3.10 Paleontological Resources

This section describes OEA's analysis of potential impacts on paleontological resources from construction and operation of the proposed rail line. Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains (Murphey and Daitch 2007). Paleontological and fossil resources vary widely in their relative abundance and distribution and not all are regarded as scientifically important (BLM 2008):

> A paleontological resource is considered to be scientifically important if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities.

The subsections that follow describe the study area, data sources, methods OEA used to analyze potential impacts, the affected environment, and the potential impacts of the proposed rail line on paleontological resources.

3.10.1 Analysis Methods

This subsection identifies the study area, data sources, and analysis methods OEA used to analyze paleontological resources.

3.10.1.1 Study Area

The study area for paleontological resources is the project footprint,[1] which includes all areas of temporary disturbance where construction activities and staging would occur. The project footprint also includes all areas of permanent disturbance, including the railbed, access roads, communications towers, and areas of cut and fill.

[1] The *rail line footprint* includes the area of the railbed, as well as the full width of the area cleared and cut or filled. The rail line footprint would also include other physical structures installed as part of the proposed rail line, such as fence lines, communications towers, siding tracks, relocated roads, and power distribution lines. The rail line footprint is the area where rail line operations and maintenance would occur. The area would be permanently disturbed. The *temporary footprint* is the area that could be temporarily disturbed during construction, including areas for temporary material laydown, staging, and logistics. Disturbed areas in the temporary footprint would be reclaimed and revegetated following construction. The *project footprint* is the combined area of the rail line footprint and temporary footprint, both of which would be disturbed during construction, comprising where construction and operations of the proposed rail line would occur.

3.10.1.2 Data Sources

OEA reviewed the following data sources to determine potential impacts on paleontological resources that could result from construction and operation of the proposed rail line.

- Geologic maps of the study area (Bryant 2010; Sprinkel 2007, 2018; Weiss et al. 2003).
- Museum and agency fossil locality databases (Utah Geological Survey 2020).
- Previous paleontological technical reports containing record search data and geologic maps (SWCA 2020).
- Published scientific literature cited throughout the section.

3.10.1.3 Analysis Methods

OEA used the following methods to analyze paleontological resources in the study area.

- **OEA reviewed information on paleontological resource potential in the study area.** The Coalition's paleontology contractor, SWCA, collected baseline information on paleontological resources in the study area (SWCA 2020), which OEA reviewed and independently verified. SWCA reviewed spatial geologic data to map the geologic units within the study area and their corresponding Potential Fossil Yield Classification (PFYC) values. The Bureau of Land Management (BLM) and other agencies use the PFYC system to identify geologic areas that are more or less likely to contain fossils (Section 3.10.2.1, *Geologic Setting,* provides a description of paleontological resource potential and the BLM PFYC system). OEA consulted with BLM to confirm the PFYC values for geologic units in the study area (BLM 2016; McDonald pers. comm.).
- **OEA reviewed information on known fossil locations.** The abundance of reported fossil discoveries in a particular area is a useful indicator for the potential of that area to contain previously undiscovered paleontological resources. OEA reviewed published scientific literature to evaluate the paleontological potential of the study area. OEA also obtained and analyzed paleontological locality data from the Utah Geological Survey (Utah Geological Survey 2020) and SWCA (SWCA 2020).
- **OEA assessed the potential impacts on fossil-bearing formations and known fossil localities.** OEA evaluated potential project-related impacts based on scientific importance, number, and locations of previously recorded fossil discoveries (or fossil localities) within the study area and the likelihood, based on maps of PYFC designations, that the study area could contain previously undiscovered fossils. OEA's analysis focused on the potential for discovering scientifically important paleontological resources during construction. OEA mapped the geologic units that each Action Alternative would cross, assigned the corresponding PFYC value, and calculated the acreage within each PFYC unit that each Action Alternative would cross. The Action Alternatives encompassing larger areas of high potential rock units would have a higher potential for paleontological resource impacts.

3.10.2 Affected Environment

This subsection identifies the existing environmental conditions related to paleontological resources in the study area.

3.10.2.1 Geologic Unit Classification

Paleontological resources occur in many geologic units. A geologic unit is a layer or layers of rocks that can be grouped together based on their characteristics and mapped. A geologic unit can be a single rock formation or layer, a group of many formations that are associated with each other, a subgroup, or member, of a larger formation, or a collection of loosely associated rocks and sedimentary deposits. The BLM PFYC system classifies geologic units based on the relative abundance of vertebrate, invertebrate, plant, and trace fossils that have been documented within them, with a higher classification number corresponding to a higher potential for fossil occurrences. Since its adoption as policy by BLM (BLM 2007), the PFYC system has come to be widely used by both paleontologists and government agencies. Paleontologists apply the PFYC value to the geologic formation, member, or other distinguishable unit at the most detailed mappable level available. The six PFYC classes are briefly described as follows.

- **PFYC 1 (very low potential).** Geologic units that are not likely to contain recognizable paleontological resources.
- **PFYC 2 (low potential).** Geologic units that are not likely to contain paleontological resources.
- **PFYC 3 (moderate potential):** Geologic units where paleontological resources vary in significance, abundance, and predictable occurrence.
- **PFYC 4 (high potential).** Geologic units known to contain a high occurrence of paleontological resources.
- **PFYC 5 (very high potential).** Geologic units that consistently and predictably produce significant paleontological resources.
- **PFYC U (unknown potential).** Geologic units that cannot receive an informed PFYC assignment.

BLM has assigned PFYC rankings to all geologic units in the study area.

3.10.2.2 Geologic Setting

The geology of the area through which the proposed rail line would pass consists of the Uinta Basin (Basin) and the highlands and mountains that surround it. The Basin occupies approximately 6,800 square miles of northeastern Utah. Structurally, it is an asymmetrical, elongate synclinal[2] basin that is oriented east–west. It is bounded by the Uinta Mountains to the north, the Douglas Creek Arch and Roan Plateau to the east, the Book Cliffs/Tavaputs Plateau to the south, and the Wasatch Range to the west. Many of the rocks in the study area formed from stream and lake sediments that were deposited between approximately 83 million years ago and 1,000 years ago, although most of the sequence consists of rocks of middle Eocene age (approximately 40 to 49 million years old). Between approximately 80 and 35 million years ago, during a period of mountain building in western North America known as the Laramide orogeny, these sedimentary deposits were pushed upward by geologic uplift, creating the Uinta Mountains and the adjacent Basin. During that time, more than 25,000 feet of shallow-water sandstone and shale accumulated (Stokes 1986). As the mountains were uplifted, Paleozoic-age and Mesozoic-age rocks became exposed. Throughout

[2] A syncline is a feature made up of rock layers that have been deformed, or folded, by geologic processes so that the youngest rock layers are closest to the center of the fold. Synclines that are circular or elongated are known as basins.

the Basin, layers of newer rock from the Paleogene period dip gently from all directions to the northern margin, where the strata are sharply upturned and faulted along the southern flank of the Uinta Mountains uplift (Johnson 1985).

The Basin and the highlands surrounding it are well known for their geologic history and paleontological importance.[3] The fossil record in this region is discontinuous but rich, spanning a period of at least 535 million years from the Cambrian Period to the Pleistocene Epoch. The region has produced many important fossil specimens, including numerous holotypes, or specimens of previously unknown species. Many of these specimens are now housed in museums throughout the United States. Important specimens documented from within and around the study area include protoreodons (extinct pig-like mammals), rodents (*Pseudotomus* sp. and *Mytonomys sp*. [Black 1968]), perissodactyls and artiodactyls (*Triplopus* sp., Mytonomeryx sp.), primates (*Mytonius* sp.), lagomorphs (*Mytonolagus* sp.), and reptiles (e.g. *Procaimanoidea utahensis* [Gilmore 1946]). In addition, isolated trace fossils from as early as 1,100 million years ago have been reported in the Precambrian Uinta Mountain Group that some scientists have interpreted to be tiny fossil algal globules (Graham 2006). Trace fossils have also been reported in the Uinta Formation (Hamblin et al. 1998, 1999; Scott and Smith 2015).

The study area includes 11 sedimentary bedrock geologic units ranging in age from Cretaceous to Eocene, as well as 11 unnamed Quaternary surficial sedimentary deposits (Table 3.10-1). From oldest to youngest, the bedrock units consist of the North Horn, Flagstaff Limestone, Colton, Green River, and Uinta formations and their constituent members. Pleistocene-aged and Holocene-aged sediments deposited by rivers, streams, gravity, and wind overlie the bedrock geologic units in valleys and floodplains. Fossils occur in all sedimentary bedrock geologic units, as well as older surficial sedimentary deposits from the Pleistocene age.

The most scientifically important geologic units in the study area—which have high and very high paleontological potential (PFYC 4 and 5)—are found in the North Horn Formation, the Green River Formation, and the Uinta Formation. The Late Cretaceous to Eocene sedimentary units in these formations contain a rich and diverse fossil record spanning the Cretaceous-Paleocene boundary that documents the evolution of plants and animals, as well as the evolution of environments in North America. Noteworthy events recorded in these rocks include the extinction of dinosaurs (North Horn Formation), the transition from tropical to more-open woodland ecosystems during the early and middle part of the Eocene Epoch (Colton and Green River formations), the development and history of massive Lake Uinta during the early and middle part of the Eocene Epoch (Green River and Uinta formations), and the evolutionary diversification of mammals during the Paleocene and Eocene ages of North America (North Horn, Green River, and Uinta formations). Table 3.10-1 provides a list of geologic units in the study area and the acreage of each geologic unit that the Action Alternatives would cross.

[3] The information in this section was largely excerpted with minor modifications from Murphey and Daitch (2007) with approval of the authors.

Table 3.10-1. Geologic Units in the Study Area

Geologic Unit	Map Symbol	Typical Fossils	Age	BLM PFYC	Acres[a] Indian Canyon Alternative	Acres[a] Wells Draw Alternative	Acres[a] Whitmore Park Alternative
Alluvium and colluvium, mixed; mixed alluvium and eolian; flood-plan and channel alluvium	Qac, Qae, Qal	Holocene deposits are too young to contain *in-situ* fossils.	Holocene	2	141	270	141
Alluvial-fan deposits; alluvium; Piedmont alluvium, undivided	Qaf; Qa, Qal; Qa	Pleistocene deposits may contain mineralized or partially mineralized remains; Holocene deposits are too young to contain *in-situ* fossils.	Pleistocene and Holocene	2	859	385	875
Landslide deposits	Ql	Pleistocene deposits could contain mineralized or partially mineralized remains, though landslide deposits are not conducive to fossil preservation; Holocene deposits are too young to contain *in-situ* fossils.	Quaternary	2	232	315	26
Glacial outwash deposits of pre-Bull Lake age	Qgpb	Pleistocene deposits may contain mineralized or partially mineralized remains.	Pleistocene	2	401	94	401
Older pediment deposits	Qop	Pleistocene deposits may contain mineralized or partially mineralized remains.	Pleistocene	2	--	412	--
Pediment mantle	QTpm	Miocene, Pliocene, and Pleistocene deposits may contain mineralized or partially mineralized remains; Holocene deposits are too young to contain *in-situ* fossils.	Miocene[b] to Holocene	2	15	15	31

Geologic Unit	Map Symbol	Typical Fossils	Age	BLM PFYC	Acres[a] Indian Canyon Alternative	Acres[a] Wells Draw Alternative	Acres[a] Whitmore Park Alternative
Uinta Formation; upper, lower, B, and C members	Tuu, Tul, Tub, Tuc	Mammals including primates, chalicotheres, uintatheres, artiodactyls and perissodactyls; reptiles including many types of turtles, and fish. Index taxa include *Amynodon reedi*, *Eobasileus cornutus, Eomoropus amororum*, and *Hyrachyus eximius* among many others (Gunnell et al. 2009; Murphey et al. 2011).	Eocene	5	787	926	853
Green River Formation, middle and lower members	Tgm, Tgl	Various fish, turtles, crocodiles and alligators, birds, many types of mammals, and varieties of invertebrates including insects, snails and clams. Diverse and well preserved plants.	Middle to Upper Eocene	4	313	326	381
Green River Formation, sandstone and limestone facies	Tgsl	Contains numerous stromatolites. Vertebrates (fishes, amphibians, reptiles, bird, mammals), invertebrates (insects, arthropods, mollusks), plants, ichnofossils.	Middle to Lower Eocene	4	231	984	286
Green River Formation; saline facies and upper member	Tgs, Tgu	Plants, insects, vertebrates including rays, primates, rodents, and *Hyracotherium* (an early horse).	Eocene	4	284	3,540	284
Colton Formation	Tc	Invertebrates including freshwater mollusks, ostracods and charophytes, as well as one occurrence of a bird (Hardy 1959)	Paleocene to early Eocene	3	628	628	1,370

Geologic Unit	Map Symbol	Typical Fossils	Age	BLM PFYC	Acres[a]		
					Indian Canyon Alternative	Wells Draw Alternative	Whitmore Park Alternative
Flagstaff Limestone and North Horn Formation (Undivided)	TKfn	North Horn: dinosaurs including ceratopsians, hadrosaurs, theropods, and the titanosaurid sauropod *Alamosaurus sanjuanensis,* as well as dinosaur eggs (Jensen 1966), crocodilians, testudinids, teiid lizards, and two mammal localities that produced the Late Cretaceous marsupial *Aletridelphys hatcheri* (Clemens 1961). Flagstaff: gastropods and pelecypods and one occurrence of a pantodont (mammal) from a roadcut (Miller 1986).	Paleocene and Upper Cretaceous	4	51	51	26

Notes:

The North Horn Formation (PFYC 4) and Flagstaff Limestone (PFYC 3) are mapped as undivided in the study area. Therefore, per standard BLM procedure, PFYC 4 is applied to the entire undivided unit.

[a] Acres are rounded to the nearest whole acre.

[b] The age of the Pediment mantle may extend back to the late Miocene but this is uncertain.

3.10.2.3 Record Search Results

There are numerous previously recorded scientifically important and unimportant fossil localities in the Green River Formation and Uinta Formation within 1 mile of the study area. In addition, four previously recorded fossil localities in the Colton Formation are located near the study area. No previously recorded fossil localities occur near the study area in the Flagstaff Formation or North Horn Formation. Table 3.10-2 lists the previously recorded fossil localities in the study area of each Action Alternative. In total, there are 26 important fossil localities in the study areas of the Indian Canyon Alternative and Whitmore Park Alternative, and one important fossil locality in the study area of the Wells Draw Alternative. All of these scientifically important localities are in the Uinta Formation.

Table 3.10-2. Previously Recorded Paleontological Localities in the Study Area by Action Alternative

Localities	Indian Canyon Alternative	Wells Draw Alternative	Whitmore Park Alternative
Scientifically Important Localities			
Private land	2	1	2
Federal land	0	0	0
State land	0	0	0
Tribal trust land	24	0	24
Total Scientifically Important Localities	26	1	26
Nonimportant Localities			
Private land	0	0	0
Federal land	0	3	0
State land	0	0	0
Tribal trust land	145	0	145
Total Nonimportant Localities	145	3	145
Total Localities (Important and Nonimportant)	**171**	**4**	**171**

Notes:
Source: Utah Geological Survey 2020

3.10.3 Environmental Consequences

Construction and operation of the proposed rail line could result in impacts on paleontological resources. This subsection first presents the potential impacts that would be the same for all three Action Alternatives and then compares the potential impacts that would be different across the Action Alternatives. For comparison purposes, this subsection also discusses the status of paleontological resources under the No-Action Alternative.

3.10.3.1 Impacts Common to All Action Alternatives

Construction

Construction of any of the Action Alternatives would involve excavation activities within geologic units that have a PFYC value of 3 or greater. Those excavation activities could potentially result in direct adverse impacts on scientifically important paleontological resources. Depending on the depth of sensitive geologic units, grading, drilling, and trenching could damage or destroy paleontological resources at or below the surface. Without mitigation, these fossils, as well as the paleontological data they could provide if properly salvaged and documented, could be adversely affected (destroyed), rendering them permanently unavailable. Direct adverse impacts can typically be mitigated through implementation of a paleontological monitoring and treatment plan (Section 3.10.4, *Mitigation and Unavoidable Environmental Effects*). Mitigation also creates a beneficial impact because it results in the salvage of fossils that may never have been unearthed via natural processes. With mitigation, these newly salvaged fossils become available for scientific research, education, display, and preservation into perpetuity at a public museum.

Temporary surface activities, such as vegetation removal and staging, generally do not extend deep enough to affect paleontologically sensitive geologic units, but those activities could cause indirect impacts by exposing subsurface fossils to weathering by wind and water.

Operations

Rail operation activities, such as train movements, inspections, maintenance, and minor repairs, would not result in direct adverse impacts on paleontological resources because those activities would not involve ground disturbance. However, indirect impacts could result from the public accessing new roads developed as part of construction of the proposed rail line. Increases in public access could increase the likelihood of the loss of paleontological resources through vandalism and unlawful collecting (i.e., poaching). Human activities that result in increased erosion could cause indirect impacts through increases in exposure of subsurface fossils and their destruction via weathering. Most indirect impacts on paleontological resources would be difficult to avoid, but they could be greatly reduced by increasing public awareness about the scientific importance of paleontological resources through education, community partnerships, and interpretive displays, as well as informing the public about penalties for vandalism and unlawful collection.

3.10.3.2 Impact Comparison between Action Alternatives

Construction

All six of the paleontologically sensitive (PFYC 3-5) geologic units occur in the study area for each Action Alternative (Table 3.10-1 and Figure 3.10-1). Table 3.10-3 summarizes the paleontologically sensitive PFYC acreage and fossil localities that could be affected by surface and subsurface construction activities in the study area of each of the Action Alternatives.

Table 3.10-3. PFYC Acreage and Fossil Localities in the Study Area by Action Alternative

Action Alternative	PFYC 5 Acres[a]	PFYC 4 Acres[a]	PFYC 3 Acres[a]	Localities[b]	Scientifically Important Localities[b]
Indian Canyon	787	879	628	171	26
Wells Draw	926	4,901	628	4	1
Whitmore Park	853	977	1,370	171	26

Notes:
[a] Source: BLM 2016; SWCA 2020; Foss 2007; McDonald pers. comm.
[b] Source: Utah Geological Survey 2020

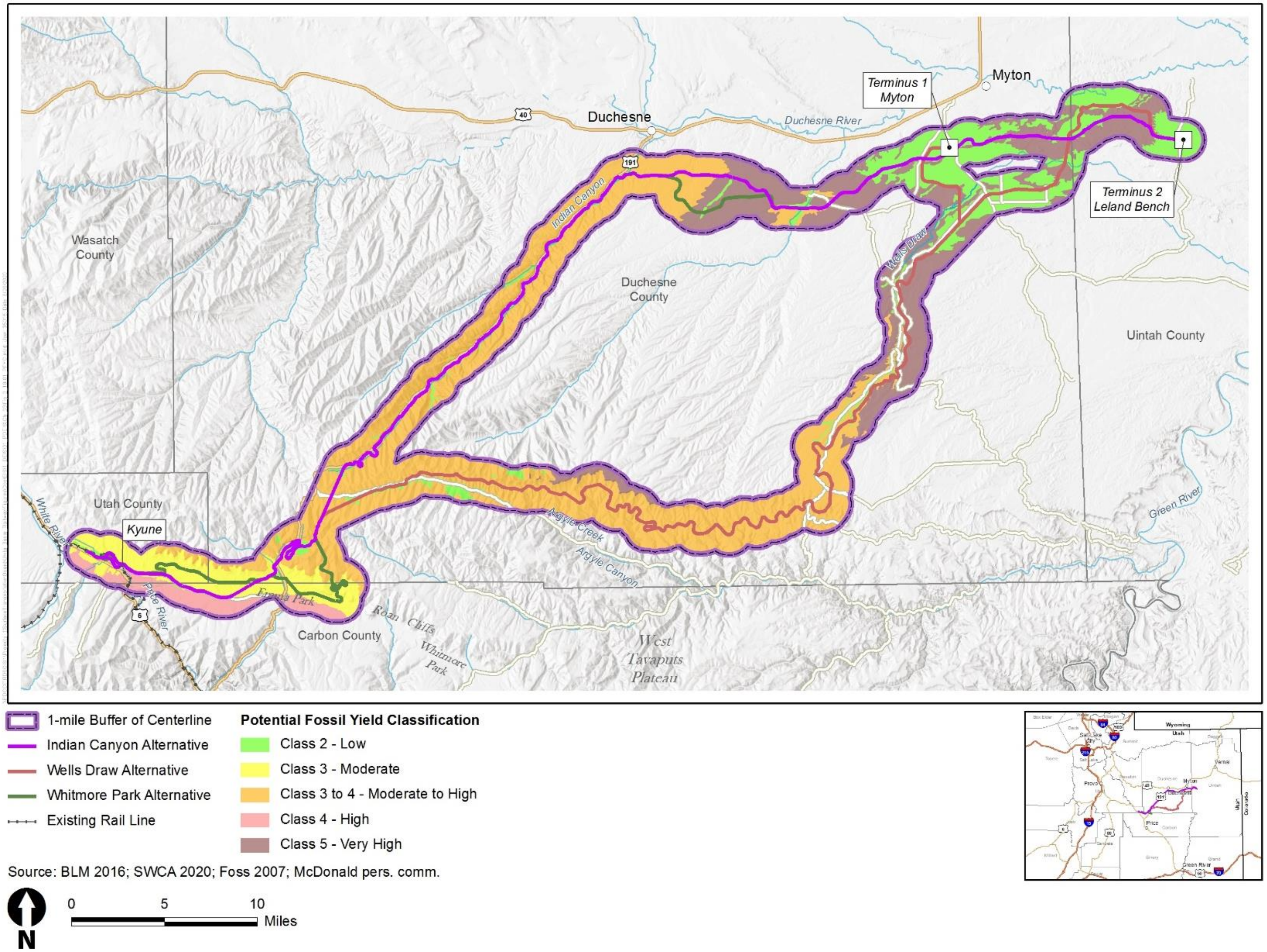
While detailed information regarding the size and locations of surface and subsurface construction activities is not known at this stage of design, OEA used general locational information about project features (e.g., areas of cut and fill) to estimate impacts on paleontological resources from excavating activities. As discussed previously, excavating activities pose a greater risk of damaging or destroying scientifically important paleontological resources than temporary surface activities. Table 3.10.4 identifies the acreage of paleontologically sensitive PFYC acreage within areas of cut and fill where the Coalition would remove material (i.e., the areas of cut), and within tunnels where the Coalition would use drilling and blasting procedures to construct the tunnel. Other construction activities, such as grading, for which specific location information is not known, could also result in direct impacts depending on the depth of sensitive geologic units. The Wells Draw Alternative would have the highest potential for adverse impacts on scientifically important undiscovered paleontological resources because it would affect the most acreage of PFYC 4 and 5 geologic units at the surface and subsurface, followed by the Whitmore Park Alternative and then the Indian Canyon Alternative.

Table 3.10-4. PFYC Acreage in Areas of Cut and Tunnels in the Study Area by Action Alternative

Action Alternative	Construction Type	PFYC 5 Acres	PFYC 4 Acres	PFYC 3 Acres
Indian Canyon	Cut	95	96	103
	Tunnel[a]	--	46	--
	Total	**95**	**142**	**103**
Wells Draw	Cut	98	664	100
	Tunnel[a]	--	54	--
	Total	**98**	**718**	**100**
Whitmore Park	Cut	100	82	174
	Tunnel[a]	--	56	--
	Total	**100**	**138**	**174**

Notes:
[a] Based on the 100-foot-wide rail line footprint and estimated tunnel lengths. OEA anticipates the width of the tunnels to be much narrower; therefore, this acreage estimate likely overestimates impacts.
Sources: BLM 2016; SWCA 2020; Foss 2007; McDonald pers. comm.

Figure 3.10-1. Potential Fossil Yield Classification



Notes:

PFYC is shown for a 1-mile buffer from the Action Alternative centerlines for reference. The study area for paleontological resources is the project footprint.

To minimize potential impacts on scientifically important paleontological resources, OEA is recommending mitigation requiring the Coalition to develop and implement a paleontological resources monitoring and treatment plan (PALEO-MM-1). Except for tunnel mining and blasting, which cannot be safely monitored, impacts resulting from construction activities can be mitigated by following the procedures of a paleontological monitoring and treatment plan. To address impacts from tunnel construction, OEA is recommending mitigation requiring the Coalition inspect the spoils piles created by tunnel construction activities, which would allow for the potential recovery of fossil resources (PALEO-MM-1).

Of the 26 known scientifically important localities in the study area for the Indian Canyon Alternative and Whitmore Park Alternative, two are located on private land and the remaining 24 are located on Tribal trust land. There is one scientifically important fossil locality within the study area of the Wells Draw Alternative located on private land. None of these localities were removed at the time of discovery, and OEA assumes that the fossils remain at the sites.

All three Action Alternatives would cross a scientifically well-known and fossil-rich area named Myton Pocket, which has produced abundant, well-preserved, and scientifically important paleontological resources. Six of the documented fossil localities in the study area of the Indian Canyon Alternative and one of the documented localities in the study area of the Wells Draw Alternative are within the Myton Pocket area. Although OEA has not identified any previously discovered Myton Pocket fossil localities within the study area of the Whitmore Park Alternative, it is likely that the study area contains undiscovered fossil localities. Because all three Action Alternatives would cross the Myton Pocket, there is a high potential for adverse impacts on recorded and unknown fossil localities in this area. OEA concludes that any of the Action Alternatives would adversely affect scientifically important paleontological resources in the Myton Pocket area if mitigation measures were not implemented.

Operations

Operation of the Action Alternatives could result in indirect impacts on paleontological resources through construction of new roads that would increase public access and, thus, the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. OEA anticipates that the Action Alternatives with the longest rail lines would have the most access roads and, therefore, the greatest potential for impacts on paleontological resources. The Wells Draw Alternative, the longest rail line at approximately 103 miles long would have the greatest potential for impacts, followed by the Whitmore Park Alternative and the Indian Canyon Alternative. To minimize potential impacts from increased public access, OEA is recommending mitigation requiring the Coalition to undertake activities to increase public awareness of the importance of paleontological resources, as part of its paleontological resources monitoring and treatment plan (PALEO-MM-1).

3.10.3.3 No-Action Alternative

Under the No-Action Alternative, the Coalition would not construct and operate the proposed rail line and there would be no impacts on paleontological resources.

3.10.4 Mitigation and Unavoidable Environmental Effects

To avoid or minimize impacts on paleontological resources during construction and operation of the proposed rail line, OEA is recommending that the Board impose a mitigation measure that would require the Coalition to contract with a qualified paleontologist to develop and implement a paleontological resources monitoring and treatment plan to mitigate impacts on paleontological resources on lands classified as PFYC 3 or higher (Chapter 4, *Mitigation*). The plan should include a preconstruction survey to locate, document, and recover scientifically important paleontological resources found on the surface; monitoring of ground-disturbing activities during construction to recover scientifically important subsurface paleontological resources; inspection of spoils piles created by tunnel construction for fossils; preparation, identification, and analysis of fossils collected during surveys and monitoring; curation and deposition of scientifically important paleontological resources into a federally approved repository; and increasing public awareness of the importance of paleontological resources.

If OEA's recommended mitigation measure is imposed, OEA concludes that construction and operation of the proposed rail line would not significantly affect paleontological resources. Some direct impacts, including damage to fossils, may be unavoidable during construction, depending on the final construction methods used. Tunnel construction activities, including mining and blasting, for example, could result in the loss of scientifically important paleontological resources because these activities cannot be safely monitored. OEA believes, however, that these unavoidable impacts would be minimized by the implementation of OEA's recommended mitigation measure.