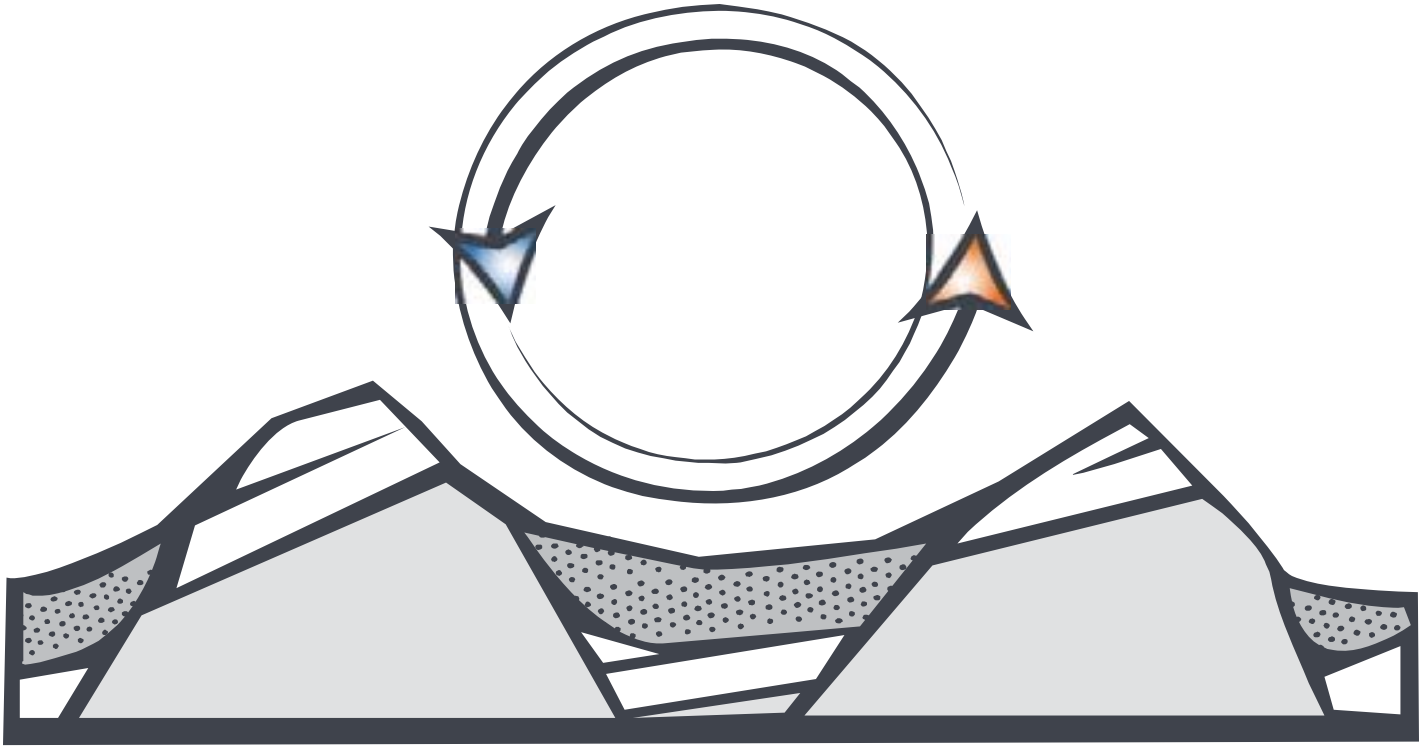

Appendix E

Review of Paleontological resource Sections of BLM Resource Management Plans in the Project Area

This page intentionally left blank

APPENDIX E
REVIEW OF PALEONTOLOGICAL RESOURCE SECTIONS OF BLM RMPS IN THE PROJECT AREA

This appendix defines the potential fossil yield classification (PFYC) System (BLM-IM 2008-009) that the BLM applies to paleontological resources and includes a summary review and PFYC estimate for readily available RMPs within the project area.

Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

Using the Potential Fossil Yield Classification (PFYC) system, geologic units are classified based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils and their sensitivity to adverse impacts, with a higher class number indicating a higher potential. This classification is applied to the geologic formation, member, or other distinguishable unit, preferably at the most detailed mappable level. It is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be

considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions.

The descriptions for the classes below are written to serve as guidelines rather than as strict definitions. Knowledge of the geology and the paleontological potential for individual units or preservational conditions should be considered when determining the appropriate class assignment. Assignments are best made by collaboration between land managers and knowledgeable researchers.

Class 1 – **Very Low**. Geologic units that are not likely to contain recognizable fossil remains.

- Units that are igneous or metamorphic, excluding reworked volcanic ash units.
- Units that are Precambrian in age or older.

(1) Management concern for paleontological resources in Class 1 units is usually negligible or not applicable.

(2) Assessment or mitigation is usually unnecessary except in very rare or isolated circumstances.

The probability for impacting any fossils is negligible. Assessment or mitigation of paleontological resources is usually unnecessary. The occurrence of significant fossils is non-existent or extremely rare.

Class 2 – **Low**. Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Vertebrate or significant invertebrate or plant fossils not present or very rare.
- Units that are generally younger than 10,000 years before present.
- Recent aeolian deposits.
- Sediments that exhibit significant physical and chemical changes (i.e., diagenetic alteration).

(1) Management concern for paleontological resources is generally low.

(2) Assessment or mitigation is usually unnecessary except in rare or isolated circumstances.

The probability for impacting vertebrate fossils or scientifically significant invertebrate or plant fossils is low. Assessment or mitigation of paleontological resources is not likely to be necessary. Localities containing important resources may exist, but would be rare and would not influence the

classification. These important localities would be managed on a case-by-case basis.

Class 3 – **Moderate** or **Unknown**. Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence; or sedimentary units of unknown fossil potential.

- Often marine in origin with sporadic known occurrences of vertebrate fossils.
- Vertebrate fossils and scientifically significant invertebrate or plant fossils known to occur intermittently; predictability known to be low.

  (or)
- Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.

Class 3a – **Moderate Potential.** Units are known to contain vertebrate fossils or scientifically significant nonvertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area, and opportunities may exist for hobby collecting. The potential for a project to be sited on or impact a significant fossil locality is low, but is somewhat higher for common fossils.

Class 3b – **Unknown Potential.** Units exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed. The unknown potential of the units in this Class should be carefully considered when developing any mitigation or management actions.

(1) Management concern for paleontological resources is moderate; or cannot be determined from existing data.

(2) Surface-disturbing activities may require field assessment to determine appropriate course of action.

This classification includes a broad range of paleontological potential. It includes geologic units of unknown potential, as well as units of moderate or infrequent occurrence of significant fossils. Management considerations cover a broad range of options as well, and could include pre-disturbance surveys, monitoring, or avoidance. Surface-disturbing activities will require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action, and whether the action could affect the paleontological

resources. These units may contain areas that would be appropriate to designate as hobby collection areas due to the higher occurrence of common fossils and a lower concern about affecting significant paleontological resources.

Class 4 – **High**. Geologic units containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented, but may vary in occurrence and predictability. Surface disturbing activities may adversely affect paleontological resources in many cases.

Class 4a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two acres. Paleontological resources may be susceptible to adverse impacts from surface disturbing actions. Illegal collecting activities may impact some areas.

Class 4b – These are areas underlain by geologic units with high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 4 is moderate to high, depending on the proposed action.

(2) A field survey by a qualified paleontologist is often needed to assess local conditions.

(3) Management prescriptions for resource preservation and conservation through controlled access or special management designation should be considered.

(4) Class 4 and Class 5 units may be combined as Class 5 for broad applications, such as planning efforts or preliminary assessments, when geologic mapping at an appropriate scale is not available. Resource assessment, mitigation, and other management considerations are similar at this level of analysis, and impacts and alternatives can be addressed at a level appropriate to the application.

The probability for impacting significant paleontological resources is moderate to high, and is dependent on the proposed action. Mitigation considerations must include assessment of the disturbance, such as removal or penetration of protective surface alluvium or soils, potential for future accelerated erosion, or increased ease of access resulting in greater looting potential. If impacts to significant fossils can be anticipated, on-the-ground surveys prior to authorizing the surface disturbing action will usually be necessary. On-site monitoring or spot-checking may be necessary during construction activities.

Class 5 – **Very High**. Highly fossiliferous geologic units that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils, and that are at risk of human-caused adverse impacts or natural degradation.

Class 5a – Unit is exposed with little or no soil or vegetative cover. Outcrop areas are extensive with exposed bedrock areas often larger than two contiguous acres. Paleontological resources are highly susceptible to adverse impacts from surface disturbing actions. Unit is frequently the focus of illegal collecting activities.

Class 5b – These are areas underlain by geologic units with very high potential but have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation due to moderating circumstances. The bedrock unit has very high potential, but a protective layer of soil, thin alluvial material, or other conditions may lessen or prevent potential impacts to the bedrock resulting from the activity.

- Extensive soil or vegetative cover; bedrock exposures are limited or not expected to be impacted.
- Areas of exposed outcrop are smaller than two contiguous acres.
- Outcrops form cliffs of sufficient height and slope so that impacts are minimized by topographic conditions.
- Other characteristics are present that lower the vulnerability of both known and unidentified paleontological resources.

(1) Management concern for paleontological resources in Class 5 areas is high to very high.

(2) A field survey by a qualified paleontologist is usually necessary prior to surface disturbing activities or land tenure adjustments. Mitigation will often be necessary before and/or during these actions.

(3) Official designation of areas of avoidance, special interest, and concern may be appropriate.

The probability for impacting significant fossils is high. Vertebrate fossils or scientifically significant invertebrate fossils are known or can reasonably be expected to occur in the impacted area. On-the-ground surveys prior to authorizing any surface disturbing activities will usually be necessary. On-site monitoring may be necessary during construction activities.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
AK	Anchorage	Bay	July 2006	yes	2, 4 and 5	Short section with no specific information. Paleontological resources assessed by Lindsey (1986).
AK	Anchorage	Ring of Fire	June 2006	yes	2, 4 and 5	Moderately thorough description (by sub-area) of paleontological resources and previous work.
AK	Fairbanks and Anchorage	Kobuk-Seward	February 2006	yes	cannot be determined	Short section with little specific information. Paleontological resources assessed by Lindsey (1986).
AK	Glennallen	East Alaska	April 2006	yes	3, 4 and 5	Moderately thorough description (by sub-area) of paleontological resources and previous work.
AZ	Arizona Strip	Arizona Strip	January 2007	Appendix 3b	2, 3, 4 and 5	Virtually no paleontologic discussion within the AE chapter. Appendix 3B contains information on paleontological resource occurrences, and a geologic map is provided (map 3.10). Figures 3.1 and 3.2 are stratigraphic sections.
AZ	Arizona Strip	Vermillion Cliffs and Grand Canyon-Parashant Nat. Mons.	January 2007	yes	2, 3, 4 and 5	Essentially the same paleontological report as the Arizona Strip RMP
AZ	Lake Havasu	Arizona and California	May 2007	yes	cannot be determined	Paleontological resources are discussed, but no specific details of fossils, geologic formations, or paleontological sensitivity is included. Paleontological resource classification system used is not the current PFYC. Insufficient information is provided to assess paleontological sensitivity or to provide PFYC designations. Paleontology section written by an archaeologist.
AZ	Tucson	Ironwood Forest Nat. Mon.	March 2007	yes	1 and 2	Brief paleontological resource section that concludes that only PFYC class 1 and 2 are present. Paleontological resources analyzed by Cultural Resource and Geological Staff (not by a paleontologist). Insufficient information is included to properly assess paleontological sensitivity.
AZ	Yuma	Arizona and California	December 2006	yes	2, 3, 4 and 5	Broad paleontological discussion with short list of known fossils provided, but no specifics on geologic formation associations, and no information about

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
						formations and their fossil occurrences. Paleontological resource evaluation conducted by a geologist/archaeologist.
CA	Arcata	Headwaters Forest Reserve	September 2003	no	cannot be determined	No mention of paleontological resources.
CA	Arcata	King Range	November 2004	yes	cannot be determined	Short paragraph concluding that paleontological resources would not be affected, and thus are not discussed or analyzed in the RMP. Based on the geologic map provided, and the information included in the geology section, paleontologic resources may actually be affected. No paleontologist input included in RMP.
CA	Bakersfield district	Caliente Resource Area	August 2007	no	2, 3, 4 and 5	Virtually no mention of paleontological resources and no specific AE chapter provided. Fossil occurrences are mentioned within three of the 16 ACEC sections (chapter 11). These provided sufficient information to tentatively provide PFYC designations.
CA	California Desert District	South Coast Resource	June 1994	no	cannot be determined	No mention of paleontological resources.
CA	California Desert District	California Desert Conservation area	March 1999	no	cannot be determined	Paleontological resources discussed in the context of "cultural and paleontological resources." However, no specific discussion of paleontological resources is provided, nor is there any mention of specific paleontological resources within the management area.
CA	Eagle Lake		May 2007	no	cannot be determined	Paleontological resources are included in the AE chapter section 3.2 (Cultural Resources and Paleontology), but no discussion of paleontology is provided, nor is there any mention of paleontological resources within the management area.
CA	El Centro	Eastern San Diego Co.	February 2007	yes	cannot be determined	A paleontological resources discussion is included, but with no reference to the types of paleontological resources occurring in the management area, or to exposures of specific formations. Furthermore, the paleontological resource classification system used in

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
						this RMP is not the PFYC.
CA	Folsom	Sierra	not available	yes	cannot be determined	One short paragraph concluding that paleontological resources are limited to plant microfossils. No information about specific geologic formations is provided.
CA	Palm Springs-South Coast	Santa Rosa and San Jacinto Mnts	February 2004	no	cannot be determined	No assessment of paleontological resources.
CA	Surprise		May 2007	no	cannot be determined	Paleontological resources included in the AE chapter section 3.2 (Cultural Resources and Paleontology), but no discussion of paleontological resources is provided, nor is there any mention of paleontological resources within the management area.
CA	Ukiah District	Redding resource	July 1992	no	cannot be determined	No assessment of paleontological resources.
CO		McInnis Canyon/ Colorado Canyons Conservation area	July 2004	yes	2, 3, 4 and 5	General description of paleontological resources in the area with some reference to fossil types and mapped formations. No citations of primary literature used in analysis.
CO	Canon City District	Northeast Resource area	May 1985	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, there is no specific discussion about, nor specific reference to, fossils or formations.
CO	Canon City District	Royal Gorge	January 1995	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Canon City District	San Luis	September 1991	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Craig District	Kremmling	1983	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
CO	Craig District	White River	July 1997	no	cannot be determined	Paleontological resources discussed in the context of management and mitigation. However, no specific discussion about, nor specific reference to, fossils or formations is provided.
CO	Glenwood Springs	Roan Plateau	August 2006	yes	2, 3, 4 and 5	Fairly complete review of paleontological resources in the field office.
CO	Montrose District	San Juan/San Miguel	December 1984	yes	2, 3, 4 and 5	Paleontological resources section is brief, and references some specific formations, but lists no specific fossil types.
CO	Montrose District	Uncompahgre	September 1998	no	cannot be determined	Paleontological resources discussed in response to public comment; however, there is no specific discussion about, nor specific reference to, fossils or formations.
CO	San Juan	Silverton	August 2004	no	cannot be determined	No assessment of paleontological resources.
ID	Twin Falls District	Craters of the Moon	July 2005	yes	2	Very general discussion of types of fossils found in various Pleistocene deposits and tree molds in lava flows.
ID	Boise district	Snake River Birds of Prey	April 2006	yes	cannot be determined	Report concluded that paleontological resources would not be impacted. No specific information on the fossils or formations in the management area is provided.
ID	Boise district	Cascade Resource area	not available	yes	cannot be determined	Very brief paleontological resources section with no specifics on fossil types or formations.
ID	Burley	Cassia	January 1985	no	cannot be determined	No assessment of paleontological resources.
ID	Challis	Challis Resource area	July 1999	no	cannot be determined	Very brief (6 pages) RMP with no mention of paleontological resources other than a statement of protection.
ID	Coeur d'Alene		October 2006	yes	1 and ?5	Paleontological resources determined to be of low significance, but no reference to specific formations was made. Report references an old PFYC classification system.
ID	Cottonwood		May 2006	yes	2, 3	Brief paleontological resources section with general description of types of fossils and rocks found in the

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
						management area.
ID	Jarbidge	Jarbidge Resource Area	1987- Under revision	yes	cannot be determined	Brief review of areas of paleontological resources in the management area.
ID	Idaho Falls district	Medicine Lodge	December 1985	no	cannot be determined	No assessment of paleontological resources.
ID	Lower Snake River Dist.	Bureau	August 2001	no	cannot be determined	2 page Environmental Statement; Notice of intent
ID	Lower Snake River Dist.	Owyhee	December 1999	no	cannot be determined	No assessment of paleontological resources.
ID	Pocatello		October 2006	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.
ID	Salmon	Lemhi	August 2001	no	cannot be determined	No assessment of paleontological resources.
ID	Shoshone and Burley	Monument	January 1986	no	cannot be determined	No assessment of paleontological resources.
MT	Butte	Butte Resource area	June, 2007	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Butte District	Garnet	January 1986	no	cannot be determined	No assessment of paleontological resources.
MT	Butte District	Headwaters	November 1983	no	cannot be determined	No assessment of paleontological resources.
MT	Dillon	Dillon	March 2004	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.
MT	Lewiston District	West HiLine	1988	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Lewiston District	Upper Missouri River Breaks	September 2005	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
MT	Miles City District	Big Dry	February 1995	yes	2, 3, 4 and 5	Thorough review of paleontological resources in the management area.
MT	Miles City District	Billings Resource area	November 1983	no	2, 3, 4 and 5	Estimated PFYC classes based on stratigraphic section (Figure 3.1) included in chapter 3 geology section.
MT	Miles City District	Powder River	December 1984	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.

Table E-1
Review of RMPs and PFYC Estimates

State	Field Office/District	Area	Date of RMP	Paleontological Resources Analyzed?	PFYC Class Estimate[1]	Comments
			1984			management area.
UT		Grand Staircase-Escalante	February 2000	yes	2, 3, 4 and 5	Brief review of paleontological resources in the management area.
WA	Spokane District	Iceberg Point	June 1990	no	cannot be determined	No assessment of paleontological resources.
WA	Spokane District	Spokane	June 1992	no	cannot be determined	No assessment of paleontological resources.
WA	Spokane District	Yakima Firing Center	June 1993	no	cannot be determined	No assessment of paleontological resources.
WY	Casper	Platte River	July 1985	no	cannot be determined	No assessment of paleontological resources.
WY	Casper	Newcastle/ Nebraska	May 1992	no	cannot be determined	No assessment of paleontological resources.
WY	Newcastle		September 2000	no	cannot be determined	No assessment of paleontological resources.
WY	Pinedale	Snake River	April 2004	no	cannot be determined	No assessment of paleontological resources.
WY	Rawlins	Lander	June 1987	no	cannot be determined	No assessment of paleontological resources.
WY	Rawlins	Great Divide	November 1990	no	cannot be determined	No assessment of paleontological resources.
WY	Rock Springs	Green River	October 1997	no	cannot be determined	No assessment of paleontological resources.
WY	Rock Springs	Kemmerer	June 1986	no	cannot be determined	No assessment of paleontological resources.
WY	Rock Springs	Pinedale	December 1988	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Grass Creek	September 1998	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Washakie	September 1988	no	cannot be determined	No assessment of paleontological resources.
WY	Worland	Cody	November 1990	no	cannot be determined	No assessment of paleontological resources.