

5.16 PALEONTOLOGICAL RESOURCES

5.16.1 AFFECTED ENVIRONMENT

Background

The Cadiz Project area is mostly located on lake playas which are part of a great trough running from Manix Lake southeast across the Mojave Desert via Bristol, Cadiz and Danby dry lakes. The trough is characterized by a series of broad, alluvial valleys outlined by fault zones. South of Amboy, the trough is named the Bristol-Cadiz-Danby Trough. It has been speculated that the Bristol-Cadiz-Danby Trough was a route which connected the ancestral Colorado River to the Mojave River. The Mojave River drainage system supported a series of permanent lakes in Pleistocene times the largest of which was Lake Manix (Reynolds 1991) to the northwest of the Cadiz Project site.

The extent and relationships of the Pleistocene bodies of water are unresolved, as is the structural nature of the trough. It is very likely that fossils from the Cadiz Project area could provide essential biostratigraphic data that will contribute to a greater understanding of these issues.

Results of the Literature Research and Field Surveys

Most of the project area is undeveloped and no paleontological resources are recorded for those areas. Fossils in the general region of the project were located as part of the All American-Celeron pipeline (10 localities) and Pacific Agriculture (169 localities) projects (Reynolds 1991).

During the field survey for this project, Gust Osteological Analysis and RMW Paleo Associates located 23 fossil localities and one fossil locality was located by Applied Earthworks (Æ) as shown in Table 5.16-1.

Identifiable fossils were recovered from 23 of the 24 localities as shown in Table 5.16-1. The fossils recovered along the water conveyance facility alignments consist largely of fragments of mammalian longbones and one rabbit bone. The variety of fossils collected from the wellfield area include flamingo, Canada goose, mammoth, camel, two kinds of horse, coyote, dwarf pronghorn antelope, jackrabbit, ground squirrel, kangaroo rat and freshwater snail. The fossils were identified by Christopher Shaw, Sherri Gust, Richard Reynolds and Daniel Guthrie. These specimens show excellent condition and demonstrate the potential for important information to be recovered.

Most of the Cadiz Project area consists of lake beds, paleosols and carbonate beds with a high potential for subsurface paleontological resources. A few parts of the Cadiz Project area appear to consist of paleosols overlain by recent alluvium, particularly where the Combination Alternative water conveyance facility alignment passes the Kilbeck Hills and to the north of the Iron Mountain Pumping Plant. Even those areas where no surface fossils were recovered have a high potential for subsurface fossil resources.

The area of abundant fossils in the project wellfield area does not have the depositional characteristics of a lake bed. Rather, that area consists of carbonate beds, including caliche and root casts, interspersed with sandy silts. A lake margin playa or marsh environment is indicated by the fossil assemblage and the carbonate beds. This was also the conclusion reached by previous paleontologists (Reynolds 1991). This area is referred to as the Cadiz Playa in this EIR/EIS. The Cadiz Playa is east of the dry bed of Bristol Lake and north of the dry bed of Cadiz Lake. It may have received water from one, both or smaller drainages of Fenner Valley.

**TABLE 5.16-1
FOSSIL LOCALITIES DOCUMENTED IN THE CADIZ PROJECT FIELD SURVEY**

Location No.	Location ID	USGS Quadrangle	Notes	Owner
59	TJM	Cadiz Lake NW	Alluvium	Cadiz Inc.
60	TJM	Cadiz Lake NW	Carbonate	Cadiz Inc.
65	MWT	Chubbuck	Paleosol	BLM
185	EAB	Chubbuck	Paleosol	BLM
186	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
187	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
188	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
189	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
190	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
191	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
192	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
193	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
194	EAB	Chubbuck	Paleosol	BLM
195	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
206	SRA	Cadiz Lake NW	Carbonate	Cadiz Inc.
207	SRA	Cadiz Lake NW		Cadiz Inc.
208	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
209	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
210	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
211	MLP	Cadiz Lake NW	Jacket	Cadiz Inc.
1272	DNS	Chubbuck	Not collected	BLM
1273	DNS	Cadiz Lake NW	Jacket	Cadiz Inc.
1274	DNS	Cadiz Lake NW		Cadiz Inc.

The time of deposition of the Cadiz Playa as currently exposed appears to have been within 1.8 to 0.4 million years ago. This estimate is based on the total faunal assemblage recovered from the Cadiz Playa, both by the survey for the Cadiz Project and previous work by the San Bernardino County Museum (SBCM). The land mammal chronological sequence for North America based on characteristic faunal assemblages associated with geochemical dates is well defined in California (Lundelius et. al. 1987). The identification and analysis of the SBCM collection as reported in Reynolds (1991) and Reynolds and Reynolds (1992) indicated the presence of the giant tortoise (*Geochelone* sp.), which is found in Irvingtonian to Rancholabrean Age deposits. Additional review of that collection resulted in identification of nine specimens of the Rexroad cat (*Felis rexroadensis*) which is Blancan to Irvingtonian Age. The survey collection for this project contains mammoth (*Mammuthus* sp.) which is not present in the Blancan. Based on the presence of these temporally diagnostic genera, the Cadiz Playa is Irvingtonian in age (Lundelius et. al. 1987). Subdivisions of the Irvingtonian, based on rodent assemblages are also well defined (Repenning 1987), however the existing samples are insufficient for this type of analysis.

The boundary of the Blancan and Irvingtonian Age corresponds to the Pliocene-Pleistocene boundary. Since the current surface has partially exposed Irvingtonian deposits, there is enormous potential for subsurface excavation to reveal older deposits.

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Comparative analysis of stratigraphy and fossil communities, as sampled throughout the Bristol-Cadiz-Danby Trough in conjunction with this project, could provide information on paleohydrologic history, timing and prehistoric life.

5.16.2 CEQA THRESHOLDS OF SIGNIFICANCE

Paleontologic resources are nonrenewable resources of important scientific value which include fossils and fossiliferous deposits. For purposes of CEQA, a project would be considered to result in a significant adverse impact related to paleontological resources if it results in the disturbance or destruction of rock formations determined to have high potential for significant nonrenewable fossiliferous resources, as defined by the Society of Vertebrate Paleontologists (SVP). As noted earlier, there are fossiliferous formations documented for the Cadiz Project area. Because these formations have high potential for containing important paleontological resources, based on previously recorded sites in these formations, the disruption or destruction of these formations would be considered a significant adverse impact of the Cadiz Project.

According to guidelines of the San Bernardino County Museum, fossils are considered to be of significant scientific interest if one or more of the following apply:

- The fossils provide data on the evolutionary relationships and developmental trends among organisms, both living and extinct;
- The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;
- The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;
- The fossils demonstrate unusual or spectacular circumstances in the history of life; and
- The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism or commercial exploitation, and are not found in other geographic locations.

As defined, significant paleontologic resources are determined to be fossils or assemblages of fossils which are unique, unusual, rare, uncommon, diagnostically or stratigraphically important, and/or those which add to an existing body of knowledge in specific areas-stratigraphically, taxonomically and/or regionally. They can include fossil remains of large to very small aquatic and terrestrial vertebrates, remains of plants and animals previously not represented in certain portions of the stratigraphy, and assemblages of fossils that might aid in stratigraphic corrections, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimateology and the relationships of aquatic and terrestrial species. For any or all of these reasons, paleontologic remains are recognized as nonrenewable resources significant to American culture, and as such are protected under provisions of the Federal Land Policy Management Act of 1976 and subsequent related legislation, policies and enacting responsibilities.

For a further discussion of CEQA thresholds of significance, see Section 5.20.

5.16.3 METHODOLOGY

Paleontological resource impacts were evaluated for the following components of the Cadiz Project alternatives:

- A pumping plant at the site of the existing Iron Mountain Pumping Plant and the Colorado River Aqueduct (Eastern and Eastern/Canal Alternatives) and at the Iron Mountain Pumping Plant West Portal of the Western and Combination alternatives water conveyance facility alignment.
- An approximately 35-mile long water conveyance facility from the Colorado River Aqueduct to the Cadiz-Fenner valleys for all the alternative alignments.
- Spreading basins and extraction wells in the Cadiz-Fenner valleys for all the alternatives.
- A power distribution facility easement north of the Riverside/San Bernardino County line for the Western and Combination Alternatives.

Background research included a review of pertinent geologic and paleontological literature, maps and other documentation. The Regional Paleontologic Locality Inventory at the SBCM was searched for records of previously recovered fossils in the Cadiz Project area.

Based on previous paleontological work in the area showing substantial surface fossils, a field survey was conducted of the alternative water conveyance facility alignments, the project wellfield, project spreading basins and the power distribution facility.

The field survey was conducted in two-person teams spaced approximately 50 yards apart. Deviations to inspect potentially fossiliferous outcrops and exposures were made when appropriate. Surface visibility was excellent in most areas.

All potentially significant paleontological resources were documented with a written record and photographs. The presence of any identifiable paleontological resources constituted a fossil locality. Fossils judged to be both significant and subject to possible damage were collected and prepared in accordance with the SVP Guidelines.

5.16.4 IMPACTS

The Cadiz Project will have both beneficial and adverse effects related to paleontological resources. Adverse effects include direct impacts (crushing, breaking, removal) through ground-disturbing activities such as grading of the construction zone and trenching for the water conveyance facilities and wellfield. These activities could result in the loss of paleontologic resources. The construction duration will be short-term but the loss of paleontological resources will be permanent and irretrievable. Indirect adverse impacts during construction include clearing, dumping, vehicular damage (mostly from weight crushing fossils), construction storage and illegal collecting. Most of these impacts are also permanent and potentially significant as they make fossils permanently unavailable for scientific investigation by destroying or removing them.

Beneficial effects will result from retrieval of fossils and sediments for scientific study. As a byproduct of the recovery, scientific work and educational activities could occur.

The paleontologic significance of the Cadiz Project area was assessed based on the survey conducted and geologic maps of rock units. Overall, because of its location in the Bristol-Cadiz-Danby Trough with its richly fossiliferous lake beds, carbonate beds and paleosols, the Cadiz Project is in an area with high potential for paleontological resources. Figure 5.16-1 indicates the locations of important soil and rock units, with high potential for paleontological resources, along the water conveyance facility alignments and in the vicinity of the other Cadiz Project features.

Eastern and Eastern/Canal Alternatives

As shown on Figure 5.16-1, three segments of the Eastern and Eastern/Canal alternatives water conveyance facility alignment pass through areas of high potential for paleontological resources consisting of lake beds and paleosols. The project wellfields and spreading basins are in areas with high potential for resources, including carbonate beds in the Cadiz Playa. The remaining segments of the Eastern and Eastern/Canal alternatives water conveyance facility pass through areas with recent alluvium. It is anticipated that the paleosols extend under this alluvium. Because the depth of the overlying alluvium is currently unknown, it is assumed that excavation would intercept the possible underlying paleosol. As a result, these segments of the Eastern and Eastern/Canal alternatives water conveyance facility alignments are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock formations along the Eastern Alternative and Eastern/Canal alternatives water conveyance facility alignments and in the vicinity of the other project facilities, construction could result in significant adverse impacts on paleontological resources. Mitigation measures, provided later in this section, would substantially reduce this potential adverse impact of these alternatives. However, residual impacts could remain significant, particularly if the water conveyance facilities trench intercepts the underlying paleosol.

Once construction is completed, the only activity along the Eastern and Eastern/Canal alternatives water conveyance facility and at the project facilities will be associated with operations and maintenance of the project facilities. All traffic will be restricted to existing roads or permanent maintenance roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term, there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under these alternatives.

Western Alternative

As shown on Figure 5.16-1, a long segment in the middle part of the Western Alternative water conveyance facility passes through areas of high potential for paleontological resources consisting of lake beds and paleosols. The project wellfield and project spreading basins are in areas with high potential, including carbonate beds in the Cadiz Playa. The remaining segments of the Western Alternative water conveyance facility pass through areas with recent alluvium. It is anticipated that the lake beds and paleosols extend under this alluvium. Because the depth of the overlying alluvium is unknown at this time, it is assumed that pipeline trenching would intercept the anticipated underlying fossil-bearing formation.

As a result, these segments of the Western Alternative water conveyance facility are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock formations along the Western Alternative water conveyance facility and in the vicinity of the other project features, construction of this alternative could result in significant adverse impacts on paleontological resources. Mitigation measures, provided later in this section, would substantially reduce this potential adverse impact of this alternative, but residual impacts could remain significant.

Once construction is completed, the only activity along the Western Alternative water conveyance facility and at the project facilities will be associated with operations and maintenance. All traffic will be restricted to existing roads or permanent access roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term,

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there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under the Western Alternative.

Combination Alternative

As shown on Figure 5.16-1, two segments of the Combination Alternative water conveyance facility alignment pass through areas of high potential for paleontological resources consisting of paleosols and lake beds. The project wellfield and spreading basins are in areas with high potential, including carbonate beds. The remaining segments of the Combination Alternative water conveyance facility pass through areas with recent alluvium. It is anticipated that the lake beds and paleosols extend under this alluvium. Because the depth of the overlying alluvium is unknown at this time, it is assumed that pipeline trenching may intercept the anticipated underlying fossil-bearing formation.

As a result, these segments of this water conveyance facility alignment are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock formations along the Combination Alternative water conveyance facility and in the vicinity of the other project facilities, construction of this Alternative could result in significant adverse impacts on paleontological resources. Mitigation measures provided later in this section would substantially reduce this potential adverse impact, but residual impacts could remain significant.

Once construction is completed, the only activity along the Combination Alternative and at the project facilities will be operations and maintenance of the project facilities. All traffic will be restricted to existing roads or permanent access roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term, there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under the Combination Alternative.

No Project Alternative

Fossils, including the significant assemblage of the Cadiz Playa, would not be affected by construction-related impacts under the No Project Alternative, since no construction would occur. However, erosion and damage from existing land uses would degrade the fossil resources. Fossils and related samples would not be available for scientific study, education or public relations under the No Project Alternative.

5.16.5 MITIGATION MEASURES

The mitigation program is designed to alleviate adverse impacts on paleontologic resources as a result of the Cadiz Project. Due to the fact that so much of the Cadiz Project area has high-potential for fossils, there could be significant adverse impacts on paleontological resources under all the build alternatives. To reduce these adverse impacts to an acceptable level, a major part of the mitigation effort will be directed toward the recovery of scientifically important fossils, recovery of associated scientific data, preliminary work to establish the significance of the collection and preservation of recovered specimens in a recognized repository to allow future study by qualified investigators. To accomplish these goals, the following mitigation measures are required for all project alternatives:

- P-1 Prior to initiation of Cadiz Project construction, a paleontologist shall relocate the fossil localities that are within the Cadiz Project construction right-of-way to evaluate the recorded sites and determine the need for further data collection including excavation.

- P-2 A paleontological monitor shall be present during construction trenching and grading operations within areas with a high potential to uncover fossils. If subsequent information indicates that alluvial layers overlying fossil-bearing strata are of sufficient thickness to avoid interception of those fossil-bearing areas, no paleontological monitor needs be present during ground disturbing activities in those areas.
- P-3 The paleontological monitor shall work with the construction manager to salvage whole fossils or complete elements such as whole skeletons or sections of skeletons. Fossils may be salvaged from the trench spoil to the degree possible, and may be salvaged from within the trenches particularly to recover whole skeletons or sections of skeletons with the concurrence of the construction manager.
- P-4 The paleontological monitor shall collect soil samples from random locations along the water conveyance facility trench where fossil-bearing strata are intercepted to obtain a representative sample of fossils and associated data in the Cadiz Project construction area. The paleontologist shall prepare a sampling program to be approved by BLM and Metropolitan.
- P-5 The salvaged fossils and sediment samples shall be processed, analyzed and curated in accordance with accepted government standards. A report shall be promptly prepared to document methods, findings, results and conclusions and shall include an itemized inventory of specimens. The report shall be submitted to BLM, Metropolitan, and the County of San Bernardino.
- P-6 Cadiz Project-sponsored funding of the paleontological salvage, processing, analysis, curation and report preparation shall not exceed 0.25 percent of the total construction costs for the Cadiz Project.

5.16.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Mitigation measures P-1 through P-6 will substantially reduce the adverse impacts of the Cadiz Project related to paleontological resources. It is anticipated that human error and the practical limitations on recovery imposed by the construction schedule will cause loss of some fossil remains and perhaps destruction of some unrecorded fossil localities. However, it is possible to reduce events of this nature based on the implementation of mitigation measures P-1 through P-6.

Nonetheless, the Cadiz Project could result in significant adverse impacts on paleontological resources that cannot be mitigated to a below a level of significance after mitigation.