Creek Hot Springs flow from three principal vents. In 2015, the combined flow was measured at just over 40 gpm, with a temperature of 90.7 °F (32.6 °C), a pH of 6.22, and a TDS concentration of 1,927 mg/L (GWIC #197921). Like La Duke Hot Springs, the flow system and reservoir rocks supplying the Bear Creek Hot Springs likely consist of Paleozoic carbonates that originate in YNP and dip into the Gardiner fault. This system has a lower surface temperature than La Duke Hot Springs, as well as a lower reservoir temperature estimate (158 °F, 70 °C; Kharaka et al., 1991). There is also the potential for La Duke and Bear Creek Hot Springs to receive flow from the adjacent Precambrian rocks of the Beartooth uplift to the north and east (Pierce, 1991). However, strontium isotope models indicate that only a small amount of flow is likely sourced from Precambrian rocks (Kharaka, 1991). The major chemical characteristics are similar between the La Duke and Bear Creek sites, indicating that the springs belong to a similar flowpath localized along the Gardiner fault (Sorey, 1991).

Another four miles to the south, hot springs discharge inside YNP from the Mammoth system with a total flow of 9,350 gpm. It is estimated that approximately 10% of the flow issues from the Mammoth Terraces, while the rest of the water flows into the nearby Gardner River (sic) (Sorey, 1991). Multiple springs and one monitoring well exist at the site, where temperatures range from 111.2-161.5 °F (44-72 °C), pH values range from 6.08 to 6.76, and TDS concentrations range from 2,121 to 3,076 mg/L (Kharaka, 2002). The water at Mammoth Hot Springs is most likely derived from a combination of northward lateral flow from the Norris-Mammoth corridor and from deep circulation of water originating from more local sources (e.g. meteoric recharge to permeable Paleozoic units). The estimated reservoir temperature for the Mammoth system is higher than any of the sites in the KGRA (212 °F, 100 °C) and reflects this deep circulation (Kharaka et al., 1991). Based on the concentrations of dissolved conservative elements, magmatic volatile gases, and the ratios of stable isotopes, about 30-40% of the water at Mammoth appears to consist of flow from the Norris area to the south (Sorey, 1991). Geophysical data and heat-balance calculations indicate that partial-melt conditions (930 - 1,110 °F; 500-600 °C) may exist underneath Norris and provide heat to this flow system at a depth of 3.5 miles, but it is not clear whether this is an independent magmatic source (Stanley et al., 1991).

CONNECTIONS BETWEEN SYSTEMS

Results from the USGS investigations indicated that there could be flow paths between Mammoth Hot Springs and La Duke Hot Springs, but there was no chemical evidence that such flow was actually occurring. This apparent lack of flow could be due either to geologic barriers or to the current distribution of hydraulic head in subsurface reservoirs (Sorey, 1991). However, there was chemical evidence of a small component of Mammoth-type water in Bear Creek Springs (0-20%) and evidence of substantially greater flow in the past (>12,000 years ago) between Mammoth and other parts of the Corwin Springs KGRA (Sorey, 1991). It was determined that large-scale geothermal development in the KGRA that caused substantial head changes could potentially result in decreased discharge from thermal springs in YNP. However, geothermal wells could still be developed within the KGRA with no discernible risk to YNP's thermal springs, "provided the combined production from all wells was less than about 60 L/s (950 gpm)" (Sorey, 1991).

The USGS investigations identified the recharge sources and thermal systems within YNP that are responsible for the hot springs in the KGRA and the northern end of YNP. The dominant dissolved ion signatures of geothermal springs located within the Yellowstone caldera indicate volcanic reservoir rock influence (e.g. primarily sodium, chloride, and silica). Further to the north at Mammoth and the Corwin Springs KGRA, the dissolved ion signatures suggest an increasing influence from sedimentary reservoir rocks (e.g. primarily calcium, bicarbonate, and sulfate) as shown in **Figure 3.12**. Although a similar suite of cations is observed around the Emigrant Mining District and Chico Hot Springs, the hot springs at Mammoth and the KGRA have TDS concentrations that are significantly higher than the other sites (1,927-3,076 mg/L vs. all others <300 mg/L). The concentration ratios of magnesium, sodium, potassium, chloride, and sulfate found in the Mammoth and KGRA samples form separate clusters in the cation and anion diagrams (**Figure 3.12**).

The USGS also performed mixing model calculations for geothermal springs within YNP and the KGRA, based on a mass balance approach using the concentrations and isotopic ratios of conservative elements like chlorine, lithium, boron, and helium (Kharaka, 1991). These models relied on the proportional mixing of two opposite end members. Well Y-10 was selected as the monitoring point within YNP to represent the Mammoth system end member, and Chico Hot Springs was selected as the other. Chico Hot Springs was selected as the other end member because it "must not have any component of water from the Mammoth system; this requirement would rule out from consideration any sites located in the Norris-Mammoth corridor" (Kharaka, 1991). This demonstrates the disconnected nature of Chico Hot Springs from YNP, and the authors note that Chico is a better representation of geothermal water interacting with Paleozoic sediments around valley margins.

Stable isotope ratios of water were also included in this analysis, i.e. $\delta^{18}\text{O}$ and $\delta^2\text{H}$ (or " δD " for deuterium), which quantify the isotopic signatures for the atoms that make up the water molecule (H_2O). The following equation is often used to express the ratio of stable isotopes for any element (X) as a δ (delta) value, given in units of permil (‰). This equation takes the ratio of two stable isotopes (^yX and ^zX) within a given sample, and compares that to the ratio found in an internationally established, empirical standard (Clark and Fritz, 1997). Negative δ values indicate an abundance of the lighter isotope, while more positive values indicate increasing

isotopic enrichment (heavier isotope). In the case of water isotopes, the ratio of $^{16}\text{O}/^{18}\text{O}$ is compared to an empirical standard to calculate $\delta^{18}\text{O}$, and the ratio of $^1\text{H}/^2\text{H}$ (or D) is used to calculate δD .

$$\delta^z X = \left(\frac{\left(\frac{^z X}{^y X} \right)_{\text{sample}}}{\left(\frac{^z X}{^y X} \right)_{\text{standard}}} - 1 \right) \cdot 1000$$

When $\delta^{18}\text{O}$ and δD values from precipitation are plotted against one another for a specific geographic area, the result is known as a local meteoric water line. These results are often compared to a Global Meteoric Water Line (GMWL), which accounts for precipitation signatures from different elevations and latitudes around the world (Craig, 1961). When sample results are compared to this line, spatial deviations can provide useful information about the origin of a water sample (e.g. elevation of recharge as snow or rain) and the evolution of that water in the hydrologic cycle (e.g. evaporation, geothermal isotope exchange, etc.).

The USGS collected precipitation samples from across the greater Yellowstone region, established a local meteoric water line that is nearly identical to the GMWL, and determined that groundwater in and around YNP is predominantly derived from cold, isotopically-light precipitation (snow) (Kharaka et al., 2002). The stable isotope data for Chico, La Duke, and Bear Creek hot springs are consistent with high elevation recharge sources, i.e. shifted to more negative oxygen values along the GMWL. This trend is also observed in the high elevation spring and borehole sites that were sampled around the Emigrant Mining District. However, this does not suggest that the Emigrant Mining District and geothermal systems are connected, but rather that the precipitation feeding those separate systems likely occurs at similar high elevations across a broad region. The effects of geothermal isotopic exchange and oxygen enrichment (i.e. positive shift in values off of the GMWL, no change in deuterium) are less prominent in the Chico, La Duke, and Bear Creek hot springs samples, but are more drastic in the samples from Mammoth Hot Springs (**Figure 3.13**).

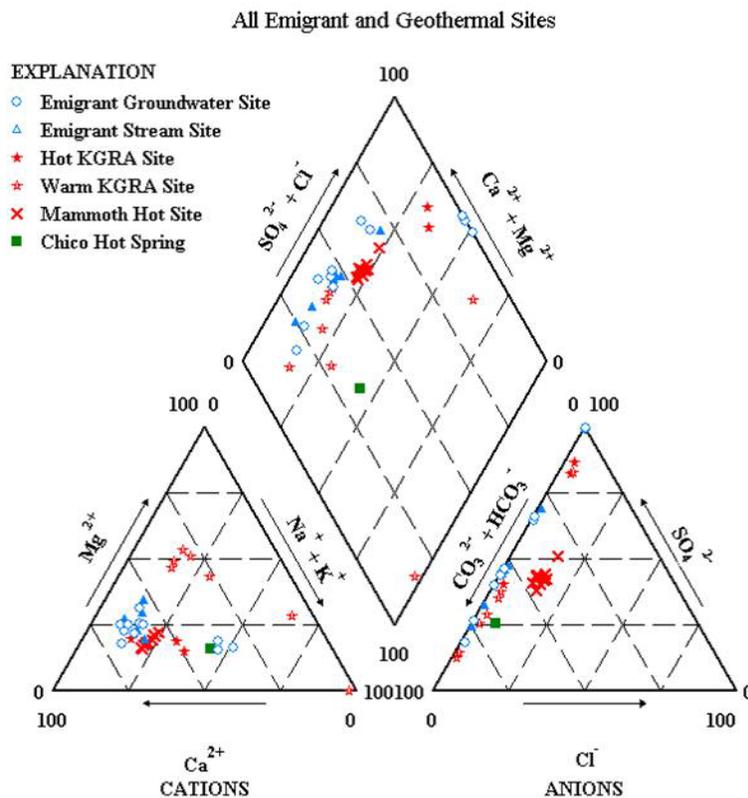


FIGURE 3.12: Ratios of major dissolved ions (in % composition) are shown for Chico Hot Springs, the major sites around Emigrant Creek/East Fork drainages, and the KGRA and YNP hot springs. The bottom left triangle shows dominant cations, the bottom right triangle shows dominant anions. The central diamond is a composite of the two datasets and is used to categorize water types based on all major ions. Data taken from GWIC database (<http://mbmgwic.mtech.edu/>) and Kharaka et al. 2002.

YELLOWSTONE VOLCANISM

The volcanism most directly identified with YNP has built an immense volcanic plateau in northwestern Wyoming over the past 2 million years. The region has evolved through three major cycles of explosive eruptions, subsequent ground collapse, accumulation of rhyolitic lava flows and ash deposits, and uplift and extensive faulting. Although there is ongoing debate about the source and mechanism controlling the movement of the Yellowstone mantle plume or “hotspot” (Fouch, 2012), it is clear that the earliest eruption events related to the Yellowstone hotspot occurred in southeastern Oregon/southwestern Idaho between 12 and 15 million years ago. The oldest caldera-forming eruption that took place in the current location (northwestern Wyoming) occurred roughly 2.1 million years ago and produced the Huckleberry Ridge Tuff (USGS, 2012). Subsequent large eruptions created the Mesa Falls Tuff (1.3 million years ago) and the Lava Creek Tuff (640,000 year ago). The latter eruption formed a ~1,500 square mile caldera in the present-day Yellowstone Plateau. Between 180,000 and 70,000 years ago, many smaller rhyolitic eruptions occurred along two primary vents within the caldera **Figure 3.14** (USGS, 2012).

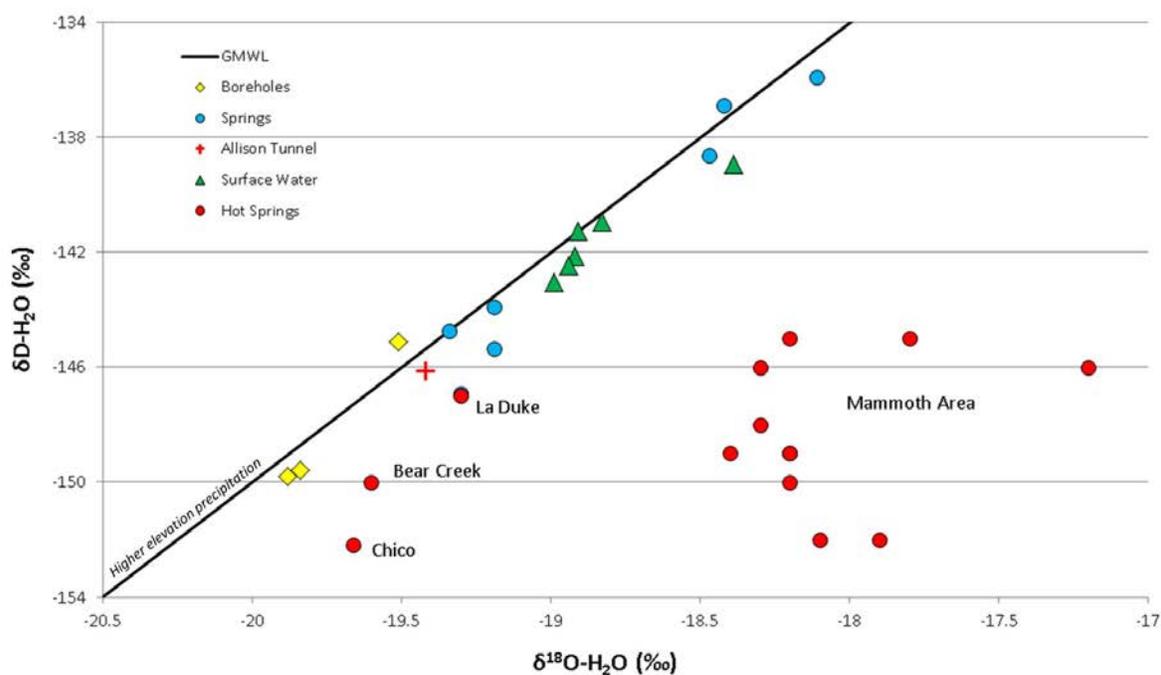


FIGURE 3.13: Stable isotope data for water ($\delta^{18}\text{O}$ and δD) from Emigrant Creek/East Fork drainage sites and the major geothermal sites in the region. Data are plotted against the Global Meteoric Water Line (Craig, 1961) for reference. Many of the surface water and groundwater sites in the Emigrant Creek subwatershed cluster near the GMWL, while geothermal springs in the region have isotopically enriched signatures. Data taken from GWIC database (<http://mbmggwic.mtech.edu/>) and Kharaka et al., 2002.

As discussed previously, the Absaroka-Gallatin volcanics which host the Emigrant Mining District are estimated to have formed during the mid- to early-Eocene, 45 to 55 million years ago (Smedes and Prostka, 1972). The volcanic province consists of deeply eroded andesitic, dacitic, and basaltic volcanoes and the deposits of epiclastically reworked material derived from them, consolidated tuffs, and a variety of related intrusive rocks. It is important to note that the volcanic units, intrusive units, and mineralization that would be encountered by drilling in the Emigrant Mining District area are much older than, and completely unrelated to, the volcanic system in YNP.

The northern rim of the most recently formed caldera is located near Canyon Village, Wyoming, approximately 35 miles south of the Emigrant District. As discussed in previous sections, mining and exploration drilling have already occurred within the Emigrant, Sixmile, and Mill Creek districts for over a century. There is no record of seismic activity correlated with these historic activities and the most recent volcanic activity within YNP occurred as rhyolitic lava flows on Pitchstone Plateau nearly 70,000 years ago (USGS, 2012).

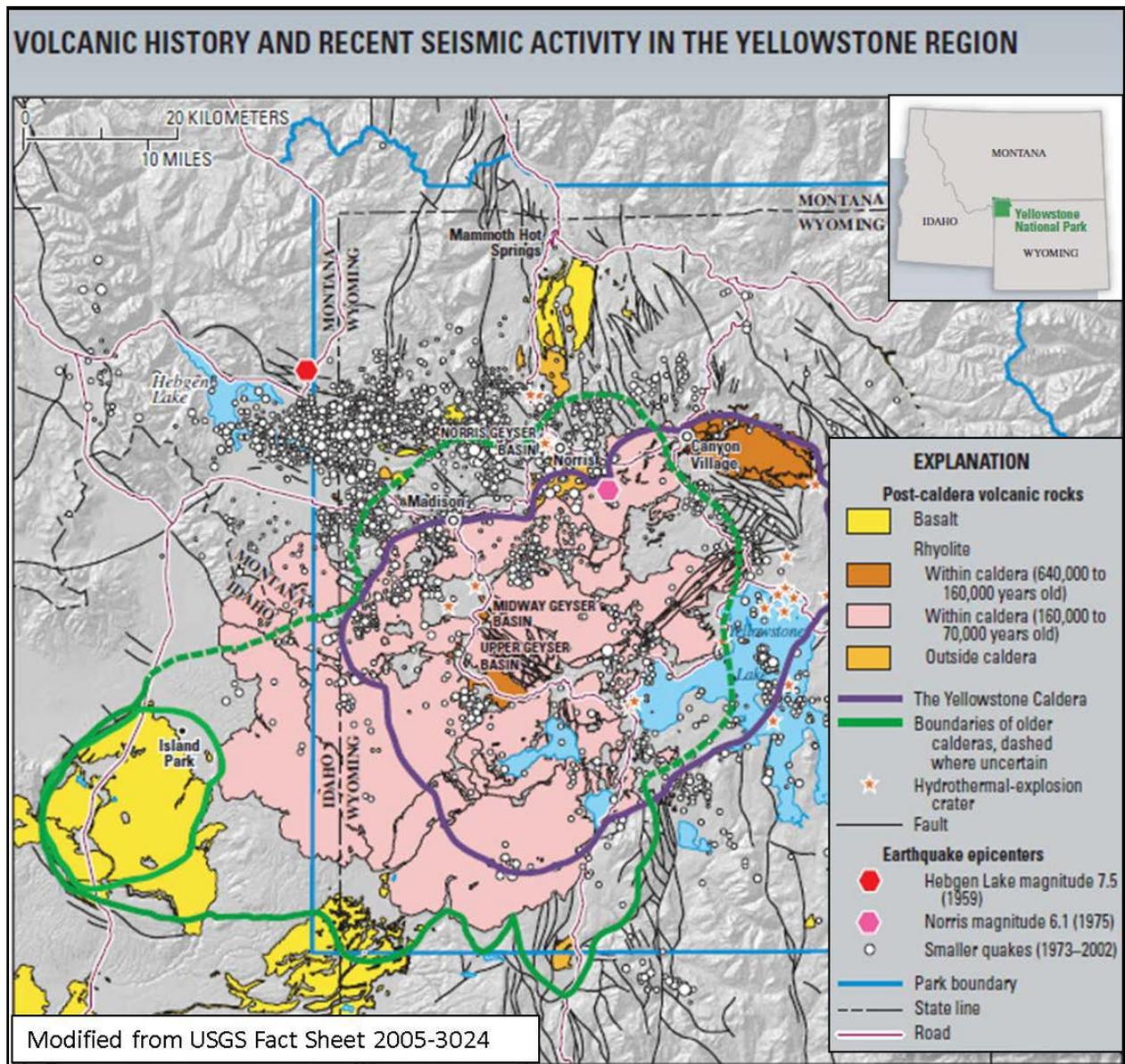


Figure 3.14: The extent of the three previous caldera-forming eruptions are shown superimposed with seismic events, post-caldera volcanic rocks, and other landmarks within Yellowstone National Park. The Emigrant Mining District and Proposed Action area are located to the north, outside the extent of this figure (USGS, 2005).

Furthermore, exploratory boreholes were drilled to collect core samples within the principal thermal areas of YNP in 1967 and 1968 by the USGS, in collaboration with the National Park Service (NPS) and the National Aeronautics and Space Administration (NASA) (White et al. 1975). Thirteen holes were drilled to depths between 200 and 1,100 feet, and were located within multiple geyser basins in the caldera (White et al. 1975). Although some of the holes encountered bursts of steam and pressurized water exceeding 392 °F (200 °C), no seismic or volcanic activity was triggered. Nearly half of the holes were plugged and abandoned shortly after drilling, while the others were left open for further observation and sampling (White et al. 1975). The USGS has also directly addressed concerns about drilling into the YNP caldera: “Notwithstanding the enormous expense and technological difficulties in drilling through hot,

mushy rock, drilling is unlikely to have much effect. At near magmatic temperatures and pressures, any hole would rapidly become sealed by minerals crystallizing from the natural fluids that are present at those depths” (USGS, 2015).

3.7.3 DIRECT AND INDIRECT IMPACTS

3.7.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. The potential impacts related to mechanized exploration work would not occur, but the existing impacts to water resources in the Emigrant Creek subwatershed would continue in their current state.

As identified in **Figure 3.7 and Table A.1**, recent water quality data indicate that Emigrant Creek exceeds the acute and/or chronic aquatic life standards for metals in three out of the four sampled locations (above and below the East Fork confluence, above the Great Western Mine). Water quality exceedances were not observed in the samples taken from the upper East Fork drainage, nor from the springs within the St. Julian Mine area (Proposed Action sites). However, metal concentrations increased in the East Fork drainage further down-gradient, primarily due to the influence from groundwater on the north side of the stream. Based on the chemical characteristics of the springs and abandoned mine drainage to the north, it is clear that water resources are impacted there by the oxidation and weathering of alteration minerals that occur in the volcanics. It is assumed that similar mineral weathering, though higher in the drainage, is responsible for the degradation of water quality in Emigrant Creek above the influence from the East Fork drainage. Under the No Action Alternative, these mineral weathering processes and the degradation of water quality in Emigrant Creek and the East Fork drainage would continue into the future for an indeterminable length of time. Similarly, groundwater and smaller surface tributaries outside of the Proposed Action drainages would continue to contribute flow and variable dissolved chemical loads to Emigrant Creek.

The flowing boreholes that exist within the subwatershed would also continue to flow, although the water from the boreholes will likely continue to infiltrate into the ground instead of discharging directly to the stream. The same scenario is likely for the mine drainage discharging out of the Allison Tunnel, although there may be a time in the future at which the accumulation of ferricrete alters the flow and/or chemistry of that adit seepage.

Under the No Action Alternative, the potential impacts to water resources from road maintenance, drill pad and laydown area preparation, and increased traffic related to drilling would not occur. This also excludes the construction of erosion control structures and other best management practices (BMPs) along the roadway and pad sites, so the potential to degrade surface water quality during storm events would continue to exist. Public traffic related activities would continue along the access roads and could include stream crossings. Although the stream crossings consist of coarse, angular rock, there is potential for turbidity to increase briefly at that point in the stream as a result of traffic-related disturbance on the road. Short-term changes in existing water quality resulting from ordinary and everyday activities do not require permits.

No mechanized exploration would occur under the No Action Alternative, so water needed for drilling would not be withdrawn from boreholes or from the East Fork drainage. Similarly, there would be no potential for contamination of water by fuel or oil from pumping water or drilling operations. This also precludes the potential development of artesian groundwater flow from new exploration boreholes, and there would be no need to use a cyclone or construct sumps for cuttings and fluid management.

As discussed previously and in the Proposed Action analysis below, there does not appear to be a direct connection between the St. Julian Mine area and the groundwater resources feeding Chico Hot Springs. Furthermore, these separate systems appear to be disconnected from the geothermal resources within the Corwin Springs KGRA and YNP. The flow and water chemistry at those geothermal sites would not be affected by the No Action Alternative. The potential exists for those sites to be affected by other environmental factors (e.g. fluctuations in precipitation and recharge rates, increased well development, damage from human disturbance, and future seismic and volcanic activity in YNP), but those issues are unrelated to this proposal and the potential impacts remain the same under any alternative.

3.7.3.2 Proposed Action

Under the Proposed Action, Lucky Minerals Inc. would explore the St. Julian Mine claim area for mineralization as discussed in previous sections. The Proposed Action would consist of a two-year period of exploration-related activities centered on the St. Julian Claim Block, as depicted in multiple figures. Seasonal closures or temporary cessations of drilling operations are unlikely to impact water quality in the area, as the drill sites and access roads would be stabilized to minimize the potential for sediment transport prior to cessation. The ongoing impacts to water resources that are described in the No Action Alternative section would continue to occur under the Proposed Action.

Lucky Minerals would access the drilling sites by using the existing roads which follow Emigrant Creek and the East Fork drainage and by maintaining the road within the St. Julian Claim Block. There would be potential to impact surface water with sediment and debris during road maintenance work, drill pad and laydown area preparation, and from drilling-related traffic. These road surfaces could also be susceptible to erosion from significant storm events. Lucky Minerals proposes to minimize the potential for those impacts to occur, by sloping roads to the outside wherever practical to enhance drainage and prevent channeling. Drill sites will be located a minimum of 100 feet away from all perennial streams, i.e. 100 feet of slope distance. Based on site-specific review of sediment transport potential (based on slope, proximity, existing vegetation, and soil depths), silt fences or straw wattles would be installed at drill sites where deemed necessary. In those cases, the sediment controls would be installed immediately down slope of the drill sites on the roadway. Erosion controls may also be needed around the laydown area, based upon sediment transport potential at the old mill site. Access to the proposed drilling sites would also include two existing stream crossings (Emigrant Creek below the Great Western Mine; upper East Fork drainage below the St. Julian Mine), but no additional stream crossings are proposed. Although these crossings are used regularly by the public, Lucky Minerals would need to obtain a 318 Authorization for the potential streambed disturbance and short-term turbidity associated with increased traffic. Any improvements or

mitigation measures that are developed through that authorization would likely lessen the impacts from public traffic as well.

Under the Proposed Action, it would be necessary to use water or some type of drilling fluid to cool the bit, to lubricate the advancing hole, and to remove cuttings from the bit face up to the surface. Current practice in the drilling industry is to use one or more types of synthetic polymer or mud products to increase the viscosity of water. These regulated, commercially-supplied additives are non-toxic and biodegradable, and are unlikely to compromise the water quality of groundwater potentially encountered during drilling. Based on the artesian hydraulic head observed on the adjacent slope in the Duval Corporation boreholes, the lack of evidence for a deep permeable aquifer, and the viscosity of the drilling fluids, it is likely that the fluids would not circulate into the target rock.

Water for drilling would be pumped from either the existing artesian boreholes or from the East Fork of Emigrant Creek, utilizing the water right that is attached to the St. Julian Mine claims. This water right allows for the withdrawal of 1,122 gpm (2.5 cfs), but it is expected that drilling would only require a maximum use of 50 gpm. Even the withdrawal rate of 50 gpm would only occur if fluids are not recirculated at the pad as proposed. By using the cyclone technology that is proposed to separate solids from the fluid, it is likely that smaller volumes of fresh water would be needed. The baseflow rates measured in 2015 indicate that the combined East Fork of Emigrant Creek flow is less than 10% of the flow in Emigrant Creek near Old Chico. A small withdrawal in the upper East Fork of Emigrant Creek would have an indiscernible impact on the volume reaching downstream users. Water would be pumped and distributed to the drilling sites using high-pressure, rubber-coated, woven steel water hoses. Plastic or steel tanks would be used to hold the mixed drill fluids and for storing make-up water at the drill site. Water holding tanks could also be used at pumping sites. There were no water quality exceedances measured in the upper East Fork of Emigrant Creek, the two seeps near the St. Julian Mine, nor the Duval Corporation boreholes, so it is also unlikely that local groundwater quality in the boreholes would be degraded by using the water sources that are proposed for drilling purposes.

To minimize the potential for spill contamination at the pump site, containment and clean up kits would be provided to handle at least 90 gallons of fuel, which is 1.5 times the estimated fuel that would be at that location. The pump itself would be contained within a lined berm to prevent any spillage, with the capacity to handle at least 1.5 times the volume of fuel contained in the pump (15 gallons) and in the attached 45 gallon drum (i.e. 1.5×60 gallons = 90 gallons). The pump will also be located on the existing ground disturbance, away from the stream bank. Similar precautions would be taken at the drill pads, where each vehicle would carry a spill kit and each drill would be equipped with a large industrial spill kit capable of handling 1.5 times the total fuel located at the drill. Oil, grease, hydraulic fluid, and other petroleum products would not be intentionally released on the exploration sites. Any of these waste fluids that remain at the end of drilling would be disposed of appropriately off-site, through arrangements with Park County. The areas around the water pump and drills would be visually monitored to ensure any leaks or spills do not escape the containment systems. If a release occurred, Lucky Minerals would follow the Spill Management and Reporting Policy that is provided in its proposal, and the contaminated material would be removed immediately and disposed of at a proper disposal site (ARM 17.24.105). Site hygiene measures will consist of portable toilets,

which would be serviced weekly or as needed, to serve the drill site work crews. If used appropriately, these measures should prevent impacts to the quality of surface water or groundwater.

The drill system would operate with a closed-loop design, where fluids are mixed at the drill site in holding tanks, and from which fluid is pumped directly down the drill pipe. Return fluids and cuttings would be directed through a cyclone partitioning system, where the solids would be effectively removed from the fluid, and then disposed of in sumps. The fluid could then be reintroduced into the primary holding tank and reused for drilling. This system does not require water or drill fluids to be contained in the sumps, but the pits would be lined as a precaution in case of upset conditions. Compared to other drilling and water management techniques in the industry, the cyclone system reduces the drilling water demand and potential impacts to surface water, and reduces the potential for seepage into shallow groundwater from fluid-bearing sumps.

Based on the artesian hydraulic heads observed at lower elevations on the slope adjacent to the west, it is likely that Lucky Minerals would also encounter artesian conditions during drilling, though this may not be the case at every drill pad that is proposed. Following that comparison, it is also likely that the proposed boreholes could produce water with chemistry and flow similar to the Duval Corporation boreholes and the seeps below the St. Julian Mine (≤ 5 gpm and no aquatic life standard exceedances), and that water would likely infiltrate back into the rocky ground. This would have no discernible impact on water quantity or quality in the East Fork of Emigrant Creek drainage, and even less so further downstream in Emigrant Gulch. Any local impacts from a flowing borehole would be eliminated as each hole is completed, as the holes are required to be plugged at depth (bottom to top) prior to removal of the drill rig (ARM 17.24.105). It is important that the appropriate combination of bentonite and cement be used to seal all holes, especially as dictated for flowing wells (ARM 17.24.106 and 36.21.671). The reclamation bonding must also be adequate to ensure artesian hole plugging at each site (ARM 17.24.106).

The Proposed Action area is located outside of both the CGWA and Corwin Springs KGRA boundaries (**Figure 3.10**). As discussed earlier in this section, multiple USGS investigations identified the recharge sources and thermal systems within YNP that are responsible for the hot springs in the KGRA and the northern end of YNP. These previous studies are consistent with more recent hydrological and chemical observations, indicating that there is no known connection between the Proposed Action area and the groundwater resources feeding Chico Hot Springs (LaFave, 2016). Furthermore, these separate systems appear to be disconnected from the geothermal resources within the Corwin Springs KGRA and YNP. Consequently, the flow, temperature, and water chemistry at those geothermal sites would not be affected by the Proposed Action.

The concerns that drilling in the St. Julian Claim Block could initiate seismic or volcanic activity within YNP have no scientific basis and are deemed unreasonable for a number of reasons. The Proposed Action area is located 35 miles from the nearest margin of the YNP caldera and the volcanic units in the Emigrant Mining District are genetically unrelated to, and more than 40 million years older than, the Yellowstone caldera system. This distance is far too great for any discernible impacts from drilling to occur within the caldera, and there is no record of seismic

or volcanic activity correlated with any mining activities in the Emigrant Mining District in the last century. There were also no impacts to the seismic and volcanic stability of the YNP thermal system when core drilling took place within the YNP caldera and geyser basins in the 1960s (White et al. 1975). Under these conditions, the potential risks to the YNP thermal systems from the Proposed Action will not be considered further.

3.7.3.3 *Agency-Modified Alternative*

The Agency-Modified Alternative is the same as the Proposed Action, with the inclusion that Lucky Minerals should develop a mitigation plan for containing flow from artesian boreholes, if those conditions are encountered during drilling. The plan should be easily and effectively implemented to prevent any potential discharge of water or sediment to surface waters or wetlands, prior to plugging and abandoning the drill hole and removing the rig.

3.7.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. No indirect impacts to Water and Geothermal Resources are anticipated.

3.8 LAND USE, NOISE, AND RECREATION

3.8.1 ANALYSIS AREA AND METHODS

The analysis area for land use, noise, and recreational resources includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area (Emigrant Creek Road and Road 3272). The analysis methods for land use and recreational resources included reviewing the Park County Growth Policy (2006), Gallatin Forest Plan (2015), two separate field visits with interested stakeholders, and publically available Geographic Information System (GIS) files for various land jurisdiction references. The analysis method used for noise included a qualitative analysis of similar-sized equipment to estimate noise levels that could be expected during the proposed project.

3.8.2 AFFECTED ENVIRONMENT

3.8.2.1 *Land Use*

The land uses in the analysis area of the proposed Lucky Minerals exploration project are generally those associated with a mountainous forested area. There are no industrial or residential land uses in or adjacent to the analysis area.

As seen in **Figure 3.15**, the majority of the land jurisdiction in the analysis area is held by the CGNF, although there are small, dispersed inholdings of private land. This is typical of Park County, as more than half of the County is publicly owned with most of that in forest lands managed by the CGNF (Park County Growth Policy, 2006). The Forest Service lands in the analysis area are in the CGNF Plan which identifies the Emigrant Creek drainage as Management Area 3 (MA3). The goals for MA3 calls for lands in this area to be “managed

essentially in their current condition to protect existing improvements and resources, with minimal investment for resource activities.”

Park County has five zoning districts, all of which are outside the analysis area of Lucky Minerals’ proposed exploration project (Park County Growth Policy, 2006). Park County does not have any zoning in the Lucky Minerals analysis area. Also, there are no conservation easements in the land use and recreation analysis area for this project.

During scoping, the public expressed concern that Yellowstone National Park and other areas with special designation may be impacted (**Figure 3.16**). Table 3.7 identifies the areas and provides their approximate distance from the St. Julian Claim Block.

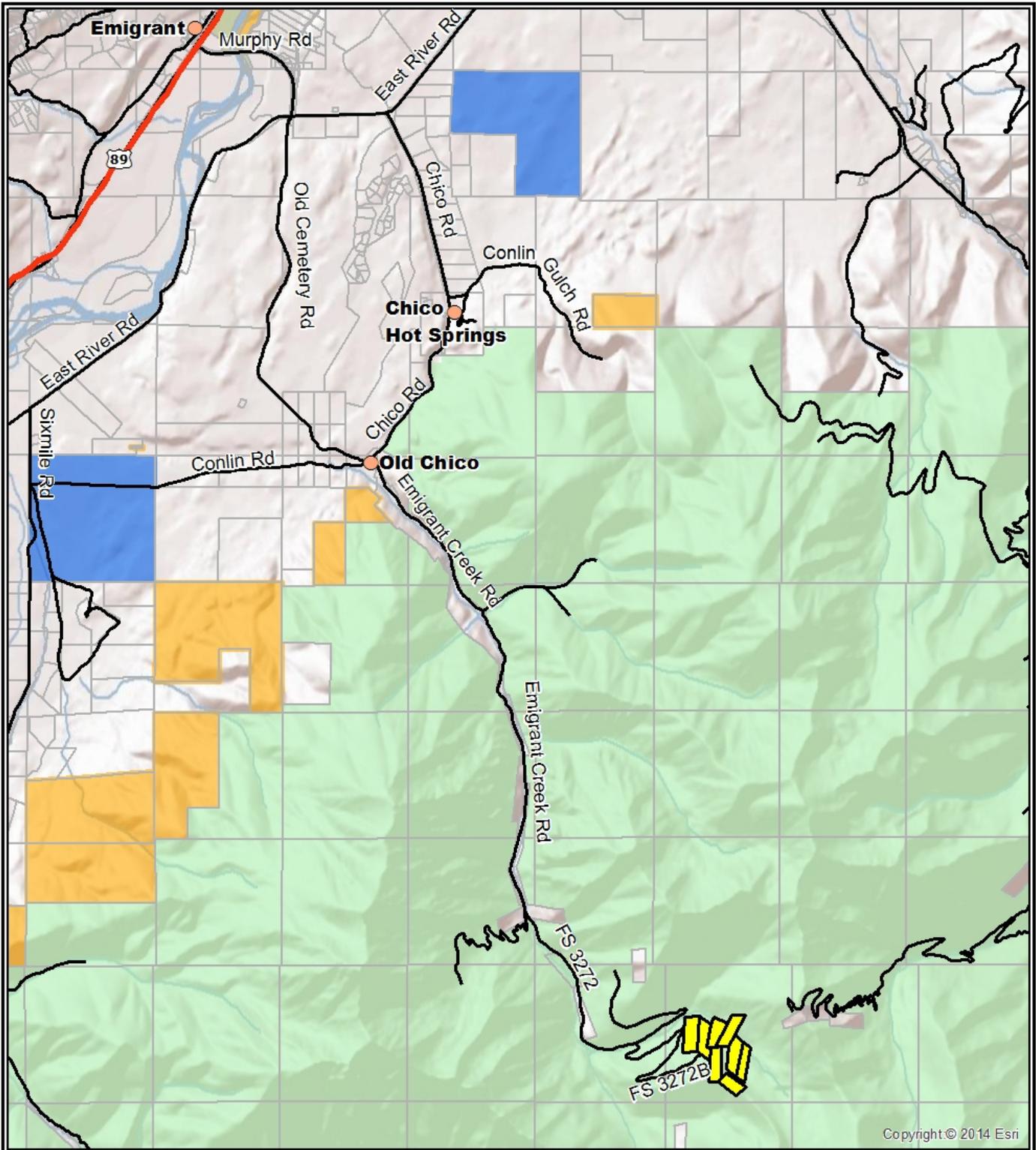
Name	Approximate miles from St. Julian Claim Block*
Absaroka-Beartooth Wilderness Area	3.0
Sliding Mountain Research Natural Area	6.5
Passage Creek Research Natural Area	7.8
Dome Mountain Wildlife Management Area	8.8
East Fork Mill Creek Research Natural Area	10.0
Hyalite-Porcupine-Buffalo Horn Wilderness Study Area	18.0
Yellowstone National Park	21.0
Palace Butte Research Natural Area	27.0
*Nearest area boundaries	

3.8.2.2 *Noise*

Human and animal perception of noise is affected by intensity, pitch, duration, and by the auditory system and physiology of the animal. Noise levels are typically measured in decibels (dBA). As a result of the Noise Control Act of 1972, EPA developed acceptable noise levels under various conditions that would protect public health and welfare with an adequate margin of safety. EPA’s *Levels Document* indicates that outdoor day-night noise levels less than or equal to 55 dBA are sufficient to protect public health and welfare in residential areas and other places where quiet is a basis for use (EPA, 1979). Although DEQ analyzes noise impacts in its MEPA environmental reviews, it does not have regulatory authority to enforce noise restrictions.

The St. Julian Claim Block currently has sound levels characteristic of rural and forested lands. Lands located in or near wilderness areas experience day-night noise levels as low as 30 to 40 dBA (EPA, 1979). Noise contributors in forest or wilderness settings typically include wind, wildlife, flowing water, overhead aircraft, and recreationists. Other noise sources in the analysis area include automobiles, ATVs, snowmobiles, chainsaws, and recreational shooting. Vehicles use roads in the analysis area for recreational purposes or for access to private lands. Automobile, ATV, and snowmobile noise levels range from 60 to 110 dBA (EPA, 1979) and chainsaws and firearms range from 100 to 175 dBA (Stewart, 2015).

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Legend

-  Roads
-  Proposed Exploration Area
-  Montana State Trust Lands
-  US Bureau of Land Management
-  US Forest Service

N

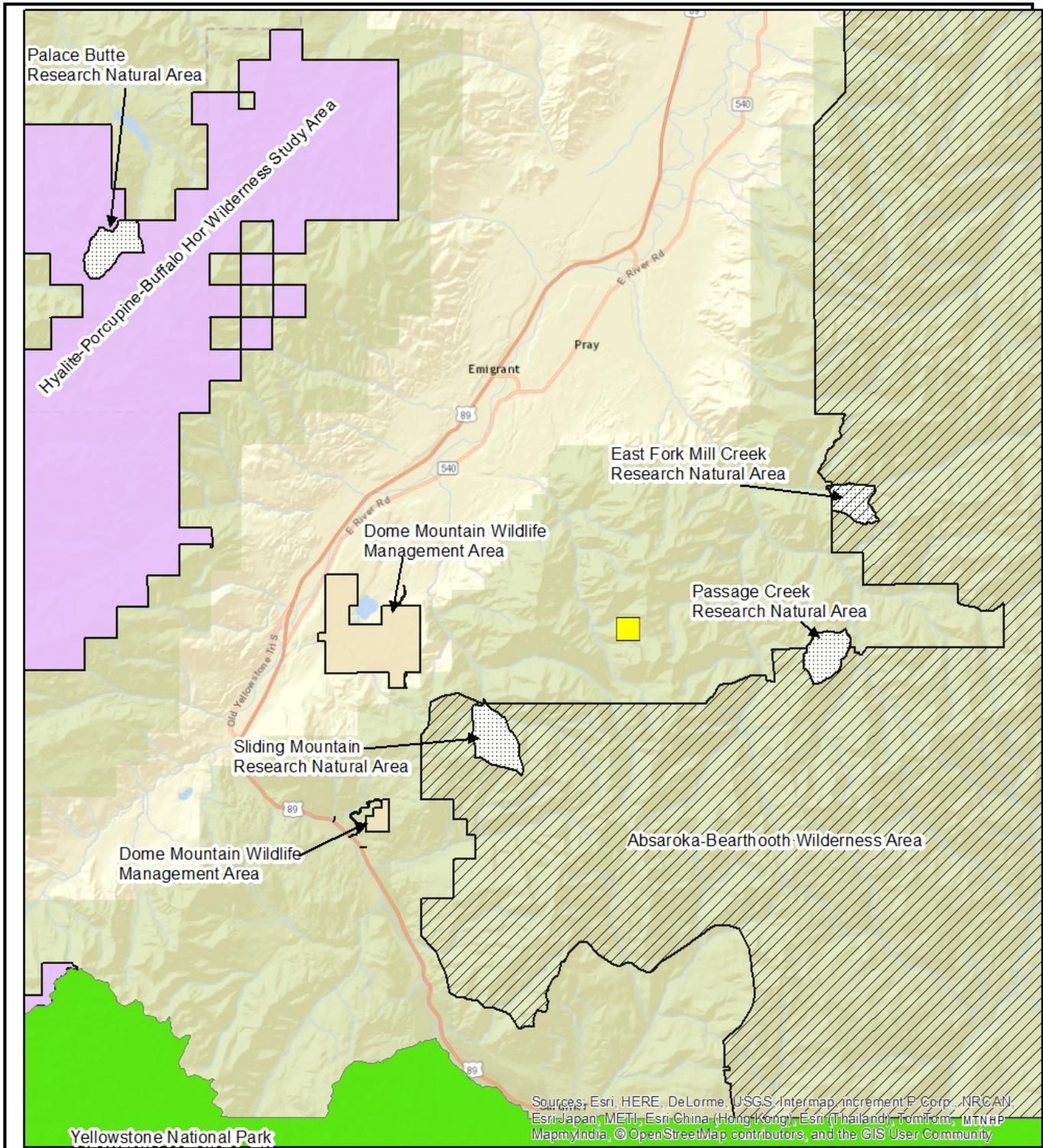


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Miles

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Lucky Minerals Exploration Project
Land Ownership
Figure 3.15

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Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri/Japan, METI, Esri/China (Hong Kong), Esri (Thailand), TomTom, ITN, HP Map/India, © OpenStreetMap contributors, and the GIS User Community

Legend

 Proposed Exploration Area	 Wilderness Area
 National Park	 Wilderness Study Area
 Research Natural Area	 Wildlife Management Area

**Lucky Minerals Exploration Project
Special Management Areas
Figure 3.16**

N



0 2 4 8 12 16 Miles

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3.8.2.3 *Recreation*

The analysis area contains a number of recreational opportunities that vary by season on CGNF or private land. Late spring and summer can provide opportunities for hiking, photography, horseback and bicycle riding, wildlife viewing, ATV riding, camping, and picnicking. Fall and winter bring skiing, hunting, snowshoeing, and snowmobiling. At Old Chico there are cabins used for recreational purposes and a resort called Chico Hot Springs. Emigrant Creek trail is about 0.8 mile from the St. Julian Claim Block at the closest point. Potential traffic impacts to these recreational areas are discussed in the Transportation Section. There are no developed campgrounds in the analysis area. Emigrant Creek Road provides recreational users the access to the area for these outdoor uses in the area.

3.8.3 DIRECT AND INDIRECT IMPACTS

3.8.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Road maintenance / grading would not occur and access would be by four-wheel drive, ATV, and by foot. Land uses, noise, and recreation opportunities would remain similar to their existing state.

3.8.3.2 *Proposed Action*

LAND USE

The total estimated ground disturbance on the St. Julian Claim Block would be approximately 4.8 acres for the drilling activities for both drilling seasons of 2016 and 2017 (**Table 2.1**). About 3.48 acres of disturbance may occur for access road upgrades on the St. Julian Claim Block. Drill pads would disturb about 0.52 acre and a laydown yard would be approximately 0.8 acre. There would be no permanent structures built and no disturbance associated with permanent structures for this alternative. Disturbed area would be kept to a minimum size necessary to accommodate the exploration operation.

The existing access road, Emigrant Creek Road and CGNF designated Road 3272, to the St. Julian Claim Block would be cleaned in localized areas to ensure the road is safe; disturbance would be confined to the original width of the road alignment (Dykes, 2016). The disturbance associated with the existing access road to the St. Julian Claim Block was not included as part of the total land use disturbance as proposed work would be limited to localized areas and done within the existing road prism which is currently disturbed. Based on DEQ's field reviews and the type of equipment proposed for use, DEQ assumes that the initial mobilization up to the St. Julian Claim Block and demobilization would be done by "walking the equipment" on Emigrant Creek Road. During mobilization, equipment would be unloaded from trailers in a safe and level location at the beginning of Emigrant Creek Road. Equipment then would be driven individually along Emigrant Creek Road to the St. Julian Claim Block. At the conclusion of the Proposed Action during demobilization, the equipment would traverse Emigrant Creek Road individually to be loaded on to trailers.

The laydown yard features would be located at or near the old St. Julian Mill site on the previously disturbed road network within the St. Julian Claim Block. The proposed drilling is to occur on the existing access road or at wider parts, and intersections on the existing road network within the St. Julian Claim Block. All project disturbances would be on private land (patented mineral claims) for the drilling activities. The proposed exploration activities on the St. Julian Claim Block would not disturb any CGNF lands. The types of land use disturbance would be to the existing access road and to previously disturbed areas of private forest land.

There would be no impact from the Proposed Action on the specially designated areas in **Table 3.7** or Park County zoning districts. Park County does not have zoning requirements on private land for exploration projects (C. Jones conversation w/ Lawson Moore (Park County Planner), 4/20/16).

All lands disturbed on the St. Julian Claim Block would be reclaimed to the existing state; however, the access roads improvements may enhance drainage and prevent channeling. The laydown yard would not be reclaimed until all exploration activities have concluded for the project.

NOISE

There would be a temporary impact from the Proposed Action during exploratory drilling, road maintenance and grading activity, and drill site / pad construction. These activities include both stationary and mobile equipment, including the following:

- D-7 type dozer or equivalent
- G-12-14 type grader or equivalent
- JD-50 or equivalent type track mounted excavator or tractor mounted back-hoe
- LF-70 track mounted diamond drilling machine
- Diesel- or gas-powered water pumps
- Service and operation trucks
- ATV

Generally the noise levels associated with this type of equipment ranges from 60 to 100 dBA at a reference distance of 50 foot from the loudest side of the equipment (Federal Highway Administration, 2016).

Wildlife may be negatively affected by project activities associated with the Proposed Action and are discussed in more detail in **Section 3.4**. There may also be short-term noise impacts from the Proposed Action to non-motorized recreationists seeking low ambient noise levels near the analysis area.

RECREATION

In most cases, recreational use and access to the public land in the analysis area would continue as it does currently. Emigrant Creek Road provides recreational users access to activities on the public land in the vicinity of the Lucky Minerals proposed project. Short-term impacts during the proposed activities may include increased use of Emigrant Creek Road, increased noise, and

restricted access when drill rigs block roads, and increased night lighting adjacent to the St. Julian Claim Block.

Mobilization and demobilization of equipment and “walking the equipment” on Emigrant Creek Road may cause ATV and other type of recreational users to avoid the area during this short period of time. DEQ assumes it will take one day per drill rig and the associated equipment to navigate Emigrant Creek Road during mobilization and demobilization. Under this alternative, flaggers and/or pilot cars would be used when large equipment is being mobilized or demobilized to minimize conflict with recreational users on Emigrant Creek Road.

The operations phase of the exploration of the proposed project would occur on private land and recreational use would continue to take place on public lands. Public motorized and non-motorized access would not be affected since the drilling would take place on private land. The Transportation Section will discuss traffic impacts to the area.

Individuals using the public lands near the St. Julian Claim Block may notice increased noise and night lighting. Since exploration activities would take place in a forested and mountainous area, the visual impacts to recreational users would be limited to viewers in the immediate area of upper Emigrant Creek.

Lucky Minerals would use lights that shield or direct the light down to not impact viewers further from the St. Julian Claim Block. The night lighting may have a short-term impact on users of public lands near the St. Julian Claim Block during the exploration project. The impact would only affect recreationists adjacent to the St. Julian Claim Block and who are currently accustomed to the area’s remoteness.

3.8.3.3 Agency-Modified Alternative

The Agency-Modified Alternative would be the same as Proposed Action.

3.8.3.4 Indirect Impacts

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. As a result of the Proposed Action, road improvements could increase ease of access to the area. This may have an indirect impact to future land use and recreation in the area.

3.9 SOILS, VEGETATION, AND RECLAMATION

3.9.1 ANALYSIS AREA AND METHODS

The analysis area for soils, vegetation, and wetlands includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area (**Figure 3.19**). Soil units, topography, and road network within the St. Julian Claim Block are shown on **Figure 3.17**.

Soils in the vicinity of the Lucky Minerals St. Julian Claim Block have been mapped by the United States Department of Agriculture, Natural Resources Conservation Service (USDA

NRCS, 1996). The field work, map unit designation, and technical quality control for the survey were conducted by the CGNF with work performed during the period 1976 – 1984. Soils maps and profiles of the soil units and associated characteristics were evaluated through a USDA Web Soil Survey (USDA, 2016). The soil report produced through Web Soil Survey is referenced on **Figure 3.17 and Table 3.8**.

3.9.2 AFFECTED ENVIRONMENT

3.9.2.1 Soils

The St. Julian Claim Block is characterized as high relief with convex glaciated mountain ridges and narrow valleys along the stream corridor. The St. Julian Claim Block is mountainous and heavily forested upper sub-alpine forest. Elevation ranges from approximately 8,000 ft near creek level to approximately 9,000 ft at the top of the ridge (USGS 1955). Landforms in the analysis area have been influenced by glacial erosion from the steep slopes on the mountain side and deposition of moraines reworked into alluvial terraces along the stream in the valley bottom. Landforms are derived from glacial action including cirques, troughs, and moraines. Soils in the area are formed in colluvium and glacial till deposited on sloped to steeply sloped surfaces of late-Pleistocene or Holocene age.

The soils in the St. Julian Claim Block are underlain by coarse-grained volcanic rock, classified as cryochrepts (**Figure 3.17 and Table 3.8**). Cryochrepts are pale colored, young soils, freely draining, and droughty with low organic matter content. The content of angular rock fragments in the subsoil ranges from 35 to 50 percent. Cryochrepts are cold region soils and the temperature regime has a mean annual soil temperature at a depth of 20 inches that is higher than 32 degrees F but lower than 46 degrees F. The frost free period is 30–70 days. Due to the granitic parent materials these soils do not have an accumulation of clay in the subsoil and have moderately acidic pH.

Table 3.8 USDA Web Soils Survey (USDA, 2016)				
Map Soil Unit	Map Unit Name	Landform	Parent Material	Habitat Type
22-1A	Dystic Cryochrepts-Rock Outcrop	Cirques, Troughs	Colluvium Derived From Granite	Subalpine Fir/ Grouse Whortleberry
35-1C	Typic Cryochrepts, Glacial Drift Substratum	Moraines	Glacial Drift Derived From Granite	Subalpine Fir/ Grouse Whortleberry
22-1C	Typic Cryochrepts – Cirque Headwalls	Cirques, Troughs	Colluvium Derived From Granite	Subalpine Fir/ Grouse Whortleberry; Subalpine Fir/ Whitebark Pine
<p><u>Map Unit 22-1A</u></p> <ul style="list-style-type: none"> • Dystic Cryochrepts-Rock outcrop complex, granitic substratum. 15% rock outcrops. <ul style="list-style-type: none"> ○ Typical profile <ul style="list-style-type: none"> • A – 0 to 7 inches: very cobbly sandy loam. • Bw – 7 to 16 inches: very gravelly sandy loam • C – 16 to 60 inches: very cobbly loamy sand <p>Limitations: Soil unit 22-1A is a poor source of reclamation material due to droughty texture and low organic matter content. Cobble content, sand content, and acidic characteristics limit utility for reclamation materials. Use as topsoil is limited due to rock fragments. Shallow excavations tend to have unstable walls. Limited for road construction due to steep slopes and large stones.</p> <p><u>Map Unit 35-1C</u></p>				

- Typical Cryochrepts – glacial drift substratum derived from granites on steep slopes. Moraines located on lower third of mountain flank.
 - Typical profile:
 - A – 0 to 3 inches: gravelly loam.
 - Bw – 3 to 16 inches: very gravelly sandy loam
 - C – 16 to 60 inches: very cobbly loamy sand

Limitations: Soil unit 35-1C is not rated as a source of reclamation material. Poor source of topsoil due to large rock fragments and low cation exchange capacity. Limited for shallow excavations due to large stones and unstable excavation walls. Soil is poor roadfill source due to cobble content and stones. Very limited for road construction due to steep slope, large stones, and frost action.

Map Unit 22-1C

- Rock Outcrop – Typical Cryochrepts complex, cirque headwalls. 40% rock outcrops, 40% cryochrepts and similar soils, 20% rubble lands.
 - Typical profile:
 - A – 0 to 3 inches: gravelly loam.
 - Bw – 3 to 16 inches: very gravelly sandy loam
 - C – 16 to 60 inches: very cobbly loamy sand

Limitations: Soil unit 22-1C is not rated as a source of reclamation material, topsoil, or roadfill. Rock outcrops and rubble lands limit shallow excavation and potential location for roads.

3.9.2.2 *Vegetation*

Vegetation around the St. Julian Claim Block is characterized as subalpine woodland. It is characteristically a high-elevation mosaic of stunted tree clumps, open woodlands, and herb- or dwarf-shrub-dominated openings, occurring above closed forest ecosystems and below alpine communities. It includes open areas with stands of whitebark pine occurring most commonly on south-, east-, and west-facing aspects. Subalpine fir is the co-dominant in these systems and is often the most prevalent tree species. Engelmann spruce is usually associated with subalpine fir and occurs as either a climax co-dominant or as a persistent, long-lived seral species in most upper elevation subalpine fir habitat types. Landforms include ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, landslides and rockslides, and cirque headwalls and basins.

Elevation ranges from 7,000 ft to 9,000 ft. The climate is typically very cold in winter and dry in summer. Snow accumulation is high in basins, but ridgetops have little snow accumulation because of high winds and sublimation. In this harsh, often wind-swept environment, trees are usually stunted and flagged from damage associated with wind, blowing snow, and ice crystals, especially at the upper elevations. Fire suppression, disease, insects and potentially climate change are changing the structure, distribution and composition of these woodlands.

Subalpine fir / grouse whortleberry is the major habitat type on the St. Julian Claim Block (Pfister et al 1977). The whitebark pine/subalpine fir habitat type is found at the higher elevation portion of the site. These habitat types are found extensively in the highest elevation forests of Montana, east of the continental divide. A cold climate and low timber productivity are associated with these habitat types. Disturbed areas exhibit slow recovery from disturbance with regrowth dominated by the same species found in old-growth stands. Subalpine fir is the indicated climax for this habitat type, but stands are also characterized by whitebark pine, which is a long-lived, seral dominant on drier, higher elevation sites. Additional species found in subalpine fir/grouse whortleberry habitat are listed on Table 3.9.

Table 3.9	
Subalpine Fir/Grouse Whortleberry Habitat	
Mountain Heath	Hitchcock's Woodrush
White Mountain Heather	Alpine Bluegrass
Alpine Currant	Sandberg's Bluegrass
Short Fruited Willow	Alpine Timothy
Planeleaf Willow	Pinegrass
Purple Mountain Hairgrass	Parry's Rush

Special Status Plants

The MNHP database was reviewed to assess the potential impacts to previously inventoried special status plant species and vegetation communities. The MNHP data search reported four Montana Species of Concern (SOC) or Potential Species of Concern (PSOC) that have been previously inventoried in Park County in the area around the St. Julian Claim Block. These four species are beautiful fleabane; wedgeleaf saltbush; whitebark pine; and many-ribbed sedge. Whitebark pine is known to occur in the analysis area.

Beautiful Fleabane: Two observances of this species have been made in Montana. One observation of this species in Park County was documented in 1989. The location is listed as near the headwaters of a tributary to Davis Creek (Mathews 1989). The observation was approximately 2 miles southeast of the project site in subalpine meadow habitat. Observation was in a forest opening on a gentle north-facing slope at the 7,000 ft elevation. While secure and common throughout its range, the plant is at risk of extirpation in the state.

Wedgeleaf Saltbush: This species has been observed in a wetland/riparian area 4 miles northwest of the St. Julian Claim Block. The last documented observation in Park County was in 1897. The general habitat is vernal moist, alkaline soil around ponds and along streams in the valleys. The species range is British Columbia and Saskatchewan south to Utah and Nevada. Wedgeleaf salt is common and abundant across its range but potentially at risk in the state due to limited range and habitat.

Whitebark Pine: Whitebark pine is a common component of subalpine forests and a dominant species of treeline and krummholtz habitats. The species is known to exist in the St. Julian Claim Block which includes historic drilling pads located in upslope and ridgetop locations. Whitebark pine is considered a sensitive species by the Forest Service and the BLM due to severe impacts from past mountain pine beetle outbreaks and by the introduced pathogen, white pine blister rust. Whitebark pine is apparently secure throughout the Rocky Mountain subalpine woodland zone but may be rare, or declining, in parts of its range.

Many-Ribbed Sedge: This species was observed in Counts Creek drainage three miles southeast of the St. Julian Claim Block (Mathews, 1989). The observation site was noted

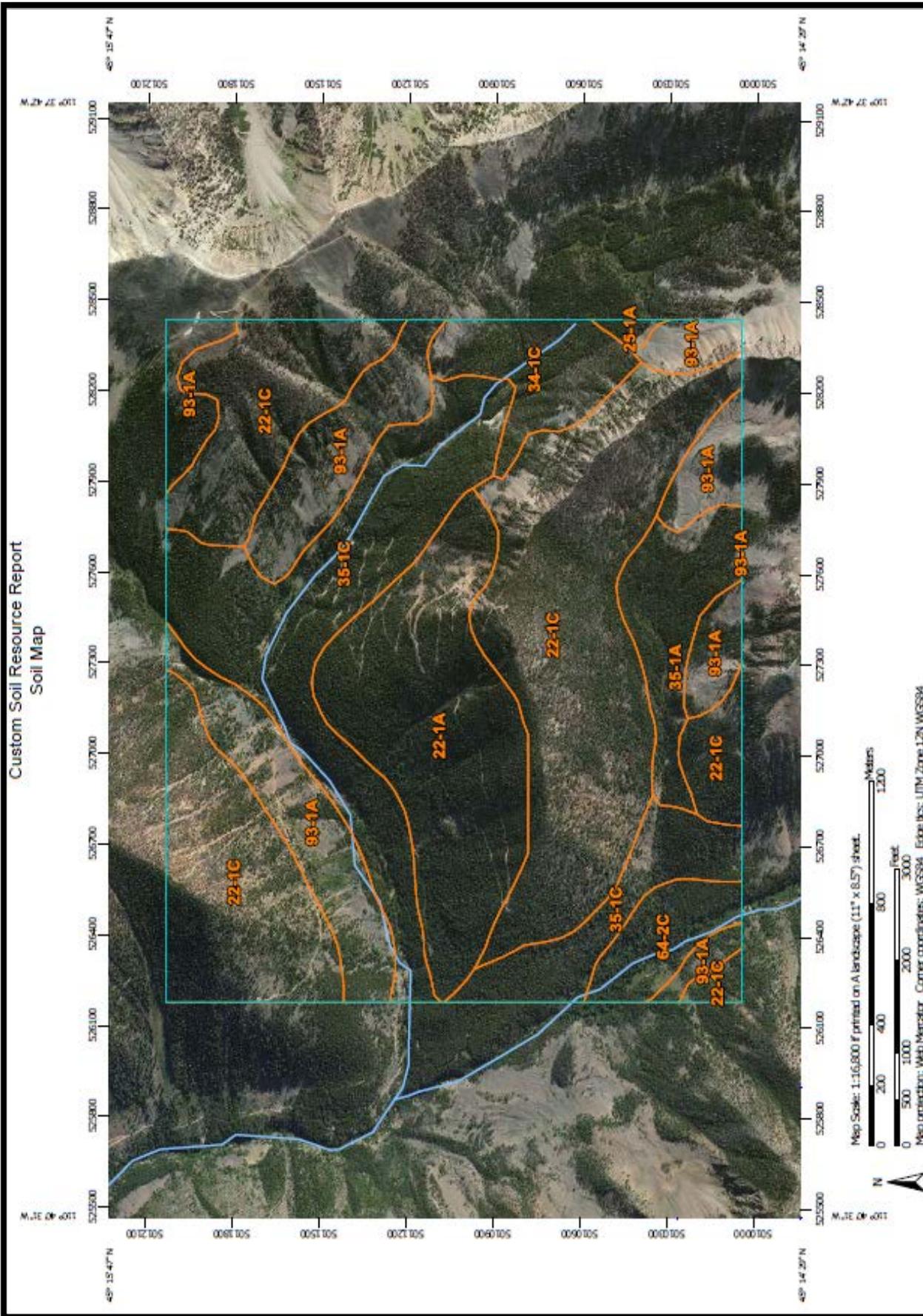


Figure 3.17
St. Julian Exploration Project, Park County, Montana
Soil Map Units Associated with Lucky Minerals Exploration Proposal

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as a subalpine meadow 20 years following a clearcut. The location was noted as montane grassland at an elevation of 7,200 ft. The general habitat is grasslands and meadows in the montane and subalpine region. The species range is British Columbia to Montana south to Nevada and Utah. Many-ribbed sedge is globally secure across its range but has limited range in the state.

Table 3.10
Montana Species of Concern Identified by Montana Natural Heritage Program

Common Name	Status ¹ USFWS/State/ Forest Service/BLM	Blooming period	Habitat and Elevation	Distribution Information
Beautiful Fleabane	State: S1S3 (SOC) Global: G5	July-September	Meadows and forest openings in the montane and subalpine zones. 7000 ft elevation	1989 observation in Park County was approximately 2 miles southeast of the project site in subalpine meadow habitat. Observation was in a forest opening on a gentle north-facing slope.
Wedgeleaf Saltbush	State: S3 Global: G5	August-September	Alkaline soils around ponds and streams in valley bottoms.	This species has been observed in a wetland/riparian area 4 miles northwest of the St. Julian Claim Block. Last documented observation in Park County was 1897.
Whitebark Pine	USFSW: Candidate USFS: Sensitive BLM: Sensitive State: S3 Global: G3G4	Cones remain closed and on tree until opened or dislodged by birds or squirrels	Subalpine forests. 7000 ft– 9000 ft elevation	Common component of subalpine forests. Species is known to exist in the St. Julian Claim Block which includes old drilling pads located near the ridgetop.
Many-ribbed Sedge	State: S2S3 Global: G5	Flowering and fruiting in July	Grassland/meadows in the montane and subalpine zones 7,200 ft elevation	This species was observed in 1989 3 miles southeast of the St. Julian Claim Block. The site was a 20 year old clearcut located in Counts Creek drainage

¹ **USFWS: Candidate:** Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. The USFWS encourages their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Endangered Species Act apply to candidate species.

USFWS: Listed threatened: Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)).

Montana SOC: Montana Species of Concern: native taxa that are at-risk due to declining population trends, threats to their habitats, restricted distribution, and/or other factors. Designation as a Montana Species of Concern or Potential Species of Concern is based on the Montana Status Rank, and is not a statutory or regulatory classification. Rather, these designations provide information that helps resource managers make proactive decisions regarding species conservation and data collection priorities.

Montana PSOC: Montana Potential Species of Concern: Potential Species of Concern are native taxa for which current, often limited, information suggests potential vulnerability.

Forest Service Sensitive: Forest Service Manual (2670.22) defines Sensitive Species on Forest Service lands as those for which population viability is a concern as evidenced by a significant downward trend in population or a significant downward trend in habitat capacity. The Regional Forester (Northern Region) designates Sensitive species on Forest Service lands in Montana. These designations were last updated in 2007 and they apply only on Forest Service-administered lands.

BLM Sensitive: Species are defined by the BLM 6840 Manual as those that normally occur on BLM- administered lands for which BLM has the capability to significantly affect the conservation status of the species through management.

3.9.2.3 Noxious Weeds

Park County has formed a weed management district to manage noxious weeds. It is unlawful to permit noxious weeds to propagate or go to seed on any land in Park County. Park County provides that anyone who enters into a weed management program with the county is considered in compliance with the County Weed Control Act (7-22-2101(5), MCA). County weed management plans consider prevention the best method for controlling noxious weeds followed by control. Prevention methods include washing all equipment prior to entry on property where land disturbing activities will take place. Use of noxious weed free seed is required for revegetation. Park County considers chemical control to be the most effective and efficient method for controlling established weeds.

Montana's County noxious weed list identifies noxious weeds pursuant to the County Weed Control Act.

Common Name	State Weed Priority ²
Hoary Cress (Whitetop)	2b
Diffuse Knapweed	2b
Spotted Knapweed	2b
Russian Knapweed	2b
Oxeye-Daisy	2b
Canada Thistle	2b
Field Bindweed	2b
Houndstongue	2b
Leafy Spurge	2b
Dyer's Woad	1b
Perennial Pepperweed	2a
Dalmatian Toadflax	2b
Yellow Toadflax	2b
Tall Buttercup	2a
Common Tansy	2b
Purple Loosestrife	1b
St. John's Wort	2b
Tamarisk	2b
Orange Hawkweed	2a
Yellow Starthistle	1a
Tansy Ragwort	2a
Rush Skeleton Weed	1b
Meadow Hawkweed	2a
Eurasian Watermilfoil	1b
Yellow Iris	2a
Sulfur Cinquefoil	2b
¹ Definition of State Priorities:	
Priority 1a	These weeds are not present in Montana. Management criteria will require eradication if detected; education; and prevention.

Priority 1b	Limited presence in Montana. Management criteria would require eradication or containment where present, and prevention and education elsewhere.
Priority 2a	Common in isolated areas of Montana. Management criteria would require containment and suppression where common; and eradication, prevention, and education where less abundant. Management shall be prioritized by local weed districts.
Priority 2b	Abundant in Montana and widespread in many counties. Management criteria would require containment and suppression where abundant and widespread; and eradication, prevention, and education where less abundant. Management shall be prioritized by local weed districts.
Priority 3	Regulated Plants: (NOT MONTANA LISTED NOXIOUS WEEDS) These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education, and prevention to minimize the spread of the regulated plant.

Source: Montana Department of Agriculture 2010; Accessed on Park County Weed Board website.

3.9.2.4 *Wetlands and Waters of the US*

The topography of the St. Julian Claim Block is characterized by ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, landslides and rockslides, and cirque headwalls and basins. There are minimal wetlands in the St. Julian Claim Block consisting of the seeps, springs, streams, and flowing boreholes described in the hydrology section. Streams with an incised channel are Waters of the US. Other large ephemeral tributary drainages in the St. Julian Claim Block would be classified as Non-wetland Waters of the US.

3.9.3 DIRECT AND INDIRECT IMPACTS

3.9.3.1 *No Action Alternative*

SOILS

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Mechanized exploration activities, road maintenance, and grading would not occur; therefore there would be no new soil disturbance. However, previously disturbed soils currently present on the St. Julian Claim Block would remain disturbed. The roads, mine dumps, and historic drill pads on the St. Julian Claim Block would continue to exist. Erosion on the steep road grades would continue. Vegetation would continue to slowly invade the existing road network which would continue to be accessed by recreational ATV and other users. Soil erosion would continue to be limited by the large rocks and high coarse fragment content of the soils. About 2.2 miles of sediment producing road network would continue to exist within the St. Julian Claim Block.

VEGETATION

Areas that are disturbed from historic mineral development and land access will continue to be disturbed. Roads created in the past would continue to exist in a barren or partially vegetated state. Whitebark pine would continue to be impacted by pine beetle and/or white pine blister rust with resultant loss of population of this USFS sensitive species. Any vegetation that has colonized the existing road network would not be disturbed.

NOXIOUS WEEDS

No activities that would initiate a weed management plan with Park County would take place.

Any prohibited noxious weeds that exist on the St. Julian Claim Block would continue without control under conditions of a mineral exploration license. To the extent that weeds are present on the St. Julian Claim Block they would persist.

WETLANDS

If Lucky Minerals did not obtain an exploration license, there would be minimal impacts to wetlands similar to what is presently occurring in area.

RECLAMATION

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Mechanized exploration activities, road maintenance, and grading would not occur; therefore the access roads and existing roads on the patented claim block would not be disturbed. The road network within the St. Julian Claim Block would remain in a partially vegetated and open condition. Natural seedfall and invasion by surrounding forest species would continue to provide seed stock for revegetation for the historic road disturbance. The partially vegetated condition of the road network within the St. Julian Claim Block would remain disturbed as it has for the past 100 years.

3.9.3.2 *Proposed Action*

SOILS

The Proposed Action would result in the construction of up to 23 exploration drilling pads on the existing disturbed road prism. Each drill pad would measure approximately 20 ft x 50 feet. Fresh road grading would result in rocks being cleared from the road network. The existing access road would be used to access the drill pad locations. Soils and organic layers would be salvaged to the extent that they exist on the disturbed soil surface. Sumps could likely be excavated larger than the stated 2 ft x 3 ft x 3 ft due to the large stones and unstable excavation walls typical of coarse rocky soils. Disturbed soils would be reclaimed by backfilling disturbances and replacing any salvaged soil, replacing any salvaged organic matter, and placing any cleared vegetation on the disturbed area. Reclamation measures would be concurrent with operations and/or begin immediately upon completion of operations at each site.

Soils would be salvaged from sump excavations and drilling areas and at the end of the exploration program disturbances would be reclaimed utilizing the salvaged soil. If all surface areas on the drill pads, materials laydown area, and the St. Julian Claim Block road network were graded, approximately 4.8 acres of soil would be disturbed. However, as described in the Proposed Action, Lucky Minerals would only grade roads as necessary for access, limiting the disturbance area. Reclamation would minimize impacts to soils, including loss of productivity, erosion, or compaction.

VEGETATION

The soil disturbance under the Proposed Action would be limited to the surface of the existing road network and to the area near the old millsite where a laydown area would be located. Consequently, limited mature vegetation would be disturbed by the Proposed Action. Clearing and grading the road network in localized areas may disturb pioneer species that have attempted to establish in the road surface. The impact to vegetation from road clearing and drill pad construction would be limited as the road is kept open by recurring traffic from ATV and off-road vehicle traffic. About 2.2 miles of sediment producing road network would continue to exist within the St. Julian Claim Block. Any vegetation that has colonized the existing road network would be removed by road grading activity. Other than localized grading of existing road surfaces, no activities are proposed that would disturb vegetation. Whitebark pine would continue to be impacted by pine beetle and/or white pine blister rust with resultant loss of population of this USFS sensitive species.

Special Status Plants

Beautiful Fleabane: The St. Julian Claim Block is composed of north-facing mountain slopes but does not include subalpine meadows. Consequently, suitable habitat for beautiful fleabane may not be present within the St. Julian Claim Block. The project approach would be to occupy previously constructed drill pads on existing road networks. No new areas are proposed for disturbance so the project would have no effect on any populations of beautiful fleabane.

Wedge-leaf Saltbush: The St. Julian Claim Block is composed of north-facing mountain slopes but riparian areas with alkaline soils do not exist in the St. Julian Claim Block. Consequently, suitable habitat for wedge-leaf saltbush is not present within the St. Julian Claim Block. The project approach would be to occupy previously constructed drill pads on existing road networks. No new areas are proposed for disturbance so the Project would have no effect on populations of wedge-leaf saltbush.

Whitebark Pine: The drilling project proposes to access the site from an existing road network and occupy existing drill pads. The project proposal would not require additional vegetation clearing and soil disturbance. If the project is limited to current disturbed areas then the project is not likely to impact stands of whitebark pine.

Many-ribbed Sedge: The St. Julian Claim Block is not subalpine meadow and the Proposed Action is not likely to impact this species.

NOXIOUS WEEDS

Lucky Minerals' equipment would be washed prior to being used in project implementation. This includes, but is not limited to drill rigs, vehicles used for transportation within the St. Julian Claim Block, and ATVs. Lucky Minerals would notify Park County of type and location of noxious weeds on private land if it is required by the weed management program. Additionally, Lucky Minerals would be bonded for potential treatment of weeds in the event that noxious weeds are noted within the St. Julian Claim Block the following growing season. Lucky Minerals would commit to annual field inspections of drill sites and laydown areas

which are used and occupied by Lucky Minerals under this Plan of Operations to monitor for noxious weed infestations for a 3-year period. In the event that noxious weeds are noted at a site, appropriate weed treatment would be coordinated with Park County and the CGNF.

The Proposed Action would include implementation of actions to prevent new sources of noxious weeds being introduced to the St. Julian Claim Block. Weed control activities would also include preventative measures such as washing and inspecting all equipment prior to using that equipment to access the drilling. Any existing weeds would be required to be controlled under the terms of the Park County weed management plan and the permit conditions of the minerals exploration license. Bond would be held to ensure weed control was satisfactory to the County and State. Impacts from noxious weeds would be minimal.

WETLANDS

There are minimal wetlands in the St. Julian Claim Block consisting of the seeps, springs, streams, and flowing boreholes. Potential sediment transport within the incised channels should be addressed with BMPs developed in a 318 Authorization. Lucky Minerals may also need to obtain other appropriate permits to address unexpected disturbance to streams and wetlands. Any improvements or mitigation measures that are developed would likely lessen the impacts.

RECLAMATION

Reclamation of soil and vegetation disturbances in subalpine environment is difficult. Limiting conditions including coarse soil texture, low effective water holding capacity, low cation exchange capacity due to limited organic matter content, short growing season, acidic soils, and periods of environmental stress all contribute to reclamation difficulties. Reclamation actions would be taken that would attempt to mitigate some of these limiting features of the site.

Reclamation measures would be concurrent with operations and/or begin immediately upon completion of operations at each site. Disturbed areas would be kept to the minimum size necessary to accommodate the exploration operation (ARM 17.24.105). If ground-leveling activities are needed or sumps are dug, all suitable on-site organic litter layer and soil material would be salvaged prior to any other site disturbance (such as drilling or leveling), and either stockpiled or used for immediate reclamation (ARM 17.24.105). Drill pad sumps would be backfilled with materials removed from the sumps. Felled or cut vegetative material (trees, logs, brush, etc.) would be stockpiled in amounts adequate for reclamation. Replacing soil materials and salvaged organic litter and placing felled vegetation over the disturbed areas would provide a substrate for invasion of forest species onto the drill pad disturbances. Revegetation potential of reclaimed drill pads would be enhanced by steps taken to salvage and replace soil.

While completion of final reclamation as soon as possible is preferable, this may not always be possible due to seasonal weather events. In such an event, interim reclamation needs would be completed for the purposes of erosion control on all exploration disturbance areas (ARM 17.24.105). This may include draining sumps, erosion control measures such as constructing or installing water bars, scarifying compacted surfaces, placement of woody debris, interim revegetation, and erosion control practices.

Exploration drill holes would be plugged at the surface five to 10 feet with cement, except as provided in ARM 17.24.106. Drill hole collar pipe or casing would be removed or cut off below ground level. Upon completion, there would be an effort to pump the remaining drill cuttings down the drill hole before plugging the hole with bentonite and cement. It may not always be possible to completely pump the drill cuttings into the hole, due to rubble or blockages from the sides of the hole. In the event that all of the cuttings cannot be pumped back down the drill hole, there are several options available with respect to the disposal of the cuttings. These options include: burying them in the sump, placing them in underground adits within the St. Julian Claim Block, or taking them to an approved waste disposal site (Dykes, 2016b). Cuttings would be disposed of in compliance with applicable State regulations (ARM 17.24.107) and in consultation with DEQ.

Excavations would be backfilled with excavated spoil material and topped with salvaged organic material and soil. Compacted surfaces created by exploration activities would be loosened and disturbed areas would be contoured to the original condition to the extent possible by reapplying salvaged material over disturbance areas. This includes reapplication of mineral soil, topped with organic soil material, woody debris, and slash. Upon completion of reclamation, any excess salvaged material (rock, soils, slash, woody debris, etc.) would be scattered in the vicinity. Excess rock or soils would not be placed or scattered in streams or wetlands.

Lucky Minerals would assume responsibility for any necessary reclamation resulting from activities of contracted and or subcontracted employees. Reclamation requirements, including soil salvage, implementation of best management practices for control erosion, and prescriptive soil treatments, would minimize any potential short and long term impacts from the Proposed Action.

3.9.3.3 Agency-Modified Alternative

The Agency-Modified Alternative would be the same as the Proposed Action with the addition of three mitigation measures.

Lucky Minerals would commit to immediately seed after any road maintenance disturbance to limit invasion of noxious weeds by eliminating the competitive advantage that disturbed unvegetated soil offers to the weed community. Seeding with a mix of alpine timothy, alpine bluegrass, and redtop would promote vegetation establishment to out-compete any weeds that might be introduced to the site. This mitigation would minimize any impacts caused by noxious weeds.

Lucky Minerals would also identify and map potential areas of disturbance along the access road and existing road network within the St. Julian Claim Block to limit road grading as much as possible. This mitigation would lessen impacts to soil disturbance and vegetation.

In addition to obtaining a permit from the Park County Conservation District for the existing creek crossings, Lucky Minerals would also survey for existing springs, seeps, and other sources of wetlands to avoid any identified potential direct and indirect impacts to wetlands during the drilling program.

3.9.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. As a result of the Proposed Action, road improvements could increase ease of access to the area. This may have an indirect impact to successful reclamation on the St. Julian Claim Block if trespassing occurred.

3.10 TRANSPORTATION

3.10.1 ANALYSIS AREA AND METHODS

The analysis area for transportation includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area (**Figure 3.19**). Qualitative analysis was made by reviewing the following road information sources:

- Gallatin National Forest Plan and associated Vehicle Use Map to determine road status in the CGNF.
- Park County Active Transportation Plan to determine plan status for Emigrant Creek Road.
- US Government Land Office (GLO) records for mineral plats in the Emigrant Creek area to determine road status across these mineral plats at the time they were filed with the Department of Interior.
- USGS quadrangle maps for 1955 and 1989 to determine road networks shown on these maps. Recent aerial imagery and measurement tools were utilized to measure the length of the currently disturbed roads on the St. Julian Claim Block.
- Conversation with Park County Road Supervisor for information about traffic counts and maintenance schedule for Emigrant Creek Road (Ed Hillman, 2016).

3.10.2 AFFECTED ENVIRONMENT

Access to the St. Julian Claim Block would be from public roads. Three county roads could potentially provide access to the mouth of Emigrant Creek near Old Chico. Chico Road, Old Cemetery Road, and Conlin Road (via Six Mile Creek Road) all provide connections to the Emigrant Creek Road from East River Road and US Highway 89. In the Proposed Action access to the Emigrant Creek Road would be from the town of Emigrant by way of the Chico Road to Old Chico (**See Figure 3.19**). From Old Chico, Emigrant Creek Road transitions to CGNF Road 3272 near the Emigrant Creek crossing. Then the access route branches off onto CGNF Road 3272B, which provides access to the St. Julian Claim Block located on the East Fork of Emigrant Creek.

US Highway 89 is a paved federal highway that parallels the west side of the Yellowstone River between Livingston and Gardner. East River Road (State Highway 540) parallels the east side of the Yellowstone River from Carter Bridge to Point of Rocks. Chico Road (County Road 205), Old Cemetery Road (County Road 288) and Conlin Road (County Road 211) are improved

roads that provide access from East River Road to Emigrant Creek Road (County Road 211E). Emigrant Creek Road transitions into CGNF Road 3272.

The Gallatin National Forest Plan for facilities and roads was modified by Plan Amendment 45, CGNF Travel Management Plan (Record of Decision 12/10/2006). The Travel Management Plan provides travel area goals, objectives, standards and guidelines. Objectives for the Mill Creek Travel Planning Area include providing “a road and trail system that accommodates traffic consistent with protecting soil and watershed condition.” A sub-objective is to “repair damage to road and trail system and schedule maintenance to attain conditions that are non-erosive.” The Motor Vehicle Use Map, CGNF (USDA-FS 2013) specifies a seasonal road closure for Emigrant Creek Road beginning at mile 4.25 to mile 7.46. This closure is in effect from December 1 to June 15. The entire length of the East Fork of Emigrant Creek Road (accessed by CGNF Road 3272B) is included in this seasonal closure. The ROD for the Forest Travel Management Plan states that the seasonal road closure is to “protect the integrity of the backcountry ski opportunities this area is targeted to provide.”

Park County approved the Park County Active Transportation Plan February 26, 2016. This planning document identifies community priorities and opportunities for outdoor recreation and active/alternative transportation. The map that accompanies the Plan identifies Emigrant Creek Road as a component of the Active Transportation Plan (Park County, 2016). A disclaimer on the map states that the information is not to be used for legal purposes. Park County identified Emigrant Creek Road as a County Class 5 Road on the lower end (Hillman, 2016).

Measurements of the satellite image road network estimate 2.2 miles of roads and switchbacks currently existing on the 130.9 acres of patented land at the St. Julian Claim Block. The satellite image in **Figure 3.18** shows the majority of this disturbance occurring on the Mill, St. Julian and Bullion lode claims.

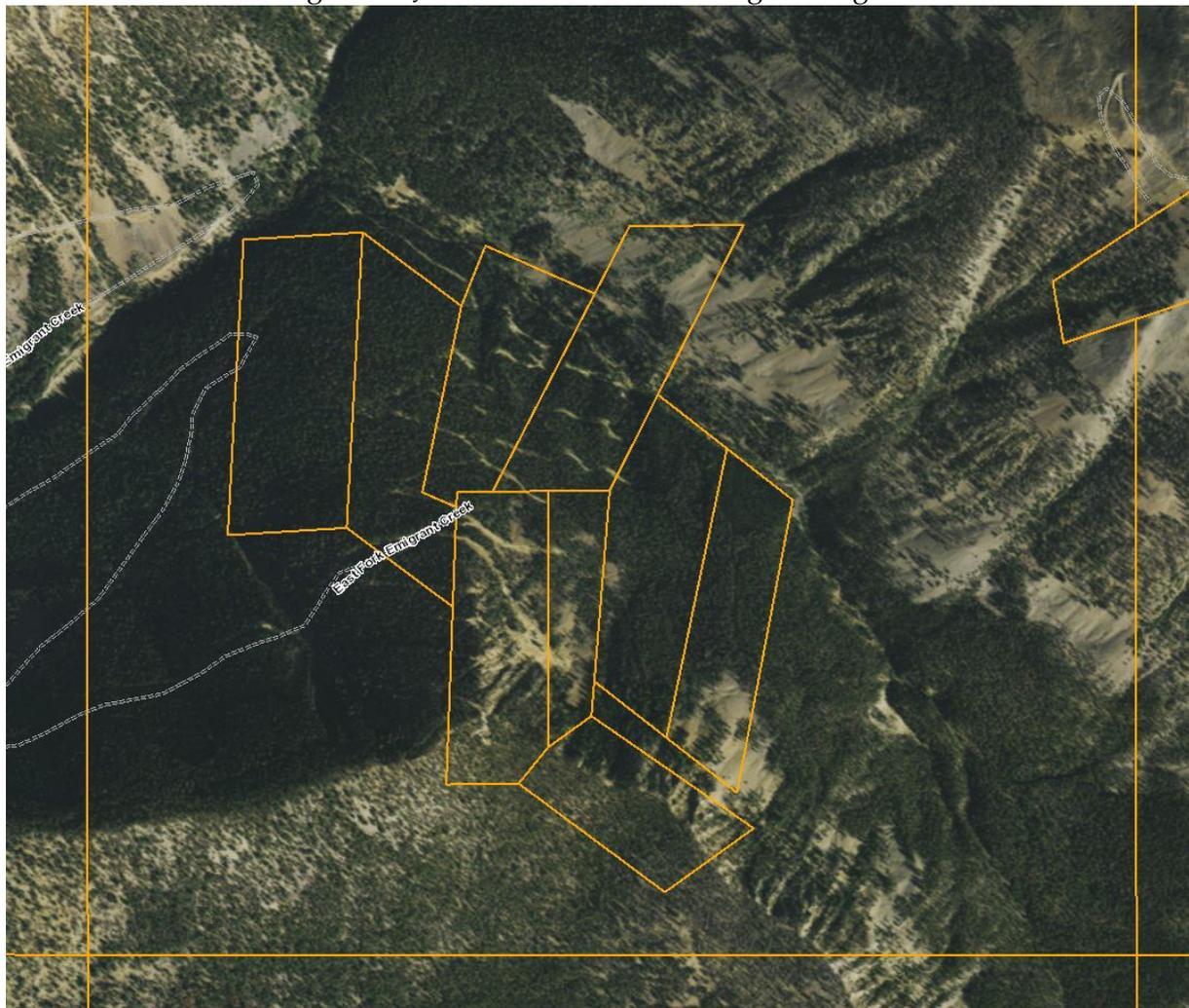
3.10.3 DIRECT AND INDIRECT IMPACTS

3.10.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Mechanized exploration activities, road maintenance, and grading would not occur; therefore the access roads and existing roads on the patented claim block would not be disturbed.

No road improvements would be constructed to improve access to the proposed drill sites, but the historic road network that extends up Emigrant Creek to the St. Julian Claim Block would continue to provide access to the private lands located at the end of the road. Emigrant Creek Road would continue to provide access for recreationists in accordance with the CGNF Travel Plan to private lands and CGNF lands in the Emigrant Creek drainage, and to the ATV/motorcycle trail that connects to Arrastra Gulch to the east. ATV and off-road traffic would continue to travel Emigrant Creek Road past private lands that the road passes through.

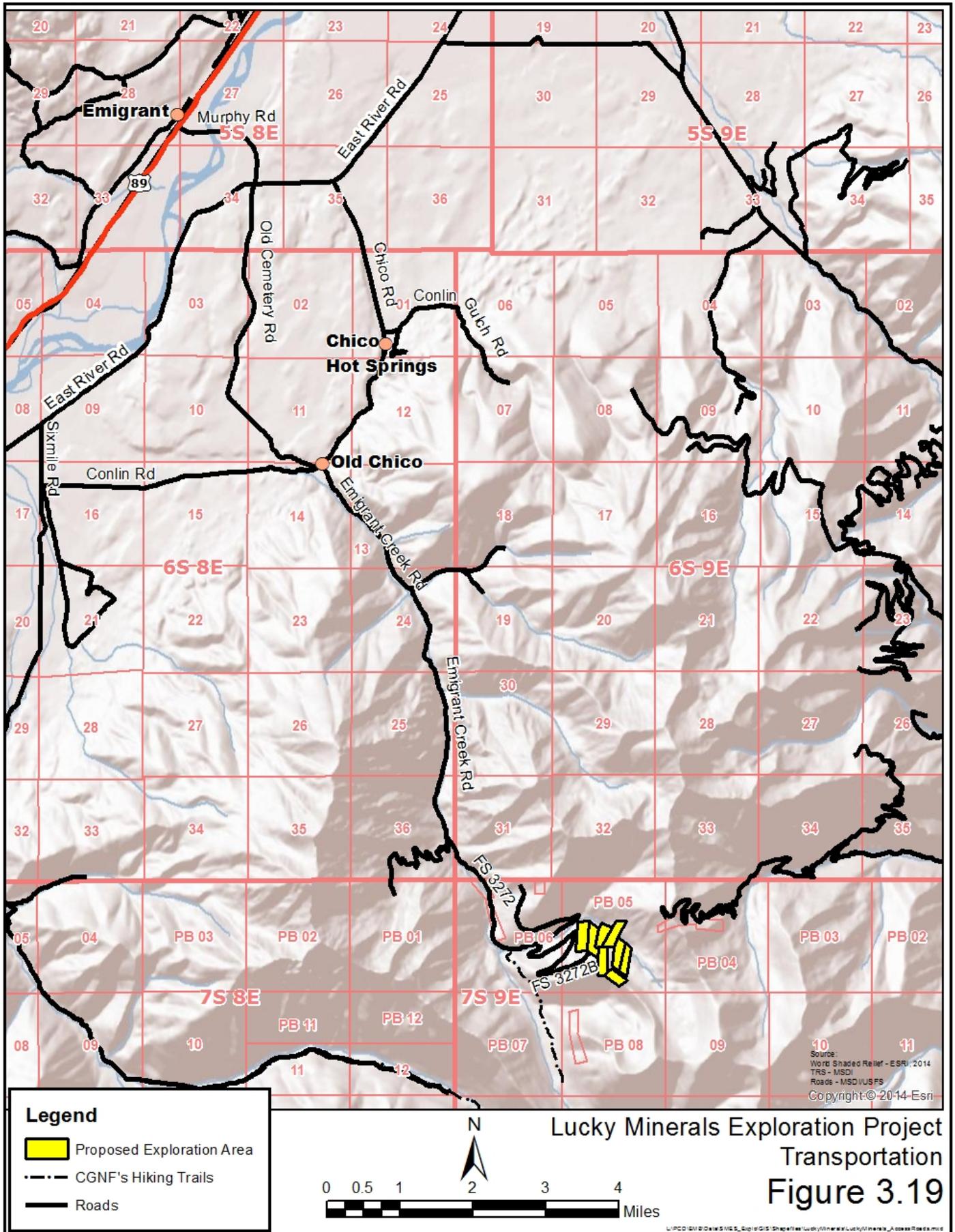
Figure 3.18
Satellite image of St. Julian Claim Block showing existing road network.



3.10.3.2 *Proposed Action*

Road improvements to the proposed drill sites would improve access on the existing roads that extends up Emigrant Creek and on the historic road network within the St. Julian Claim Block. The private lands located at the end of the road would still be accessible. Emigrant Creek Road would continue to provide access for recreationists in accordance with the Gallatin National Forest Travel Plan to private lands and CGNF lands in the Emigrant Creek drainage, and to the ATV/motorcycle trail that connects to Arrastra Gulch to the east. ATV and off-road traffic would continue to travel Emigrant Creek Road past private lands that the road passes through.

The total estimated ground disturbance would be approximately 4.8 acres for the drilling activities for both drilling seasons. About 3.48 acres of disturbance may occur for the existing road upgrades on the St. Julian Claim Block. Impacts from road disturbance are also discussed in other resource sections, including; Air Quality, Land Use, Noise, and Recreation, Soils, Vegetation, and Reclamation, Water and Geothermal, Geology and Minerals, and Wildlife.



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Once drilling equipment is onsite, Lucky Minerals would add three vehicle roundtrips a day to the existing traffic on the Emigrant Creek Road and 6 additional creek crossings a day. Lucky Minerals may have to enter into a road access agreement with Park County and/or the CGNF to address use and maintenance of the access roads. Additionally, Lucky Minerals may need to obtain appropriate stream permits for the potential streambed disturbance and short-term turbidity associated with increased traffic.

3.10.3.3 *Agency-Modified Alternative*

The Agency-Modified Alternative would be similar to the Proposed Action, with the inclusion of four additional mitigation measures.

Lucky Minerals would access the St. Julian Claim Block for mobilization and demobilization of exploration equipment using Murphy Road, Old Cemetery Road, Emigrant Creek Road, and Forest Service Road 3272/3272B. Whenever possible, Lucky Minerals would also use this access route for traffic associated with shift changes, however, other routes may be used for incidental travel, i.e., emergencies and personal travel. (See Figure 3.19). This mitigated route would minimize traffic impacts on Chico Road and Chico Hot Springs.

Travel speeds on the all access roads and within the existing road network of the St. Julian Claim Block would be limited to 25 mph to mitigate the risk of collisions with wildlife and reduce fugitive dust.

In addition to posting signs, Lucky Minerals would monitor access and, if needed, install a gate or other type of road barrier at the boundary of the St. Julian Claim Block to restrict public access to the privately-owned roads on the project area. This will mitigate potential safety issues with the public accessing the St. Julian Claim Block.

Road Maintenance would be the same as the Proposed Action; however, Lucky Minerals would provide DEQ with a map identifying potential areas of disturbance along the access road and existing road network within the St. Julian Claim Block proposed in the Agency-Modified Alternative. By identifying the areas that need improvement, the amount of unnecessary disturbance would decrease.

3.10.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. As a result of the Proposed Action, road improvements could increase ease of access to the area. This may have an indirect impact to other resources in the cumulative impact area, including, cultural, reclamation, recreation, land use, noise, and wildlife.

3.11 AIR QUALITY

3.11.1 ANALYSIS AREA AND METHODS

The air quality of a region is primarily controlled by the type, magnitude and distribution of pollutants and may be affected by regional climate. Transport of pollutants from their source areas is affected by topography and meteorology. The analysis area for air quality resources includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads proposed for access to the exploration area. Analysis methods included consultation with DEQ's Air Quality Bureau (AQB) to determine the air quality permit requirements of the proposed action and a qualitative analysis of the emission sources, including stationary equipment, self-propelled vehicles, and warming fires, described in the proposed action. The existing air quality and climatic conditions in the vicinity of the Proposed Action are detailed below. It consists of a discussion of conditions which may affect regional air quality and the existing air quality in the affected area. Site specific air quality monitoring was not conducted as part of this evaluation.

3.11.2 AFFECTED ENVIRONMENT

3.11.2.1 *Topography*

The St. Julian Claim Block is characterized as high relief with convex glaciated mountain ridges and narrow valleys along the stream corridor. The St. Julian Claim Block is mountainous and heavily forested upper sub-alpine forest. Elevation ranges from approximately 8,000 ft near creek level to approximately 9,000 ft at the top of the ridge (USGS 1955). Landforms in the survey area have been influenced by glacial erosion from the steep slopes on the mountain side and deposition of moraines reworked into alluvial terraces along the stream in the valley bottom. Surrounding the property are treeless, rocky alpine ridgelines, and cirques with short, broad valleys.

3.11.2.2 *Climate and Meteorology*

The climate of the area typically consists of warm summers and cold winters, with an average annual temperature of 35 °F (1.6 °C). The area receives 25 to 35 inches of precipitation annually, mainly in the form of snow (PRISM Climate Group). Snow accumulation is high in basins, but ridgetops have little snow accumulation because of high winds and sublimation.

3.11.2.3 *Existing Air Quality*

Existing air quality is good due to lack of emission sources in the area. Additionally, existing air quality has been unimpaired from previous exploration activities in the area. The St. Julian Claim Block is not within a Class I Airshed, nor in an area designated by the United States Environmental Protection Agency (EPA) as not attaining an ambient air quality standard.

3.11.3 DIRECT AND INDIRECT IMPACTS

3.11.3.1 *No Action*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Mechanized exploration activities, road maintenance, and grading would not occur. There would be no additional impacts to air quality in the study area. Air Quality would remain similar to the existing condition.

3.11.3.2 *Proposed Action*

In accordance with ARM 17.8.743, the Air Quality Bureau (AQB) at DEQ has determined that the Lucky Minerals project does not require a Montana Air Quality Permit for the proposed action.

(1) *A Montana air quality permit is not required under ARM 17.8.743 for the following:*

(b) mobile emitting units, including motor vehicles, trains, aircraft, and other such self-propelled vehicles; and

(j) drilling rig stationary engines and turbines that do not have the potential to emit more than 100 tons per year of any pollutant regulated under this chapter and that do not operate in any single location for more than 12 months.

The proposed equipment is classified as mobile emitting units which are not regulated by AQB. Some mobile emitting units, such as the 28 HP diesel water pump, could become regulated by AQB as stationary sources of emissions if they operate in the same location for more than 12 months. However, the water pump diesel engine would not require a Montana Air Quality Permit because it does not have the potential to emit more than 25 tons of an airborne pollutant on an annual basis (ARM 17.8.743). The limited emissions from the two drill rigs, crew trucks, and light plant generators, and water pump would be short-term and temporary.

Fugitive dust may increase on the unpaved section of Chico road for short durations in drier conditions, but would be infrequent (**See Figure 3.19**). After initial mobilization, daily traffic averages would increase by approximately three, two-way trips per day. This increase in fugitive dust from traffic would be minimal and temporary. The proposed action includes dust control measures that would be applied as needed throughout the duration of the exploration project. Additional dust control measures would be addressed by a Park County road maintenance agreement.

Due to the rocky terrain of the access road from Old Chico and the St. Julian Claim Block, vehicle speeds would decrease. This would further minimize the potential impacts of fugitive dust above Old Chico. The proposed dust control measures would be used as needed.

The proposed reclamation of the drill areas and access roads would further reduce potential sources of dust.

3.11.3.3 *Agency-Modified Alternative*

In the Agency-Modified Alternative, Lucky Minerals would access the St. Julian Claim Block for mobilization and demobilization of exploration equipment using Murphy Road, Old Cemetery Road, Emigrant Creek Road, and Forest Service Road 3272/3272B, therefore avoiding Chico Road and Chico Hot Springs. Further, Lucky Minerals would also use this access route for traffic associated with shift changes (See Figure 3.19). The use of this route would reduce or eliminate fugitive dust on Chico Road. However, because there are longer stretches of unpaved road on Old Cemetery Road, there may be a slight increase in the volume of fugitive dust. The proposed dust control measures would minimize potential impacts.

Additionally, Travel speeds on the all access roads and within the existing road network of the St. Julian Claim Block would be limited to 25 mph to mitigate the potential for wildlife collisions and reduce impacts of fugitive dust.

3.11.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. No indirect impacts to air quality resources are predicted.

3.12 VISUALS

3.12.1 ANALYSIS AREA AND METHODS

The analysis area for visual resources for the Proposed Action includes vantage points in the East Fork of Emigrant Creek drainage and other areas in Emigrant Gulch from which the St. Julian Claim Block may be seen. Analysis methods include a review of the Visual Quality Objective (VQO) developed by the Custer Gallatin National Forest applicable to the Emigrant Gulch area, Park County's zoning on private land (Park County. 2006), field observations including reference images and videos obtained from an unmanned aerial vehicle, and three-dimensional Google Earth imagery.

3.12.2 AFFECTED ENVIRONMENT

The St. Julian Claim Block is located on a northeasterly facing ridge in the East Fork of Emigrant Creek drainage. The lower reach of the St. Julian Claim Block is covered with a mature forest canopy of second-growth trees (predominately Douglas fir, Lodge Pole pine and Subalpine fir) up to 100 years old. In the upper reach, the forest canopy is interspersed with naturally occurring talus slopes.

The visual impact from previous mining and mineral exploration activity is readily apparent in the Emigrant Creek Gulch area. Access to the upper elevation portions of the patented mining claims is gained by a historic mine access road, with several spurs, that switchback across the patented mining claims. While the maturing forest growth has limited its visual impact, the existing access road can be readily seen from views across the East Fork of Emigrant Creek valley as it crosses both the lower and upper reaches of the St. Julian Claim Block.

The Custer Gallatin National Forest has developed Visual Quality Objectives (VQO) for the Emigrant Gulch area. VQOs are the desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. They refer to the degree of acceptable alterations of the characteristic landscape. The VQO for the area encompassing the St. Julian Claim Block is "Modification." Under this designation, human activity may dominate the characteristic landscape but must, at the same time; utilize naturally established form, line, color and texture. It should appear as a natural occurrence when viewed in middle-ground or background (Grosvenor, 2016). Park County does not have any visual zoning requirements on private land in the Lucky Minerals analysis area (Park County Growth Policy, 2006).

3.12.3 DIRECT AND INDIRECT IMPACTS

3.12.3.1 *No Action Alternative*

Under the No Action Alternative, Lucky Minerals would not obtain an exploration license and therefore, could not conduct the exploration activities described in its exploration license application. However, the company would still be allowed to stake claims, map the local geology, and collect surface samples. Mechanized exploration activities, road maintenance, and grading would not occur. The current condition of the visual resources would remain as they are. The historic mine access road that switchbacks across the St. Julian Claim Block would continue to be seen from across the East Fork of Emigrant Creek valley, a limited segment of Emigrant Creek, and partially seen from Emigrant Peak. The visual impacts that would result from Lucky's active drilling under the Proposed Action would not occur.

3.12.3.2 *Proposed Action*

Under the Proposed Action, the historic access road that switchbacks across the St. Julian Claim Block would continue to be seen from immediate area vantage points. The visual impact of the historic access road has been lessened over the years by a maturing forest. No mature vegetation would be disturbed by the Proposed Action, although pioneer species that have attempted to establish on the road surface may be disturbed by clearing and grading the road network. A noticeable increase in the visual impact of the historic access road is not expected.

The St. Julian Claim Block is not visible from any vantage point on U.S. Highway 89 or in the Arrastra Creek drainage because of distance and intervening geographic features. The view of the St. Julian Claim Block is also limited to a short segment of Emigrant Creek from which a viewer can look up the East Fork of Emigrant Creek drainage. Finally, the western portion of the St. Julian Claim Block can be seen from Emigrant Peak while the remainder is hidden as it wraps around a ridge.

Visual impacts will be increased during active drilling by the presence of two LF-70 track mounted diamond drilling machines and other equipment on the historic access road. The drill rigs and other equipment will appear relatively small when viewed in the context of the mountain landscape. Additionally, the drill rigs and other equipment will be shorter in height than many of the trees growing on the mountainside. Thus, the drill rigs will be partially shielded when stationed on areas of the St. Julian Claim Block that has sufficiently tall vegetation from the viewshed of observers in the immediate vicinity of the St. Julian Claim

Block. The visual impact from the presence of the drill rigs and other equipment on the historic access road will be greater at the upper reaches of the St. Julian Claim Block where the forest cover is less dense.

Visual impacts will also occur at night, when drilling would require the use of small lights similar to the ones used by highway crews. The areas illuminated by the lights will appear relatively small when viewed in the context of the mountain landscape and will be partially shielded from view by the forest cover.

The visual impacts from Lucky Mineral's exploration activity would be short term. The visual impacts from the presence of the drill rigs and other equipment would occur during the duration of the two-year drilling program. The visual impacts from the use of lights at night would occur during the periods of active drilling during the two-year period. After completion of the two-year exploration project, there is not expected to be any residual visual impacts. Because the proposed exploration activity uses the historic mine road both for access and location of the drill pads, there is expected to be minimal removal of forest vegetation. The St. Julian Claim Block should appear from immediate area vantage points much the same as it did prior to the exploration project.

3.12.3.3 *Agency-Modified Alternative*

The Agency-Modified Alternative would have similar visual impacts as the Proposed Action except Lucky Minerals is to consider what lighting is necessary and to reduce any unnecessary lighting both temporally and spatially. Nighttime lighting is to be shielded and directed to where it is needed to avoid light spillage, and only be bright enough to maintain crew safety. Thus, the visual impacts from night drilling will be less under the Agency-Modified Alternative than under the Proposed Action.

3.12.3.4 *Indirect Impacts*

Based on the MEPA model rules definition, secondary impacts are further impacts to the human environment that may be stimulated or induced by, or otherwise result from a direct impact of the action. No indirect impacts to air quality resources are predicted.

4 CUMULATIVE IMPACTS

4.1 CUMULATIVE IMPACTS

Cumulative impacts are the collective impacts on the human environment within the borders of Montana of the Proposed Action when considered in conjunction with other past and present actions related to the Proposed Action by location and generic type. Related future actions must also be considered when these actions are under concurrent consideration by any state agency through preimpact statement studies, separate impact statement evaluation, or permit processing procedures.

Three other actions in Park County are under concurrent consideration by DEQ through either separate impact statement evaluations or permit processing procedures. DEQ is conducting an environmental review for a proposed gravel pit (Riverside Gravel Pit) which, if approved, would be located 5 miles southwest of Emigrant just west of Highway 89. DEQ is also conducting an environmental review for a proposed tire disposal facility (Adkins Tire Landfill) which, if approved, would be located East of Pray off of County Road 540 (East River Road). Finally, DEQ is reviewing an application for another mineral exploration project (Crevice Exploration Project) which, if approved, would be located 7 miles east of Gardiner.

The proposed Riverside Gravel Pit, Adkins Tire Landfill and Crevice Exploration Project would be located approximately 11.5, 14 and 20 air miles from Lucky's proposed mineral exploration project at the St. Julian Claim Block, respectively. Based on the intervening distance, Lucky's proposed mineral exploration at the St. Julian Claim Block is not expected to result in any cumulative impacts when considered in conjunction with the other three projects located in Park County and currently under DEQ's review. Moreover, while the Riverside Gravel Pit and Adkins Tire Landfill would have a long-term presence in Park County, Lucky Mineral's exploration activity at the St. Julian Claim Block would be short-term, lasting only two years. Indeed, it is not known at this time whether any of Lucky Mineral's exploration activity would be conducted at the same time as the operation of the gravel pit, tire landfill or Crevice's mineral exploration activity as that depends on the timing of DEQ's action on the proposed projects.

4.1.1 GEOLOGY AND MINERALS

The Cumulative Impacts Study Area for geology and mineral resources includes the Emigrant Mining District, specifically in the area of the St. Julian Claim Block and the access roads depicted in **Figure 3.1 and 3.19**, and incorporates past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Past impacts associated with historic mining and exploration drilling in the Emigrant Mining District include road disturbance and historic mine waste. The road grading that is part of the Proposed Action and Agency-Modified Alternative would not increase the extent of the road disturbance into previously undisturbed areas and would be limited to localized areas. Any historical mine waste that occurs on the surface, which may have the potential to contaminate

soil or water resources, will continue to exist in its current state. As part of the Proposed Action and Agency-Modified Alternative, all of the core samples that are collected would be removed from the site for further analysis, and any of the geologic waste material from drilling (i.e. cuttings) would be pumped back into the drill holes, or buried and compacted in the sumps as part of reclamation. These operational practices would minimize any impacts to geology and mineral resources and would not lead to a significant cumulative impact.

4.1.2 WILDLIFE

The cumulative impacts area includes the analysis area, as well as a broader project region and is defined as the general geographic area up to a 4-mile radius of the St. Julian Claim Block and adjacent private land. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Past impacts associated with historical mining and exploration drilling in the Emigrant Mining District include road disturbance and historic mine waste and are not expected to result in a cumulative impact on wildlife from the Proposed Action.

Present actions that may have a cumulative impact to wildlife include recreation, transportation, and noise. Stress to wildlife as a result of the Proposed Action added to recreation, traffic, and noise would be minimal. After initial mobilization to the St. Julian Claim Block, the Proposed Action and Agency-Modified Alternative propose adding three vehicles per day to the access roads. The Agency-Modified Alternative added additional mitigation measures to reduce any potential cumulative impacts to wildlife. No long-term residual impacts to wildlife would exist from the proposed action because impacts are expected to be short-term and minimal. At the completion of the project, the affected environment would return to its previous state.

4.1.3 FISH AND AQUATIC INSECTS

The cumulative impacts area includes Emigrant Creek and the East Fork of Emigrant Creek (East Fork). The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

No cumulative impacts have been identified for Fish and Aquatic Resources. The absence of a fish population in both streams and presence of the physical fish barrier near the Great Western Mine claim limit any additive effect from the Proposed Action or Agency-Modified Alternative.

4.1.4 CULTURAL AND HISTORIC RESOURCES

The cumulative impacts area includes the APE identified in the analysis area. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions

under consideration. Currently there are no permitted resource actions or management projects in the project area.

Historic mining features from past mining activities were identified in the APE. There are no other activities in the APE that would have an additive effect on cumulative impacts to Cultural Resources. No significant cumulative impacts have been identified.

4.1.5 WATER AND GEOTHERMAL

The cumulative impacts area includes the hydrologic unit identified in the analysis area. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Minimal, short-term cumulative impacts to water quality from turbidity could result from additional vehicles crossing the two streams along the access roads. However, the additional six crossings per day added to the current traffic from landowners and recreationists would not have a long-term cumulative impact as the stream would return to its previous state at the completion of the project.

In the Proposed Action, any pumping of water from the stream for drilling would be sporadic. The stream flow rates measured under baseflow condition in 2015 show that the combined flow from the East Fork drainage is approximately 20% of the flow in Emigrant Creek near Old Chico. This indicates that a small withdrawal in the upper East Fork for drilling water (< 50 gpm) would have a very small impact on the volume reaching downstream sites. The drilling field season would be limited to summer months as well, so the short-term impacts from water withdrawal would not contribute to cumulative impacts on water quantity in the drainage.

Additionally, downstream from the Great Western Mine claim area, the flow in Emigrant Creek more than doubles before it reaches Old Chico, and there were no water quality exceedances measured at the lower site in 2015. This indicates the dominance of the other tributaries and groundwater sources on the hydrology and chemistry of Emigrant Creek as it exits the subwatershed. Any effects to the larger hydrologic unit from the East Fork drainage would be limited. Therefore, it is beyond the scope of this analysis to include the range of human activities that are unconnected to the Proposed Action, but which could potentially impact Emigrant Creek in the subwatershed located between Old Chico and the Yellowstone River. These activities could include placer mining and creating dredge waste piles along the stream, diverting stream flow to irrigation ditches, and impacts from the use of groundwater wells and septic systems in the valley sediments.

Previous geothermal studies have extensively documented the sources and flowpaths of hydrothermal features within and around YNP, and the data verify that there are no direct connections to the Chico Hot Springs system or to the Emigrant Mining District, therefore, no cumulative impacts were identified in the analysis.

4.1.6 LAND USE, NOISE, AND RECREATION

The cumulative impacts area for land use, noise, and recreational resources includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area (Emigrant Creek Road and Road 3272). The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Public land in the area has been and continues to be used for recreation activities including hiking, camping, hunting, and off-road vehicle use. The additional traffic and drilling noise from the Proposed Action added to the current land use in the area would have a minimal short-term impact to recreational experience. Long term cumulative impact to land use, noise, and recreation are not anticipated.

4.1.7 SOILS, VEGETATION, AND RECLAMATION

The cumulative impacts area for soils, vegetation, and wetlands includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Past impacts associated with historic mining and exploration drilling in the Emigrant Mining District include road disturbance and historic mine waste. The road grading that is part of the Proposed Action and Agency-Modified Alternative would not increase the extent of the road disturbance into previously undisturbed areas and would be limited to localized areas. As part of the Agency-Modified Alternative, unnecessary surface disturbance would be avoided and seeding those areas that are disturbed would minimize effects to soils, vegetation, and reclamation and would not lead to a significant cumulative impact.

4.1.8 TRANSPORTATION

The cumulative impacts area for transportation includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

The additive effect of the three daily vehicles used for the proposed exploration activities combined with current traffic numbers may have a minimal short-term impact to traffic safety. However, the Agency-Modified Alternative includes a mitigation to limit Lucky Minerals' vehicles to 25 MPH. Long-term cumulative impacts to traffic safety are not anticipated because these would be short-term and traffic would return to its previous state at the completion of the project.

4.1.9 AIR QUALITY

The cumulative impacts area for Air Quality includes the Emigrant Mining District, specifically in the immediate area of the St. Julian Claim Block and the roads that are proposed for access to the exploration area. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

No cumulative impacts have been identified for Air Quality as a result of implementation of the Proposed Action or Agency-Modified Alternative in the cumulative impacts area. No other emission sources are located in the identified analysis area that would combine with emissions from drilling, which are exempt under ARM 17.8.743.

4.1.10 VISUALS

The cumulative impacts area for Visual Resources includes the analysis area described in the affected environment. The cumulative analysis also considers past, present, and related future actions under concurrent consideration. DEQ consulted with local, state, federal agencies to inquire about present and future actions under consideration. Currently there are no permitted resource actions or management projects in the project area.

Other land use activities or conditions within the analysis area have affected and would continue to affect the visual characteristics of the landscape. Road cuts from historic mining, burned areas (range fires), and beetle-kill pine trees, affect the natural landscape to varying degrees and at varying seasons and duration. These land use activities and natural phenomena are expected to continue to affect visual elements of the landscape into the future. However, Lucky Minerals does not propose any road improvements outside the road prism that would lead to a long-term cumulative impact.

5 REGULATORY RESTRICTIONS

MEPA, as amended, requires state agencies to evaluate any regulatory restrictions they propose on the use of an applicant's private property (75-1-201 (1)(b)(iv)(D), MCA). Alternatives and mitigation measures are designed to further protect environmental, cultural, visual, and social resources, but they add to the cost of the project. MEPA requires state agencies to evaluate any regulatory restrictions proposed to be imposed on the proponent's use of private property (75-1-201(1)(b)(iv)(D), MCA). Alternatives and mitigation measures required by Federal or State laws and regulations to meet minimum environmental standards do not need to be evaluated for extra costs to the proponent.

Lucky Minerals would need DEQ approval of their exploration license on the St. Julian Claim Block. DEQ's selection of an alternative would be designed to make the Project meet minimum environmental standards or would have been proposed and/or agreed to by Lucky Minerals. Thus, the conditions should not constitute a compensable taking of private property

6 CONSULTATION AND COORDINATION

6.1 PREPARERS

Name	Responsibility	Credentials
Department of Environmental Quality		
Jen Lane	Project Coordination Noise Air Quality	B.A., Environmental and Social Justice
Craig Jones	Land Use Visuals GIS	B.A., Political Science
Bob Cronholm	Exploration	B.S., Geophysical Engineering
Garrett Smith	Geology Hydrology	M.S., Geoscience/Geochemistry B.S., Chemistry
John Koerth	Soils Vegetation Reclamation Transportation	B.S., Agriculture
James Strait	Cultural	B.S., Anthropology M.A., Archaeology
Wayne Jepson	Reviewer	M.S., Geology B.S., Earth Sciences
Patrick Plantenberg	Reviewer	B.S., Agricultural Science M.S., Range Science
Warren McCullough	Reviewer	B.A., Anthropology M.S., Economic Geology
Ed Hayes	Legal Review	J.D., Attorney
Garcia and Associates		
Jeanne Knox	Terrestrial Wildlife	B.S., Biology

6.2 OTHER AGENCIES CONSULTED

The following federal and state agencies and other entities were consulted during preparation and review of the EA:

- Montana Fish, Wildlife, and Parks
- U.S. Forest Service-Custer Gallatin National Forest
- Montana Natural Heritage Program
- Montana Bureau of Mines and Geology
- Park County
- Montana DEQ Air Quality Bureau

7 NEED FOR FURTHER ANALYSIS AND SIGNIFICANCE OF POTENTIAL IMPACTS

DEQ has determined that the environmental impacts resulting from Lucky Mineral's proposed exploration project will not be significant. DEQ identifies the Agency-Modified Alternative as the Preferred Alternative.

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8 GLOSSARY

Acid Rock Drainage (ARD)- a rock weathering process which produces an outflow of water with low pH and elevated concentrations of sulfates and some metals. Although a host of chemical processes can contribute to ARD, the oxidation of pyrite (i.e. reaction with oxygen and water) is the greatest contributor. This process occurs naturally within some environments, but can be exacerbated by large scale ground disturbances.

Alluvium- loose, unconsolidated soil or sediments which have been eroded, reshaped, and deposited in a non-marine setting. Particle size can range from silt and clay up to sand and gravel.

Andesite- an extrusive igneous (volcanic) rock, with a generally intermediate composition that falls between basalt and dacite. Silicon dioxide (SiO_2) content is typically between 52 and 63%.

Aphanitic- description given to igneous rocks that are so fine-grained that the component mineral crystals are not detectable by the unaided eye.

Argillic alteration- hydrothermal alteration of rock which introduces clay minerals (e.g. kaolinite, smectite and illite). The process generally occurs through interaction with moderately acidic, low temperature groundwater and can occur under atmospheric conditions. Advanced argillic alteration occurs under even more acidic conditions and higher temperatures.

Autobreccia- a clastic volcanic rock that is formed when thick, nearly solid lava breaks up into blocks and these blocks are then reincorporated into the lava flow and mixed in with the remaining liquid magma. The resulting breccia is uniform in rock type and chemical composition.

Basalt- a fine-grained extrusive igneous (volcanic) rock, which is classified as having a mafic composition. This indicates the rock has higher magnesium and iron content, but a lower silicon dioxide (SiO_2) content, typically between 45 and 52%.

Breccia- a rock composed of broken fragments of minerals or rock cemented together by a fine-grained matrix that can be similar to, or different from, the composition of the fragments.

Caldera- a large volcanic crater, typically one formed by a major eruption leading to the collapse of the mouth of the volcano.

Chalcocite- a copper-sulfide ore mineral (Cu_2S), which is opaque and has a dark-gray to black color.

Chalcopyrite- a copper-iron-sulfide ore mineral (CuFeS_2), which is opaque and has a brassy to golden-yellow color.

Cirque- a half-open steep-sided hollow at the head of a valley or on a mountainside, formed by glacial erosion.

Covellite- a relatively uncommon copper-sulfide mineral (CuS), which has an indigo blue color. It is often found in association with, or as a coating on, other sulfide minerals.

Crepuscular- animals are those that are active primarily during twilight (i.e., the period immediately after dawn and that immediately before dusk).

Cryochrept- A cold-climate soil lacking in development at both the surface and sub-surface levels.

Dacite- an extrusive igneous (volcanic) rock, which is classified as having an intermediate-felsic composition, in between andesite and rhyolite. This indicates the rock has a typical silicon dioxide (SiO₂) content between 63 and 69%.

Diamond Core Hole Drilling- a drilling technique that produces a solid core of rock that is extracted from depth for examination on the surface. The drill bit itself is a cylindrical metallic ring that contains industrial diamonds in the matrix, which aids in the strength and hardness of the bit. As drilling progresses downward, a cylindrical rock core forms in the interior of the drill pipe for later extraction.

Dissolved Oxygen- a common field parameter measurement which quantifies the concentration of molecular oxygen (O₂) dissolved in water.

Drusy Quartz- a coating of fine quartz crystals that forms on a rock void or fracture surface.

Electrofishing- a common scientific survey method which uses direct current electricity to catch fish, using a submerged cathode and anode. This affects the movement of the fish so that they swim towards the anode where they can be caught to determine population, density, and species composition.

Eocene- a major division of the geologic timescale, that is the second epoch of the Paleogene Period. The Eocene Epoch lasted from 56 to 33.9 million years ago.

Epiclast- rock clasts and minerals released by ordinary weathering processes from pre-existing consolidated rocks. Volcanic epiclasts are clasts of volcanic composition derived from erosion of volcanoes or ancient volcanic terrains

Ferricrete- a hard, erosion-resistant layer of sediments which has been cemented into a crust by iron oxides, typically derived from the oxidation of percolating solutions of iron salts.

Galena- an abundant lead sulfide mineral (PbS), which has a gray to silvery color.

Gangue- the commercially worthless material that surrounds, or is closely mixed with, a wanted mineral in an ore deposit.

Granite- an intrusive igneous (plutonic) rock, which is classified as having a felsic composition. This indicates the rock has a higher silicon dioxide (SiO₂) content, typically greater than 69%.

Granodiorite- an intrusive igneous (plutonic) rock, which is classified as having an intermediate-felsic composition, between diorite and granite in composition. This indicates the rock typically has a silicon dioxide (SiO₂) content between 63 and 69%.

Half-Graben- a geological structure bounded by a fault along one side of its boundaries, unlike a full graben where a depressed block of land is bordered by parallel faults.

Hydrologic Unit Code- a sequence of numbers or letters which classify and categorize bound hydrological features like rivers, lakes, or drainage basins.

Hydrostatic Pressure- the pressure that is exerted by a fluid at equilibrium at a given point within the fluid, due to the force of gravity. Hydrostatic pressure increases in proportion to depth measured from the surface because of the increasing weight of fluid exerting downward force from above.

Hydrothermal Breccias- a clastic rock that is formed at shallow crustal levels, when seismic or volcanic activity causes a void to open along a fault deep underground. The void typically fills with expanding hot water or steam, which then causes rock to destabilize and collapse into the void. As the cycle continues, the mixture of collapsed rock may consolidate and form a breccia.

Induced Polarization Geophysical Surveys- a geophysical imaging technique used to identify the electrical chargeability of subsurface materials.

Krummholtz- stunted windblown trees growing near the tree line on mountains.

Laramide Orogeny- a period of mountain building in western North America, which started in the Late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago. This orogeny occurred in a series of pulses, with quiescent phases intervening.

Mantle Plume- a mechanism proposed to explain volcanically active regions that are not associated with tectonic plate boundaries. These plumes or “hotspots” are posited to exist where hot rock nucleates at the core-mantle boundary and rises through the Earth’s mantle, intruding into the crustal layer.

Mesic- an environment or habitat containing a moderate amount of moisture.

Mesozoic- a major division of the geologic timescale, that is the second era within the Phanerozoic eon (between the Paleozoic and Cenozoic). The Mesozoic Era lasted from 252 to 65 million years ago, and is commonly associated with the age of dinosaurs and abundant conifers.

Meteoric Water- water derived from any form of precipitation, and the water bodies which originate indirectly from precipitation (e.g. rivers, lakes, icemelts).

Microsite- a small part of an ecosystem that differs markedly from its immediate surroundings.

Molybdenite- a relatively common molybdenum-sulfide ore mineral (MoS₂), which has a black to silvery-gray color. Molybdenite is also very soft (Mohs scale hardness= 1-1.5), and may be superficially mistaken for graphite due to similar physical properties.

Paleozoic- a major division of the geologic timescale, the earliest and longest era within the Phanerozoic eon (followed by the Mesozoic and Cenozoic). The Paleozoic Era lasted from 541 to 252 million years ago, and the early part of the era is commonly associated with the relatively sudden appearance of invertebrate animals and development of macroscopic plant life.

Permil (or per mille)- a sign used to denote “parts per thousand,” which looks like a percent sign with an extra zero in the divisor (‰).

pH- a numeric and logarithmic scale used to specify the acidity or basicity of a solution, generally reported between 0 and 14. In general terms, it is approximately the negative logarithm of the molar concentration (mol/L) of hydrogen ions.

Physiographic Province- a geographic region with a characteristic geomorphology, and often with a specific subsurface rock type or structural elements.

Pliocene- a major division of the geologic timescale, that is the second epoch of the Neogene Period. The Pliocene Epoch lasted from 5.3 to 2.6 million years ago.

Porphyry- a textural term for an igneous rock consisting of large-grained crystals dispersed in a fine-grained matrix or groundmass. The term is also used to describe a type of mineral deposit called a “copper porphyry,” which forms primarily when fluids are driven off from a cooling, intrusive magma body.

Potentiometric Surface- a hydrologic concept which is an imaginary surface that defines the level to which water in a confined aquifer would rise, were it allowed to equilibrate under atmospheric conditions. This concept is often depicted as a contoured map showing groundwater elevation.

Precambrian- a major division of the geologic timescale, that is the largest span of time in Earth’s history before the current Phanerozoic Eon. It spanned from the formation of Earth about 4.6 billion years ago, to the beginning of the Cambrian Period (within the Paleozoic Era) about 542 million years ago.

Quartz Monzonite- an intrusive igneous (plutonic) rock, which is classified as having a felsic composition. This indicates the rock has a higher silicon dioxide (SiO₂) content, typically greater than 69%. It is often confused with granite due to its similar color and mineral content, but quartz monzonite contains only 5-20% quartz, while granite contains >20%.

Quartz-Sericite-Pyrite alteration- also known as phyllic alteration, this is a hydrothermal alteration zone that occurs in permeable rock that has been affected by circulation of hydrothermal fluids. The original mineral suite (often containing orthoclase feldspar, biotite, and various silicates) may be altered to sericite, quartz, and pyrite, but the texture and mineral geometry may be preserved.

Reduction Potential (Redox)- a measure of the tendency of a chemical species to acquire electrons and thereby be reduced. This measurement is often applied to aqueous solutions, where it is a measure of the tendency of the solution to either gain or lose electrons when it is subject to change by introduction of a new species.

Reverse Circulation Drilling- a drilling method in which a pneumatic reciprocating piston (or “hammer”) is used to crush rock and advance the drill hole. The cuttings are lifted up by air, and sometimes water, through an inner tube in the drill pipe.

Rheology- is the study of the flow of matter, primarily in a liquid state, but also as solids under conditions in which they respond with plastic flow rather than deforming elastically in response to an applied force.

Rhyodacite- an extrusive igneous (volcanic) rock, which is classified as having an intermediate composition, between rhyolite and dacite.

Rhyolite- an extrusive igneous (volcanic) rock, which is classified as having a felsic composition. This indicates the rock has a higher silicon dioxide (SiO₂) content, typically greater than 69%.

Seral- is an intermediate stage found in ecological succession in an ecosystem advancing towards its climax community.

Sericite- a fine-grained mica, similar to muscovite or illite. Sericite is a common alteration mineral of orthoclase or plagioclase feldspars in areas that have been subjected to hydrothermal alteration.

Siliceous- a description of rocks that have silica (SiO₂) as a principal constituent.

Silicified- a description of rocks that have been converted into or impregnated with silica (SiO₂).

Specific Conductivity (SC)- the measure of a solution’s ability to conduct an electrical current.

Sphalerite- a common zinc sulfide mineral that may contain variable amounts of iron ((Zn,Fe)S). Sphalerite is the chief ore of zinc, and its color can vary from brown to yellow, or gray to gray-black.

Stable Isotopes- atoms whose nuclei contain the same number of protons but a different number of neutrons. Unlike radioactive isotopes which decay over time and thus change atomic weight, stable isotopes do not degrade. There are often multiple stable isotopes that exist for each light-weight element, so isotopic analysis relies on measuring the ratios of particular isotopes within a sample.

Stockwork- a complex system of structurally controlled or randomly oriented veins.

Sulfate- a very common, polyatomic ion with the empirical formula SO₄²⁻.

Sulfides- an inorganic anion of sulfur with the chemical formula S²⁻. In aqueous solutions, sulfides readily bond with transition metal cations. Many important metal ore minerals are sulfides.

Talus- a slope or deposit formed by an accumulation of broken rock debris, as at the base of a cliff. Also known as "scree."

Terrestrial- an animal that lives on land as opposed to living in water, or sometimes an animal that lives on or near the ground, as opposed to arboreal life (in trees).

Tertiary- the former term for the geologic period from 65 to 2.6 million years ago, between the extinction event at the end of the Cretaceous Period and the beginning of the Quaternary glaciation. Although no longer recognized as a formal unit by the International Commission on Stratigraphy, the term is still widely used.

Tuffs- a relatively soft rock, formed by volcanic ash that is ejected during an eruption. Following ejection and deposition, the ash may be consolidated into a solid rock. Also known as "tufa."

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APPENDIX A

Water Quality Tables

**Table A.1
Summarized Water Quality Data for Stream Sites**

GWIC ID	Stream Site Name	Sample Date	Field Parameters							Laboratory Parameters										
			Flow	Temp	pH	Specific Conductivity	Reduction Potential	Dissolved Oxygen	Total Dissolved Solids	Hardness	Sulfate	Iron	Aluminum	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	
			cfs	°C		µS/cm	mV	mg/L	mg/L	mg/L CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
285007	EAST FORK: ABOVE ST. JULIAN MINE	10/28/2015	NR	1.6	6.00	84.0	344.7	9.11	58.66	30.2	18.8	<0.015 U	0.0105	0.00021 J	<0.00010 U	<0.00050 U	<0.000060 U	<0.00010 U	0.0221	
285009	EAST FORK: BELOW ST. JULIAN MINE	10/28/2015	0.80	2.0	6.51	92.7	143.0	9.67	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
284926	EAST FORK: ABOVE CONFLUENCE	10/23/2015	1.42	3.4	6.06	99.6	99.5	9.49	77.41	32.4	33.8	0.185	0.151^a	0.00045	0.00047^b	0.01711^c	<0.000060 U	0.0007	0.118^d	
284999	EMIGRANT CREEK: ABOVE CONFLUENCE	10/29/2015	3.01	1.8	7.16	132.5	122.9	9.88	86.53	55.6	21.3	0.05 J	0.0921^a	<0.00010 U	0.00024^f J	0.00096 J	<0.000060 U	0.000250 J	0.0354	
284998	EMIGRANT CREEK: BELOW CONFLUENCE	10/29/2015	4.21	2.9	7.22	143.1	74.5	9.64	87.34	50.7	27.1	0.055 J	0.0522	<0.00010 U	0.00037^g J	0.00417	<0.000060 U	0.0006	0.0683^h	
284991	EMIGRANT CREEK: ABOVE GREAT WESTERN	10/29/2015	5.43	3.1	7.78	125.1	123.0	9.48	83.91	47.9	27.3	0.038 J	0.0466	<0.00010 U	0.00028ⁱ J	0.00574^j	<0.000060 U	0.000420 J	0.0499	
NR	UNNAMED TRIB. BELOW GREAT WESTERN	9/22/2015	0.66	5.0	5.00	140.0	NR	NR	NR	52	29	< 0.02 U	NR	<0.00010 U	0.00012	0.020^k	<0.001 U	<0.005U	0.02	
284996	EMIGRANT CREEK: NORTH PRIVATE BRIDGE	10/30/2015	14.41	3.7	7.05	142.6	137.4	10.36	89.41	64.9	17.1	<0.015 U	0.0231	0.00047	<0.00010 U	0.00146 J	<0.000060 U	<0.00010 U	0.0144	

NR = No Reading/No Data; J = above detection limit but below reporting limit; U = below detection limit.

cfs = cubic feet per second; °C = degree Celsius; µS/cm = microSiemens per centimeter; mV = millivolts; mg/L = milligrams per liter

Underlined text indicates exceedance of acute aquatic life standard; Bold text indicates exceedance of chronic life standard; Asterisks (*) indicate exceedance of human health standard.

Notes on standards: a = chronic aquatic life standard, Al = 0.087 mg/L, but this standard is only enforceable when pH = 6.5 – 9.0; b = chronic aquatic life standard, Cd = 0.00012 mg/L; c = acute aquatic life standard, Cu = 0.00484 mg/L; chronic, Cu = 0.00356 mg/L; d = acute and chronic aquatic life standards, Zn = 0.046 mg/L; f = chronic aquatic life standard, Cd = 0.00018 mg/L; g = chronic aquatic life standard, Cd = 0.00016 mg/L; h = chronic aquatic life standard, Zn = 0.067 mg/L; i = chronic aquatic life standard, Cd = 0.00016 mg/L; j = chronic aquatic life standard, Cu = 0.00499 mg/L; k = c = acute aquatic life standard, Cu = 0.00756 mg/L; chronic, Cu = 0.00534 mg/L

Data taken from MBMG results in GWIC database: <http://mbmggwic.mtech.edu/>

Sept. 2015 data from DEQ samples (Energy Labs), most are total recoverable analyses, found in **Water Quality Technical Report on file at DEQ.**

Figure A.2
Summarized Water Quality Data for Groundwater Sites Above East Fork-Emigrant Creek Confluence

GWIC ID	Groundwater Site Name	Sample Date	Field Parameters							Laboratory Parameters										
			Flow	Temp.	pH	Specific Conductivity	Reduction Potential	Dissolved Oxygen	Total Dissolved Solids	Hardness	Sulfate	Iron	Aluminum	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	
			gpm	°C		µS/cm	mV	mg/L	mg/L	mg/L CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
284923	EAST FORK: NORTH GROUNDWATER	9/22/ 2015	10	5.0	4.00	300	NR	NR	NR	15	93	0.8	<u>6.690^a</u>	0.003	<u>0.00266^b</u>	<u>0.355^c</u>	0.013^d	<0.005 U	<u>0.64^e</u>	
284923	EAST FORK: NORTH GROUNDWATER	10/23/ 2015	7.5	5.5	2.89	279.3	487.2	8.55	247.4	17	172.3	0.295	<u>6.422^a</u>	<0.00010 U	<u>0.00269^b</u>	<u>0.346^c</u>	0.00246^d	0.00367	<u>0.629^e</u>	
285013	EAST FORK: NORTH ROAD SPRING	10/28/ 2015	1	5.7	2.83	285.7	486.2	5.84	206.6	17.9	131.5	0.458	<u>5.003^a</u>	<0.00010 U	<u>0.00280^b</u>	<u>0.555^c</u>	0.00058^d	0.005	<u>0.818^e</u>	
171926	ALLISON TUNNEL MINE DRAINAGE	9/22/ 2015	30	4.9	4.5	250	NR	NR	NR	21	103	14.9	<u>3.77^a</u>	0.004	<u>0.0030^b</u>	<u>0.174^c</u>	<0.001 U	0.007	<u>1.19</u>	
171926	ALLISON TUNNEL MINE DRAINAGE	10/28/ 2015	30	3.5	2.93	262.6	446	8.64	270.8	21.1	189	5.124	<u>3.099^a</u>	0.00013	<u>0.00308^b</u>	<u>0.175^c</u>	0.00207^d	0.00725	<u>1.180^e</u>	
285001	ST. JULIAN SEEP #1	10/28/ 2015	5	2.1	5.9	176.4	356	9.13	121.3	71.6	36.9	<0.015 U	0.0123	0.00044	<0.00010 U	<0.00050 U	<0.00006 U	<0.0001 U	0.00862	
285011	ST. JULIAN SEEP #2	10/28/ 2015	0.25	2.3	6.18	308.2	92.2	0.45	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
284924	EAST FORK: SOUTH GROUNDWATER	10/23/ 2015	7.5	6	5.76	127.1	243.9	7.35	94.1	47.1	39.7	<0.015 U	0.013	0.00024 J	0.000360^f J	0.00161 J	<0.00006 U	0.00088	0.110^e	
171925	DUVAL UPPER BOREHOLE	9/22/ 2015	1.1	4.8	5.5	310	NR	NR	NR	122	48	<0.02 U	<0.03 U	0.002	<0.00003 U	<0.002 U	<0.001 U	<0.005 U	0.02	
171925	DUVAL UPPER BOREHOLE	10/23/ 2015	0.75	4.6	7.3	283.6	-75.2	2.4	186.6	130	58.7	0.393	0.00888 J	0.003	<0.00010 U	<0.00050 U	0.0015	<0.0001 U	0.0261	
284905	DUVAL MIDDLE BOREHOLE	9/22/ 2015	1.1	5.3	5.8	330	NR	NR	NR	129	63	<0.02 U	NR	0.002	<0.00003 U	<0.002 U	<0.0003 U	<0.005 U	<0.01 U	
284905	DUVAL MIDDLE BOREHOLE	10/23/ 2015	2	4.8	7.18	315.6	-60.8	0.36	208.9	137.1	74.3	0.42	0.00920 J	0.00353	<0.00010 U	<0.00050 U	0.00043	<0.0001 U	0.00681	
171924	DUVAL LOWER BOREHOLE	10/23/ 2015	NR	3.4	7.44	103.8	-50.5	3.6	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	

NR = No Reading; J = above detection limit but below reporting limit; U = below detection limit.

cfs = cubic feet per second; °C = degree Celsius; µS/cm = microSiemens per centimeter; mV = millivolts; mg/L = milligrams per liter

Underlined text indicates exceedance of acute aquatic life standard; Bold text indicates exceedance of chronic life standard; Asterisks (*) indicate exceedance of human health standard.

Notes on standards:

a = acute aquatic life standard, Al = 0.750 mg/L, but these standards are only enforceable when pH = 6.5 – 9.0; chronic, Al = 0.087 mg/L; b = acute aquatic life standard, Cd = 0.00052 mg/L; chronic, Cd = 0.000097 mg/L; c = acute aquatic life standard, Cu = 0.00379 mg/L; chronic, Cu = 0.00285 mg/L; d = chronic aquatic life standard, Pb = 0.000545 mg/L; e = acute and chronic aquatic life standards, Zn = 0.046 mg/L; f = chronic aquatic life standard, Cd = 0.000155 mg/L; g = acute and chronic aquatic life standards, Zn = 0.063 mg/L

Data taken from MBMG results in GWIC database: <http://mbmggwic.mtech.edu/>

Sept. 2015 data from DEQ samples (Energy Labs), most are dissolved analyses, found in **Water Quality Technical Report on file at DEQ.**

**Table A.3
Summarized Water Quality Data for Groundwater Sites Below East Fork-Emigrant Creek Confluence**

GWIC ID	Groundwater Site Name	Sample Date	Field Parameters							Laboratory Parameters										
			Flow	Temp	pH	Specific Conductivity	Reduction Potential	Dissolved Oxygen	Total Dissolved Solids	Hardness	Sulfate	Iron	Aluminum	Arsenic	Cadmium	Copper	Lead	Nickel	Zinc	
			gpm	°C		µS/cm	mV	mg/L	mg/L	mg/L CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
284997	BELOW CONFLUENCE, SOUTH SPRING	10/29/ 2015	75	2.3	7.4	128.8	106.6	9.68	78.9	48.5	27.3	<0.015 U	0.00906 J	<0.00010 U	<0.00010 U	<0.00050 U	<0.000060 U	<0.00010 U	0.0043	
284993	EAST SPRING #1 SOUTH OF GW	10/29/ 2015	15	4.1	7.76	89.4	119.1	9.45	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
284992	EAST SPRING #2 SOUTH OF GW	10/29/ 2015	10	4.1	7.79	89.2	117.7	9.47	58.5	37.8	8	<0.015 U	0.0205	0.00047	<0.00010 U	<0.00050 U	<0.000060 U	<0.00010 U	0.0038	
284994	WEST SPRING #1 SOUTH OF GW	10/29/ 2015	15	2.2	7.47	102.4	123.9	9.78	66.2	39.8	30	<0.015 U	0.011	0.00028 J	<0.00010 U	0.00408	<0.000060 U	<0.00010 U	0.0143	
284995	WEST SPRING #2 SOUTH OF GW	9/22/ 2015	100	2.2	5.7	110	NR	NR	NR	35	19	<0.02 U	NR	<0.001 U	0.00006	0.01^a	<0.001 U	<0.005 U	0.02	
284995	WEST SPRING #2 SOUTH OF GW	10/29/ 2015	25	2.1	7.43	106.3	130.2	10.11	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
284916	GREAT WESTERN BOREHOLE	9/22/ 2015	0.1	6.7	6	310	NR	NR	NR	116	30	<0.02 U	<0.03 U	0.006	<0.00003 U	<0.002 U	<0.001 U	<0.005 U	<0.01 U	
284916	GREAT WESTERN BOREHOLE	10/23/ 2015	0.25	4.7	7.53	289.3	-118.9	0.69	177.4	116.7	39.6	0.233	0.00896 J	0.00696	<0.00010 U	<0.00050 U	<0.000060 U	<0.00010 U	0.00149 J	
182638	PRIVATE WELL	9/10/ 2000	NR	4.5	7.6	153	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
260068	CHICO HOT SPRINGS	4/12/ 2011	320	47.3	7.52	435.9	369	5.26	269.4	121.3	50.1	<0.005 U	0.003	0.00716	<0.0002	0.00367	<0.0002 U	0.192*	0.00375	
261120	CHICO RESORT COLD SPRING	12/20/ 2000	15	7.9	8.9	163	NR	NR	106.1	73.2	2.9	<0.005 U	<0.030 U	<0.001 U	<0.002 U	<0.002 U	<0.002 U	<0.002 U	<0.002 U	

NR = No Reading; J = above detection limit but below reporting limit; U = below detection limit.
 cfs = cubic feet per second; °C = degree Celsius; µS/cm = microSiemens per centimeter; mV = millivolts; mg/L = milligrams per liter
 Underlined text indicates exceedance of acute aquatic life standard; Bold text indicates exceedance of chronic life standard; Asterisks (*) indicate exceedance of human health standard.

Notes on standards:
 a = acute aquatic life standard, Cu = 0.00521 mg/L; chronic, Cu = 0.00380 mg/L
 * = human health standard, Ni = 0.100 mg/L; acute aquatic life standard, Ni = 0.0614

Data taken from MBMG results in GWIC database: <http://mbmggwic.mtech.edu/>
 Sept. 2015 data from DEQ samples (Energy Labs), most are total recoverable analyses, found in **Water Quality Technical Report on file at DEQ.**