

## 27.1 Environmental Setting/Affected Environment

In this section, paleontological resources are described within the study area (the area in which impacts may occur), which is defined as the Plan Area (the area covered by the BDCP). The Plan Area consists of the Sacramento–San Joaquin Delta (Delta, Suisun Marsh area, and portions of the Yolo Bypass). Paleontological resources, typically called fossils, are the remains, traces, imprints, or life history artifacts (e.g., nests) of prehistoric plants and animals found in ancient sediments, which may be either unconsolidated or lithified (i.e., either poorly or well cemented). Fossils are considered nonrenewable scientific and educational resources. Fossils include the bones and teeth of animals, the casts and molds of ancient burrows and animal tracks, and very small remains such as the bones of birds and rodents. They also include plant remains such as logs, prehistoric leaf litter, and seeds. Recovered specimens in the Delta area range from the shells of marine invertebrates that occupied the Mesozoic seas before this part of California was uplifted and accreted to the North American continent more than 65 million years ago, to the bones and teeth of extinct Pleistocene megafauna such as mammoths and giant ground sloths that are less than 200,000 years old.

### 27.1.1 Potential Environmental Effects Area

This section addresses paleontological resources and the potential effects of the BDCP alternatives on paleontological resources in the Delta and Suisun Marsh areas (see Figure 1-9 in Chapter 1, *Introduction*). Information sources for this section include geological, geomorphic, and sedimentological studies, and data from the University of California Museum of Paleontology (UCMP) paleontological database collected for the Delta and its surrounding areas.

The probability of encountering fossils (paleontological sensitivity) depends on the type of geology at an excavation site; the information below is related to geological resources to the extent necessary to assess the presence of fossils. The geological units present in the Delta are discussed in Chapter 9, *Geology and Seismicity*. Figures from Chapter 9 that are helpful to understanding the information presented in this chapter include Figure 9-1, a map showing the geomorphic provinces of California and Figure 9-2, a geologic timescale. Figure 27-2, a geologic map of the Plan Area and vicinity shows surface exposures of geologic units with the potential to contain fossils.

The probability of paleontological resources being present in the Delta, as well as their likely nature and age, is discussed in the following subsections.

#### 27.1.1.1 Physiographic Setting

The Delta encompasses the northern and lowest portion of the San Joaquin Valley and the southern and lowest portion of the Sacramento Valley, which together contain the axial streams of the Central Valley of California: the San Joaquin River to the south and the Sacramento River to the north. The northwest- to southeast-trending Great Valley geomorphic province (also known as the Central Valley physiographic province) is a geologically long-lived structural trough, approximately

1 400 miles long and 50 miles wide (California Geological Survey 2002). This nearly flat alluvial plain  
 2 lies between the Sierra Nevada on the east and the Coast Ranges on the west and extends from the  
 3 Tehachapi Mountains north of Los Angeles to the Klamath Mountains (e.g., Norris and Webb  
 4 1990:412–414; Bartow 1991).

5 The Great Valley is floored by a thick sequence of sedimentary deposits that range in age from  
 6 Jurassic (about 144 to 208 million years before present [BP]) through Quaternary (present to 1.6  
 7 million BP. Under the eastern and central portions of the valley, the base of the sequence likely rests  
 8 on Mesozoic crystalline rock related to the plutons of the Sierra Nevada; to the west, basement rocks  
 9 are believed to be Franciscan metasediments (sediments that have undergone metamorphism)  
 10 and/or mélangé (large-scale breccia) similar to exposures in the Coast Ranges. Mesozoic  
 11 sedimentary rocks now in the subsurface record marine deposition. They are overlain by Tertiary  
 12 strata reflecting marine, estuarine, and terrestrial conditions, which are in turn overlain by  
 13 Quaternary fluvial and alluvial strata (river and floodplain deposits) recording uplift and erosion of  
 14 the Sierra Nevada and Coast Ranges to approximately their present shape (e.g., Norris and Webb  
 15 1990:412–414; Bartow 1991).

16 The region's proximity to the San Andreas Fault Zone results not only in tectonic activity but also in  
 17 local deformation. The Montezuma Hills constitutes an area of active deformation and a recently  
 18 upwarped crustal segment (Weber 2005), while the Carquinez Strait itself may have been closed  
 19 prior to about 0.6 million BP as a result of this activity (Lettis and Unruh 1991). Prior to 0.6 million  
 20 BP, a vast lake or network of lakes and marshes extended more than 200 miles along the floor of the  
 21 Central Valley, primarily to the south along the axis of the San Joaquin River. The end of this period  
 22 of lacustrine deposition during the Middle Pleistocene was likely due to the opening of the  
 23 Carquinez Strait (Lettis and Unruh 1991), which led to the formation of the geologically "modern"  
 24 Delta.

### 25 **27.1.1.2 Geologic and Stratigraphic Setting**

#### 26 **Near-Surface, Unconsolidated Geologic Units**

27 The unnamed geological units in the Delta and Suisun Marsh consist of a variety of facies reflecting  
 28 different environments of deposition, ranging from the clays, silts, and peats of flood basins and  
 29 marshes to the sands of levee, dune, and river channel deposits. This section presents an overview,  
 30 rather than a comprehensive listing, of these sediments and their relationships to the environment  
 31 of the Delta and its contributory streams. The discussion of sediments younger than that of the  
 32 Modesto Formation (i.e., less than 7,000 BP) is brief because these are usually considered too young  
 33 (middle to late Holocene age) to yield scientifically significant paleontological specimens.

#### 34 **Recent Overburden and Artificial Fill**

35 Recent overburden and artificial fill are typically considered to have no paleontological sensitivity  
 36 because there is no potential for these sediments to yield scientifically significant fossils. Recent  
 37 overburden and artificial fill includes agricultural soils, the sediments of artificially constructed  
 38 levees, historical flood basin deposits, and the historical "pulse" of outwash sediment from higher  
 39 elevations resulting not only from hydraulic gold mining in the late nineteenth century, but also  
 40 from grazing and agricultural land clearance (Florsheim and Mount 2003). The effects of historical  
 41 land management practices on sedimentation in the Delta have been pronounced, with many areas  
 42 displaying 5–10 feet of recent sediment immediately below the surface. Other areas immediately

1 outside the Delta on the distal reaches of the alluvial fan plains of the Sierra Nevada and Coast  
 2 Ranges did not experience this pulse of sedimentation because of their somewhat elevated  
 3 topographic position.

#### 4 **Delta and Estuarine Sediments**

5 Although the sedimentary sequence of the Central Valley is commonly thought to be relatively  
 6 continuous, this is not the case for most of the Delta area. Periodic lowering of sea level occurred in  
 7 the geologically recent past, resulting in sea level drops of as much as 400 feet during glacial  
 8 advances over the last 0.7 million BP (Bloom 1983). These in turn caused stream entrenchment and  
 9 hydrographic isolation of the current floodplains (Shlemon 1971). Concurrent with this  
 10 entrenchment, the Delta system retreated to the west, and the Sierran alluvial fans expanded  
 11 westward. Conversely, during interglaciations (periods of warmth comparable to today that  
 12 punctuated late Quaternary glaciations) such as the current Holocene (the last 11,000 years), sea  
 13 level rose to near present elevations, creating the present Delta system at the terminal reaches of  
 14 the Sierra Nevada alluvial fans. The overall relationship between sedimentation, sea level rise and  
 15 fall, and the glacial-interglacial climate cycle, is that the floodplains across this area are interglacial  
 16 in age, and there is a lack of glacial-age sedimentation (Shlemon 1971). It also means that the  
 17 present Delta is geologically quite young, and formed only within approximately the last 6,000 years  
 18 (Shlemon and Begg 1975).

19 As sea level rose at the end of the last glacial age, the eastward transgression of estuarine and deltaic  
 20 environments began. Atwater et al. (1977) noted that estuarine, and then marine, sedimentation  
 21 began in San Francisco Bay about 10,000 BP. Shlemon (1971) noted the beginning of estuarine  
 22 habitats in the western portion of the Delta area at about the same time. These authors concluded  
 23 that, by about 6,000 BP, habitats that characterize the historic Delta occupied much of the area.  
 24 Geographically, estuarine sediments are more common farther west in the vicinity of Suisun Marsh,  
 25 and the channels and basins are subject to periodic inundation, especially during the spring and fall  
 26 high tides. Older, middle Pleistocene delta and estuarine sediment dating to past sea-level high  
 27 stands are assumed to occur at some depth below the surface of the current Delta. Data from  
 28 Shlemon (1971; Shlemon and Begg 1975) suggest that this older sediment would occur below about  
 29 80 feet below sea level.

#### 30 **Younger Deposits of the Alluvial Fans**

31 The bounding alluvial fans and the fan-delta habitats of their distal reaches—generally above the  
 32 autumnal high-tide line—experienced a different sedimentary history than the Delta, and glacial-age  
 33 sediments can be found in those areas at relatively shallow depth (Atwater 1982). Fluvial  
 34 sedimentation in these areas occurs during overbank floods and from simple river meander after  
 35 sea level had reached near its present elevation but before the historic channelization of the Delta  
 36 (Lettis and Unruh 1991). The detailed mapping of the surficial geology of the fan-delta interface  
 37 (Marchand and Atwater 1979; Atwater 1982) recognizes two units of the Modesto Formation here,  
 38 as elsewhere. These mapping units consist chiefly of arkosic (quartz- and feldspar-rich) alluvium,  
 39 chiefly sand, and are thought to represent two periods of glacial outwash from the Sierra Nevada.

- 40 • Qm<sub>1</sub>, Qm<sub>1</sub>: Lower member of the Modesto Formation consisting of arkosic alluvium of the Sierra  
 41 Nevada alluvial fans; chiefly sand; probably glacial outwash. Finer-grained facies include the  
 42 silts and clays of flood-basin deposits.

- Qm<sub>2</sub>, Qm<sub>u</sub>: Upper member of the Modesto Formation also consisting of arkosic alluvium of the alluvial fan of tributary rivers issuing from the Sierra Nevada; chiefly sand; probably glacial outwash. Finer-grained facies include the silts and clays of flood-basin deposits. Eolian facies include isolated, relict dune fields on both Delta islands and the broad plains of the alluvial fans.

(Note: Qm and similar notations represent specific geological units in an area or region.)

#### Older Alluvium

Below the Modesto Formation is the older Riverbank Formation. The two formations are lithologically very similar because the sediments that compose each unit were derived from the same rocks in the headwaters of the contributory streams issuing from the Sierra Nevada and were deposited in similar alluvial fan environments. The primary differences between the Modesto and Riverbank Formations are age-related; they include the degree of consolidation/cementation, the amount of deformation (tilting and/or folding), and soil development. The older Riverbank Formation has been uplifted in some locations and can be distinguished based on tilted bedding from the flat-lying younger Quaternary alluvium. Closer to the Sierra Nevada, the Riverbank Formation forms higher terraces in an inverted topographic relationship with younger Modesto Formation deposits. However, discrimination of Modesto Formation alluvium from the Riverbank Formation is difficult in many cases. Where Modesto alluvium overlies the Riverbank Formation, the contact between the two units is frequently marked by a deeply developed paleosol with a pronounced clay horizon (Atwater 1982).

South of Suisun Marsh/Bay and along the southwestern margin of the Delta, an older alluvial unit crops out at the foot of the Coast Ranges. This is the Plio-Pleistocene Tulare Formation, which lies below the Riverbank Formation through much of the San Joaquin Valley (Lettis and Unruh 1991). Although it is normally found at depths exceeding 150 feet in the valley, uplift along the margin of the Coast Ranges has brought it to the surface. It is a poorly consolidated, nonmarine, gray to maroon siltstone, sandstone, and conglomerate. Near its base, the Tulare Formation contains a tuff (volcanic ash) correlated with the Putah Tuff, which has a potassium/argon age of 3.3±0.1 million BP (Graymer et al. 1994), while the upper member of the Tulare Formation contains the Corcoran Clay member, dated as early as 0.62 million BP. The Corcoran clay is a widespread lake deposit that formed approximately 800,000 to 600,000 BP when much of the Central Valley was filled by the Pleistocene Lake Clyde. The lake was drained by the down-cutting that created the modern day Carquinez Straits (Negrini et al. 2008).

In much of the Sacramento Valley north of the Delta, an older alluvial unit occurs stratigraphically below the Modesto Formation. This is the Tehama Formation (Lettis and Unruh 1991), which appears to be about the same age as the Tulare Formation of the San Joaquin Valley. North of Suisun Marsh and the Montezuma Hills on the distal portions of alluvial fans extending south and east from the Coast Ranges, the Tehama Formation forms terraces topographically inverted above the Modesto Formation. Helley and Harwood (1985) describe this partially lithified alluvial unit as a pale green to grey or tan sandstone and siltstone with lenses of cross-bedded pebble and cobble conglomerate.

The Montezuma Formation is another, older alluvial unit of early Pleistocene age, exposed by the local uplift of the Montezuma Hills. This poorly consolidated unit consists of orange-weathering, brown, poorly sorted quartz-lithic sand, silt, and pebble gravel. Pebbles include red chert and volcanics. It is mapped nowhere other than the uplift between Suisun Marsh on the west and the

1 Sacramento River channel and Brannan Island on the east (Graymer et al. 1994). Given its apparent  
2 age, it must be at least in part contemporaneous with the Tehama and Tulare Formations.

### 3 **Bedrock Sedimentary Units**

4 The Sacramento and the San Joaquin Rivers are the axial streams of their respective valleys, and  
5 define the bottom of the Central Valley. However, they are offset far to the west of what would be the  
6 geographic centerline of the Central Valley (Lettis and Unruh 1991). The Coast Ranges lie only a few  
7 miles to the west of the Delta, and essentially form its western boundary at Carquinez Strait.  
8 Conversely, the piedmont of the Sierra Nevada lies tens of miles to the east. Therefore, bedrock units  
9 that form the “rim” of the topographic depression encompassing the Delta and Suisun Marsh areas  
10 are those of the Coast Ranges, while Sierra Nevadan rocks do not occur in the area, except as clasts  
11 in Sierra-derived alluvium.

### 12 **Neogene Units**

13 The youngest Neogene sedimentary units in the area are the Pliocene to Pleistocene Tulare and  
14 Tehama Formations, described previously. They reflect terrestrial conditions after the Central Valley  
15 had been closed off to the sea. The next oldest unit reflects near-shore marine conditions. The  
16 Neroly Formation is a marine sandstone laid down in an increasingly shallow sea during the mid-  
17 Tertiary (late Miocene). With the Tulare Formation, it crops out as the most distal set of ridges and  
18 hills on the eastern and northern piedmont of the Coast Ranges, along the southern margin of the  
19 Delta.

### 20 **Paleogene and Mesozoic Units**

21 The Paleogene and Mesozoic sedimentary units of the eastern and northern margin of the Coast  
22 Ranges represent a sequence of increasingly deep ocean basins with increasing age. The Paleogene  
23 units are the Eocene Markley and Domingine Formations and the Paleocene Meganos Formation.  
24 These overlie and, in the tectonic setting of the eastern Coast Ranges south of Suisun Bay and west  
25 of the lower San Joaquin River, occur farther out into the valley than the marine sandstones,  
26 limestones, and shales that comprise the Great Valley Sequence. The sedimentary units that make up  
27 the Mesozoic and earliest Paleogene Great Valley Sequence reflect deep-water conditions when this  
28 area was an abyssal plain at the bottom of the ocean, some tens of miles west of an arc of volcanic  
29 islands that were situated where the Sierra Nevada is now located.

#### 30 **27.1.1.3 Paleontological Sensitivity of Potentially Affected Units**

31 Paleontological sensitivity is a qualitative assessment made by a professional paleontologist taking  
32 into account the paleontological potential of the stratigraphic units present, the local geology and  
33 geomorphology, and any other local factors that may be germane to fossil preservation and potential  
34 yield. According to the Society of Vertebrate Paleontology (2010), standard guidelines for sensitivity  
35 are: (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or to  
36 yield a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains; and  
37 (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic,  
38 paleoecological, or stratigraphic data (Table 27-1).

39 The assessment of the paleontological productivity of different stratigraphic units in the study area  
40 was based on the number of paleontological records attributed to those units. This determination  
41 was made through queries of the UCMP online database. In these database searches, invertebrate

1 and microfossil collecting sites were discriminated from the paleobotanical and vertebrate records  
 2 because there have been many microfossil studies (pollen, radiolaria, diatoms, foraminifera)  
 3 conducted on Cretaceous and Cenozoic sediments in this area. The associated collection sites are  
 4 listed in the UCMP database, along with localities where more traditional paleontological “finds”  
 5 have been made. Many sedimentary exposures that yield microfossils, or isolated invertebrate  
 6 remains, lack plant or vertebrate megafossils. In addition, many invertebrate and microfossil  
 7 localities in the UCMP database have no associated catalogued specimens (University of California  
 8 Museum of Paleontology 2009). Finally, invertebrate localities include sites where a molluscan  
 9 fauna has yielded important data and sites where only sponge spicules or echinoderm plates were  
 10 noted. When microfossil and invertebrate localities are excluded, the resultant number of plant  
 11 megafossil and vertebrate fossil sites is smaller and more reflective of the paleontological potential  
 12 of the sedimentary unit.

13 **Table 27-1. Paleontological Sensitivity Ratings**

Potential	Definition
High	Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. . .Paleontological potential consists of both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data.
Undetermined	Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine if these rock units have high or low potential to contain significant paleontological resources.
Low	Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have low potential for yielding significant fossils. Such rock units will be poorly represented by fossil specimens in institutional collections, or based on general scientific consensus only preserve fossils in rare circumstances and the presence of fossils is the exception not the rule.
No	Some rock units have no potential to contain significant paleontological resources, for instance high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites). Rock units with no potential require neither protection nor impact mitigation measures relative to paleontological resources.

Source: Society of Vertebrate Paleontology 2010.

14

15 The paleontological sensitivity of the geologic units found in the Plan Area is described below and  
 16 summarized in Table 27-2.

1 **Table 27-2. Summary of Paleontological Resource Sensitivity for Geologic Units in the Plan Area**

Geologic Unit	Age	Potential to Contain Significant Fossils
Recent overburden and artificial fill	Modern	No
Near-surface delta and estuarine sediment (mainly the peat and muck unit)	Holocene	Low
Modesto Formation	Holocene and Late Pleistocene (collectively, Late Quaternary)	High
Tehama Formation	Early Pleistocene	High
Montezuma Formation	Early Pleistocene	High
Tulare Formation	Pliocene to Pleistocene	High
Riverbank Formation	Pleistocene	High
Neroly Formation	Miocene	High
Markley Formation	Eocene	High
Domengine Formation	Eocene	Low
Meganos Formation	Paleocene	Low
Great Valley Sequence	Mesozoic	Low

2

3 **Recent Overburden and Artificial Fill**

4 Artificial fill and recent overburden, such as agricultural soils, are distributed extensively in the  
5 Delta and along its margins. The practice of creating land by placing artificial fill on the gently  
6 sloping tidal flats along the margin of San Francisco, San Pablo, and Suisun bays began about the  
7 time of the gold rush when California's first economic boom created a critical need for development,  
8 particularly along the waterfront. Developers used whatever materials were available for fill,  
9 including dune sand, alluvium, sediment dredged from the Bay, excavation spoils, quarried rock, and  
10 human-made debris such as foundry slag and garbage. Both the thickness and type of fill vary widely  
11 over short distances. In other areas of the Delta, fill has been used to create artificial levees and  
12 transportation causeways and to "reclaim" agricultural lands. In many cases, fill is indistinguishable  
13 from agricultural soils that have been subject to repeated tillage over the last century, and are  
14 disturbed usually to a depth of at least 3–4 feet.

15 No intact fossil material is expected in this type of disturbed sediment, and even if fragmentary  
16 remains were encountered they would lack scientific significance because they would not be in  
17 stratigraphic context. Lack of stratigraphic context means that the age and geologic setting of the  
18 fossil would be uncertain; without this information, the fossil's scientific utility would be  
19 compromised. Therefore, recent overburden and artificial fill, including agricultural soils, possess no  
20 paleontological sensitivity.

21 **Near-Surface Delta and Estuarine Sediment**

22 In the Plan Area, delta and estuarine sediments are typically Holocene (less than 10,000 BP) in age  
23 and possess low paleontological sensitivity. This is partly because recent sediments are traditionally  
24 accorded less scrutiny by paleontologists because they seldom yield scientifically significant  
25 macroscopic fossil remains. Muds and peats provide a rich source of microfossils for  
26 paleoenvironmental studies, but microfossils exist in the uncounted trillions throughout deposits of

1 estuarine mud and peat. Therefore, because they are recent in age and because they seldom yield  
 2 scientifically significant megafossils, estuarine sediments, including peat, are assigned low  
 3 paleontological sensitivity. Underlying these sediments are older Pleistocene sediments, described  
 4 below.

### 5 **Quaternary Alluvium**

6 As Florsheim and Mount (2003) described, the substantial lateral variability of environments near  
 7 the toes of the Sierra Nevada alluvial fans and on the margin of the Delta can result in substantial  
 8 change in the nature of sediment being deposited over a short distance. Prior to historical  
 9 disturbance, peats, clays, silts, and sands were laid down through the Delta in response to both  
 10 temporal and spatial changes in local environment. Fine-grained facies are indicative of low-energy  
 11 depositional environments of flood basins, sloughs, and ox-bows. These silts and clays, if laid down  
 12 under anaerobic conditions, would have the greatest paleontological potential. Higher energy  
 13 sediments of channels and splay deposits are more coarse-grained, but the sands that usually  
 14 constitute the bulk of this sediment also can be fossiliferous.

### 15 **Modesto Formation Sediments**

16 Holocene and Late Pleistocene (collectively, Late Quaternary) sediments are distributed in two  
 17 distinct fashions across the Delta and surrounding area. The Delta consists of middle to Late  
 18 Holocene sediments alone. However, surface exposures of older sediments assigned to the Late  
 19 Pleistocene, and perhaps early Holocene, Modesto Formation are situated on the surrounding delta-  
 20 fan areas and up to the first foothills of the Coast Ranges south of Suisun Bay and east of the lower  
 21 San Joaquin River (Helley and Harwood 1985; Marchand and Atwater 1979). Table 27-3 lists the  
 22 number of paleontological localities recorded at the UCMP attributed to the Modesto Formation or  
 23 to undifferentiated sediments of Quaternary age. Examples of vertebrate fossils found in the  
 24 Modesto Formation in the Plan Area include unspecified mammals and reptiles (University of  
 25 California Museum of Paleontology 2012).

26 **Table 27-3. Paleontological Localities Attributed to the Modesto Formation and Undifferentiated**  
 27 **Quaternary Sediments**

County	Number of Localities	
	Invertebrate and Microfossil	Paleobotanical and Vertebrate
Alameda	54	52
Contra Costa	99	45
Sacramento	3	1
San Joaquin	2	17
Solano	9	7
Sutter	0	4
Yolo	1	5

Source: University of California Museum of Paleontology 2009.

28  
 29 The generally higher numbers of fossil localities in Alameda and Contra Costa Counties in this  
 30 summary partly reflect the fact that these counties extend across the Coast Ranges to San Francisco  
 31 Bay and, therefore, encompass many fossiliferous exposures sampled by scientists for decades, as  
 32 well as many sites where construction-related excavations have exposed fossils. Based on this data,



1 undifferentiated Quaternary sediment and sediment assigned to the Modesto Formation possess  
 2 high paleontological sensitivity. Consideration of the data indicates that most fossil localities are  
 3 from Late Pleistocene or older contexts.

#### 4 **Older Alluvium**

5 Depending on the locality, stratigraphic setting, and authority, older alluvium in the region  
 6 immediately surrounding the Delta and Suisun Marsh has been mapped as the Tehama and  
 7 Montezuma Formations to the north, the Tulare Formation to the south, and the Riverbank  
 8 Formation to the east and south of the Delta and Suisun Marsh (Table 27-4).

9 **Table 27-4. Paleontological Localities Attributed to the Older Alluvium of the Riverbank, Montezuma,**  
 10 **Tulare, and Tehama Formations**

County	Number of Localities	
	Invertebrate and Microfossil	Paleobotanical and Vertebrate
Alameda	0	3
Contra Costa	5	14
Sacramento	0	6
San Joaquin	0	1
Solano	0	14
Sutter	0	0
Yolo	0	13

Source: University of California Museum of Paleontology 2009.

11  
 12 This tabulation of fossil sites found in older alluvium does not include those localities from the  
 13 Irvington Gravels near Hayward or the Livermore Gravels, because they are well removed from the  
 14 Delta and its periphery and have no bearing on the paleontological sensitivity of the area. However,  
 15 consistent with the prevailing standard of care, California's Pleistocene nonmarine strata have  
 16 yielded a wealth of stratigraphically important vertebrate fossils, including the assemblages that  
 17 defined both the Rancholabrean and Irvingtonian Stages of the North American Land Mammal  
 18 Chronology (Figure 27-1), which is used as a reference by paleontologists and stratigraphers across  
 19 the country. Because of this wealth of information, continental deposits of Pleistocene age are  
 20 almost universally treated as paleontologically sensitive in California. Therefore, older alluvium in  
 21 the area possesses high paleontological sensitivity. Examples of vertebrate fossils found in the  
 22 counties of the Plan Area in these units include mammoth, horses, rodents, reptiles, bony fish in the  
 23 Tehama Formation; mammoth, bison, camel, horse, deer, ground sloth, rodents, birds, reptiles,  
 24 amphibians, cartilaginous fish, bony fish in the Montezuma Formation; birds and bony fish in the  
 25 Tulare Formation; and mammoth, bison, camel, horse, ground sloth, dire wolf, rodents, moles, and  
 26 bony fish in the Riverbank Formation (University of California Museum of Paleontology 2012).

#### 27 **Bedrock Sedimentary Units**

28 The Tertiary and Mesozoic sedimentary units of the eastern and northern margin of the Coast  
 29 Ranges south of Suisun Bay, and also exposed in the Potrero Hills just north of Suisun Marsh,  
 30 represent a sequence of increasingly shallow ocean basins with decreasing age. Some units are  
 31 largely devoid of fossils, while others are quite fossiliferous. There is some correlation between

1 inferred depth at time of deposition and paleontological sensitivity, with sediments from abyssal  
2 plains (water depth exceeding 6,000 feet) generally lacking megafossils.

### 3 **Tertiary Marine Sediments**

4 Prior to the Plio-Pleistocene, sedimentary rocks are marine in origin and include the Miocene Neroly  
5 Formation indicating shallowing seas, and the deeper-water sediments of the Eocene Markley and  
6 Domengine formations (Table 27-5). The oldest Cenozoic unit mapped for fossils is the Paleocene  
7 Meganos Formation. These sediments encroach onto the Delta area and vicinity of Suisun Marsh  
8 only in extreme easterly Contra Costa and Alameda counties, and along the northern margin of  
9 Suisun Marsh in Solano County. Other marine rocks occur elsewhere in these counties, but they are  
10 removed from the Delta margin and the periphery of Suisun Marsh, and are not considered here.

11 **Table 27-5. Paleontological Localities Attributed to Tertiary Marine Sediments of the Neroly, Markley,  
12 Domengine, and Meganos Formations**

County	Number of Localities	
	Invertebrate and Microfossil	Paleobotanical and Vertebrate
Alameda	0	0
Contra Costa	188	14
Sacramento	0	0
San Joaquin	2	5
Solano	24	1
Sutter	0	0
Yolo	1	0

Source: University of California Museum of Paleontology 2009.

13  
14 The Neroly and Markley Formations have yielded megafossils and plant remains, while the  
15 Domengine has yielded microfossils and some invertebrates. No fossil localities are ascribed to the  
16 Meganos Formation in the UCMP database for the seven counties under consideration here. The  
17 Neroly and Markley Formations possess high paleontological sensitivity depending on location, and  
18 the Domengine and Meganos Formations possess low paleontological sensitivity because they do  
19 not appear to yield megafossils of either plants or vertebrates. Examples of vertebrate fossils found  
20 in the counties of the Plan Area in these units include early canid, horse, and early pronghorn in the  
21 Neroly Formation and bony fish in the Markley Formation (University of California Museum of  
22 Paleontology 2012).

## 1 Mesozoic Great Valley Sequence

2 The Mesozoic Great Valley Sequence, representing deep-sea sediments laid down during the Jurassic  
 3 and Cretaceous Periods prior to 65 million BP, is often difficult to subdivide into formations because  
 4 the rocks exhibit few distinguishing characteristics that can be easily applied in the field to other  
 5 outcrops in other counties (Dickinson and Rich 1972). Therefore, at the scale of this analysis, it  
 6 would be inappropriate to focus a paleontological record search on the named Great Valley  
 7 Sequence formations that lie closest to the Delta and Suisun Marsh, since in many areas they are not  
 8 named. Examination of available mapping indicated that they are all of Cretaceous age; accordingly,  
 9 Jurassic-age localities were excluded from the record review (Table 27-6).

10 **Table 27-6. Paleontological Localities from Cretaceous Marine Sediments of the Great Valley Sequence**

County	Number of Localities	
	Invertebrate and Microfossil	Paleobotanical and Vertebrate
Alameda	35	5
Contra Costa	159	6
Sacramento	0	0
San Joaquin	14	0
Solano	45	0
Sutter	4	1
Yolo	45	1

Source: University of California Museum of Paleontology 2009.

11

12 Of the 315 fossil localities recorded for the Cretaceous in the counties encompassing the Delta and  
 13 Suisun Marsh, fully 96% (302) of those are microfossil or invertebrate collection sites. In contrast,  
 14 only 4% (13 sites) are localities where vertebrate or paleobotanical remains have been recovered.  
 15 The high number of microfossil and invertebrate locality records reflects the degree to which the  
 16 Great Valley Sequence has been studied, particularly in Contra Costa County. The small number of  
 17 fossil vertebrate and plant localities reflects the deep-water deposition of much of this marine  
 18 sequence. At abyssal depths far from the coast, few macroscopic organic remains reach the sea floor  
 19 and become entombed in sediment quickly enough to be preserved. Because there is low probability  
 20 that macroscopic fossil remains would be encountered in these Cretaceous rocks, they are assigned  
 21 low paleontological sensitivity.

## 22 Units Considered for Borrow Material

23 Several geologic units, some outside the Plan Area, are being considered for borrow material, as  
 24 described in the conceptual engineering reports. These units are briefly described, and a  
 25 paleontological sensitivity assigned, in Table 27-7.

1 **Table 27-7. Units Considered for Borrow Material and Their Paleontological Sensitivity**

Unit	Age	General Location	Suitability for Borrow	Potential Sensitivity for Paleontological Resources
Yuba River Gold Fields	Modern	East of Yuba City	High	Low, based on age
Floodplain Basin Deposits	Holocene	Found throughout the Sacramento and San Joaquin Valleys; prevalent in the Delta.	Variable	Low, based on age
Modesto Formation (alluvium)	Late Pleistocene	Alluvial deposits in the center of the Sacramento and San Joaquin Valleys.	Medium	High, see text description above
Montezuma Formation (poorly consolidated, clayey sand)	Early Pleistocene	Montezuma Hills, southwest of Rio Vista	High	High, see text description above
Turlock Lake Alluvium	Early Pleistocene	Eastern edge of the Sacramento and San Joaquin Valleys	Medium	Undetermined, based on lack of information in the UCMP database.
San Pablo Group (marine sediments)	Late Miocene	Southwestern border of Sacramento and San Joaquin Delta area	Low	High, based on vertebrate and other fossils records (University of California Museum of Paleontology 2011)
Upper Cretaceous Marine Sedimentary Rocks	Late Cretaceous	West of Clifton Court Forebay	Low	Low, see text above
Panoche Formation	Late Cretaceous	West and southwest of Clifton Court Forebay	Low	High, based on vertebrate and other fossils records (University of California Museum of Paleontology 2011)
Franciscan Complex (melange)	Late Cretaceous to Jurassic	Coast Ranges west of I- 5 and south of I-580	Low	High, based on vertebrate and other fossils records (University of California Museum of Paleontology 2011)

Note: Except for paleontological sensitivity, the source for this table is DWR's 2010 Conceptual Engineering Report, All Tunnel Option, March 2010 (California Department of Water Resources 2010).

2

3 **27.2 Regulatory Setting**4 **27.2.1 Federal Plans, Policies, and Regulations**5 **27.2.1.1 Antiquities Act of 1906**

6 The Antiquities Act of 1906 (Public Law 59-209; 16 United States Code [USC] 431 et seq.; 34 Stat.  
7 225) requires protection of historic landmarks, historic and prehistoric structures, and other objects  
8 of historic or scientific interest on federal lands. Paleontological resources are included in this

category by many federal agencies, such as the Bureau of Land Management. In addition, NEPA (USC 4321 et seq.; 40 Code of Federal Regulations [CFR] 1502.25), as amended, requires federal agencies to consider the impact of their actions (including the issuance of entitlements or permits, or financial support, to a project) on important historic, cultural, and natural aspects of our national heritage. Because federally managed lands may be affected by the alternatives and because federal entitlement or permits will be required, these statutes extend to paleontological resources in the Delta. A characterization of paleontological resources that may be affected by BDCP activities and an assessment of effects of the action alternatives are required.

### 27.2.1.2 Omnibus Public Land Management Act of 2009

On March 31, 2009, President Obama signed into law the Omnibus Public Land Management Act of 2009 (H.R. 146) (OPLMA). Title 6, Subtitle D of the OPLMA, *Paleontological Resources Preservation*, requires the secretaries of the Department of the Interior (exclusive of Indian trust lands) and the Department of Agriculture (insofar as U.S. Forest System lands are concerned) to "... manage and protect paleontological resources on Federal land using scientific principals and expertise... [and] develop appropriate plans for inventory, monitoring, and the scientific and educational use of paleontological resources ..." The OPLMA further excludes casual collection from restrictions under the law, and then describes the requirements for permitting collection on federal lands, stipulations regarding the use of paleontological resources in education, continued federal ownership of recovered paleontological resources, and standards for acceptable repositories of collected specimens and associated data (Sections 6303–6305). The OPLMA also provides for criminal and civil penalties for unauthorized removal of paleontological resources from federal land, and for rewards for reporting the theft of fossils (Sections 6306–6309).

### 27.2.1.3 Federal Land Policy and Management Act (1976)

The Federal Land Policy and Management Act of 1976 (FLPMA) mandates the treatment of paleontological resources as a scientific value (FLPMA section 102[8]). This act strengthens the references pertaining to suitability and compatibility of land areas, stresses the maintenance of productivity, and seeks to avoid the permanent impairment of the productive capability of the land. For the purpose of this analysis, and in accordance with existing BLM policy, scientifically significant paleontological resources are defined as vertebrate fossils that are identifiable to taxon and/or element, noteworthy occurrences of invertebrate and plant fossils, and vertebrate trackways.

### 27.2.1.4 Code of Federal Regulations, Title 43

***Title 43 CFR, Subpart 8200:*** This addresses procedures and practices for the management of lands that have outstanding natural history values, including fossils, which are of scientific interest.

***Title 43 CFR, Subpart 8365.1-5:*** This addresses the willful disturbance, removal, and/or destruction of scientific resources or natural objects and Subpart 8360.0-7 identifies the penalties for such violations.

### 27.2.1.5 Secretarial of the Interior Order 3104

This grants the BLM the authority to issue paleontological resource use permits for lands under its jurisdiction.

## 1    **27.2.2     State Plans, Policies, and Regulations**

2       State requirements for paleontological resource management are in Pub. Res. Code Chapter 1.7,  
3       Section 5097.5/5097.9 (Stats. 1965, c. 1136, p. 2792), *Archaeological, Paleontological, and Historical*  
4       *Sites*. This statute defines any unauthorized disturbance or removal of a fossil site or remains on  
5       public land as a misdemeanor, and specifies that state agencies may undertake surveys, excavations,  
6       or other operations as necessary on state lands to preserve or record paleontological resources.

## 7    **27.2.3     Regional and Local Plans, Policies, and Regulations**

8       Historically, general plans did not provide for the preservation of paleontological resources;  
9       however, more recently, some plans have included such provisions and, as plans are updated, the  
10       updates often include oversight of paleontological resources in response to increased public  
11       awareness of the value of those resources. Where general plans in the study area do contain policies  
12       relating to paleontological resources, such policies have informed the evaluation and mitigation of  
13       impacts to such resources.

14       The general plans or development titles for Sacramento, Yolo, and San Joaquin Counties place  
15       emphasis on the preservation of historic and cultural values and on compliance with CEQA.  
16       However, their planning documents do not directly consider paleontological resources.

### 17   **27.2.3.1     Alameda County**

18       The Alameda County East County Area Plan (Alameda County 2000) places emphasis on the  
19       preservation of historic and cultural resources, including heritage resources, but does not address  
20       paleontological resources. Nevertheless, county approval of projects includes review for CEQA  
21       compliance, and the CEQA Environmental Checklist employed does include the Appendix G, Section  
22       V, part c question regarding paleontological resources. Alameda County is also home to the  
23       University of California Berkeley and the UCMP, which is one of the preeminent museums of  
24       paleontology in the United States.

### 25   **27.2.3.2     Sacramento County**

26       The Conservation Element of the County of Sacramento General Plan (Sacramento County 2011)  
27       emphasizes the educational, historic, and scientific importance of paleontological resources and  
28       notes that there are at least five recorded sites in Sacramento County which have revealed fossil  
29       remains dating back to 100,000 years ago. Policies within the Conservation Element that help to  
30       ensure that future finds of paleontological resources are protected include the following:

- 31       ● **Policy CO-161:** As a condition of approval for discretionary projects, require appropriate  
32       mitigation to reduce potential impacts where development could adversely affect  
33       paleontological resources.
- 34       ● **Policy CO-162:** Projects located within areas known to be sensitive for paleontological  
35       resources, should be monitored to ensure proper treatment of resources and to ensure crews  
36       follow proper reporting, safeguards and procedures.
- 37       ● **Policy CO-163:** Require that a certified geologist or paleoresources consultant determine  
38       appropriate protection measures when resources are discovered during the course of  
39       development and land altering activities.

### 1    **27.2.3.3           San Joaquin County**

2       The Heritage Resources Element of the San Joaquin County General Plan (San Joaquin County 1992)  
3       addresses heritage resources, including paleontological resources. The San Joaquin County General  
4       Plan notes that the County is involved with paleontological (and archaeological) sites in two ways:  
5       (1) project applications requiring the gathering of information, and (2) ensuring that if  
6       paleontological sites are found during construction, that the project will be “stopped until a qualified  
7       archaeologist has investigated the area and has determined the appropriate actions to take to  
8       protect the resource” (San Joaquin County 1992).

### 9       **27.2.3.4           Solano County**

10       The updated 2008 Solano County General Plan addresses paleontological resources in its attendant  
11       EIR (Solano County 2008). Another component of the General Plan relevant to paleontological  
12       resources is the *Cultural and Paleontological Resources Background Report* in the General Plan EIR  
13       (Solano County 2006). In its impact analysis, the EIR notes:

14           Development within Solano County in accordance with the 2008 Draft General Plan under the  
15           Preferred Plan [or the Maximum Development Scenario] may result in the destruction of  
16           paleontological resources. This impact would be potentially significant.

17       The EIR further states that, to reduce potentially significant impacts on paleontological resources to  
18       a less-than-significant level, the county will implement the following measures.

- 19           (a) Actions that do not meet the CEQA definition of a “project” and therefore do not require an  
20           environmental analysis under the CEQA process shall not be required to perform a  
21           paleontological resources analysis.
- 22           (b) All projects in Solano County that are subject to a CEQA evaluation shall include a site-specific  
23           analysis of paleontological resources. At a minimum, the site-specific analysis shall include a  
24           review of the types of the geologic formation(s) present at the project site and a determination of  
25           the likelihood that those formation(s) would contain a “unique paleontological resource” as  
26           stated in Title 14, California Code of Regulations, Appendix G (the CEQA checklist). If the site-  
27           specific analysis determines that a project may have an adverse effect on a “unique  
28           paleontological resource,” the County shall require that project specific mitigation measures be  
29           implemented to address the following:
- 30           • Cessation of work in the vicinity of the find and notification of the County Planning  
31           Department and the lead agency for the project;
  - 32           • Retention by the project applicant of a qualified paleontologist to evaluate the resource and  
33           prepare a proposed mitigation plan, which may include some or all of the following  
34           elements: a field survey, construction monitoring, sampling and data recovery procedures,  
35           museum storage coordination for any specimen recovered, and a report of findings; and
  - 36           • Implementation of recommendations made by the paleontologist, where the lead agency for  
37           the project determines that said recommendations are necessary and feasible.

### 38       **27.2.3.5           Yolo County**

39       The Conservation and Open Space Element of the County of Yolo 2030 Countywide General Plan  
40       (County of Yolo 2009) includes policies to protect cultural resources, including paleontological  
41       resources. In particular, the Conservation and Open Space Element includes the following  
42       implementation actions related to paleontological resources:

- 1       • Action CO-A63: Require cultural resources inventories of all new development projects in areas  
2       where a preliminary site survey indicates a medium or high potential for archaeological,  
3       historical, or paleontological resources. In addition, require a mitigation plan to protect the  
4       resource before the issuance of permits. Mitigation may include:
  - 5           ○ Having a qualified archaeologist or paleontologist present during initial grading or  
6           trenching;
  - 7           ○ Redesign of the project to avoid historic or paleontologist present during the initial grading  
8           or trenching;
  - 9           ○ Capping the site with a layer of fill; and/or;
  - 10          ○ Excavation and removal of the historical or paleontological resources and curation in an  
11          appropriate facility under the direction of a qualified professional.

## 12    **27.3    Environmental Consequences**

### 13    **27.3.1    Methods for Analysis**

14       The primary source of information used in developing this section is the paleontological database at  
15       the University of California Museum of Paleontology. Effects on paleontological resources were  
16       analyzed qualitatively on a large-scale level, based on professional judgment and the Society of  
17       Vertebrate Paleontology (SVP) guidelines below.

18       *SVP's Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological*  
19       *Resources* provides standard guidelines that are widely followed (Society of Vertebrate Paleontology  
20       2010). These guidelines reflect the accepted standard of care for paleontological resources. The SVP  
21       guidelines identify two key phases in the process for protecting paleontological resources from  
22       project impacts.

- 23       • Assess the likelihood that the project's area of potential effect contains significant nonrenewable  
24       paleontological resources that could be directly or indirectly impacted, damaged, or destroyed  
25       as a result of the project.
- 26       • Formulate and implement measures to mitigate potential adverse impacts.

27       An important strength of SVP's approach to assessing potential impacts on paleontological  
28       resources is that the SVP guidelines provide some standardization in evaluating a Plan Area's  
29       paleontological sensitivity. Table 27-8 defines the SVP's sensitivity categories for paleontological  
30       resources and summarizes SVP's recommended treatments to avoid adverse effects in each  
31       sensitivity category.



1 **Table 27-8. Society of Vertebrate Paleontology’s Recommended Treatment for Paleontological**  
 2 **Resources**

Sensitivity Category	Mitigation Treatment
High or Undetermined	<ul style="list-style-type: none"> <li>• An intensive field survey and surface salvage prior to earth moving, if applicable.</li> <li>• Monitoring by a qualified paleontological resource monitor of excavations.</li> <li>• Salvage of unearthed fossil remains and/or traces (e.g., tracks, trails, burrows).</li> <li>• Screen washing to recover small specimens, if applicable.</li> <li>• Preliminary survey and surface salvage before construction begins.</li> <li>• Preparation of salvaged fossils to a point of being ready for curation (i.e., removal of enclosing matrix, stabilization and repair of specimens, and construction of reinforced support cradles where appropriate).</li> <li>• Identification, cataloging, curation, and provision for repository storage of prepared fossil specimens.</li> <li>• A final report of the finds and their significance.</li> </ul>
Low or no	Rock units with low or no potential typically will not require impact mitigation measures to protect fossils.

Source: Society of Vertebrate Paleontology 2010.

3

## 4 **27.3.2 Determination of Effects**

5 CEQA requires that public agencies and private interests identify the environmental consequences  
 6 of their proposed projects on any object, or site, of significance to the scientific annals of California  
 7 (Division I, California Pub. Res. Code: 5020.1 [b]). CEQA Guidelines define procedures, types of  
 8 activities, persons, and public agencies required to comply with CEQA. Appendix G in Section 15023  
 9 provides an Environmental Checklist of questions that a lead agency should normally address to  
 10 comply with CEQA. One of the questions to be answered in the Environmental Checklist (Section  
 11 15023, Appendix G, Section V, part c) is: “Would the project directly or indirectly destroy a unique  
 12 paleontological resource or site ...?”

13 SVP’s guidelines also provide a working definition of *significance* as applied to paleontological  
 14 resources. According to SVP, significant paleontological resources are those that fulfill one or more  
 15 of the following criteria (Society of Vertebrate Paleontology 2010).

- 16 • Provide important information shedding light on evolutionary trends or helping to relate living  
 17 organisms to extinct organisms.
- 18 • Provide important information regarding the development of biological communities.
- 19 • Demonstrate unusual circumstances in the history of life.
- 20 • Represent a rare taxon or a rare or unique occurrence; are in short supply and in danger of  
 21 being destroyed or depleted.
- 22 • Have a special and particular quality, such as being the oldest of their type or the best available  
 23 example of their type.
- 24 • Provide important information used to correlate strata for which it may be difficult to obtain  
 25 other types of age dates.

1 Significant paleontological resources may include vertebrate fossils and their associated taphonomic  
2 (fossilization) and environmental indicators, invertebrate fossils, or plant fossils.

3 Effects on paleontological resources were analyzed qualitatively on the basis of professional  
4 judgment. This analysis focuses on (1) identifying activities with the potential to disturb, damage, or  
5 destroy paleontological resources if any are present on the work site and (2) developing a strategy  
6 to ensure that mitigation requiring paleontological sensitivity assessment and appropriate  
7 treatment developed on a site-specific basis is in place for those activities identified as likely to  
8 result in damage.

9 Two factors are considered when evaluating a proposed project's potential to disturb or damage  
10 significant paleontological resources. First, most vertebrate fossils are rare and are therefore  
11 considered important paleontological resources. Second, unlike archaeological sites, which are  
12 narrowly defined, paleontological sites are defined by the entire extent (both areal and  
13 stratigraphic) of a unit or formation. In other words, once a unit is identified as containing  
14 vertebrate fossils or other rare fossils, the entire unit is a paleontological site (Society of Vertebrate  
15 Paleontology 2010).

16 This impact analysis assumes that an action alternative would have an adverse effect (under NEPA)  
17 and a significant impact (under CEQA) on paleontological resources if the alternative would directly  
18 or indirectly destroy a unique or significant paleontological resource or site. For all action  
19 alternatives, operation and maintenance of BDCP facilities would not involve extensive ground-  
20 disturbing activities and modified operations and associated maintenance would not substantially  
21 increase erosion. Therefore, paleontological resources would not be disturbed and there would be  
22 no effect on paleontological resources as a result of operation or maintenance of any of the action  
23 alternatives.

### 24 **27.3.2.1 Compatibility with Plans and Policies**

25 Constructing the proposed water conveyance facility (CM1) and implementing CM2–CM22 could  
26 potentially result in incompatibilities with plans and policies related to paleontological resources.  
27 Section 27.2, *Regulatory Setting*, provides an overview of federal, state, regional and agency-specific  
28 plans and policies applicable to paleontological resources. This section summarizes ways in which  
29 BDCP is compatible or incompatible with those plans and policies. Potential incompatibilities with  
30 local plans or policies, or with those not binding on the state or federal governments, do not  
31 necessarily translate into adverse environmental effects under NEPA or CEQA. Even where an  
32 incompatibility “on paper” exists, it does not by itself constitute an adverse physical effect on the  
33 environment, but rather may indicate the potential for a proposed activity to have a physical effect  
34 on the environment. The relationship between plans, policies, and regulations and impacts on the  
35 physical environment is discussed in Chapter 13, *Land Use*, Section 13.2.3.

36 The Antiquities Act of 1906 (Public Law 59-209; 16 United States Code [USC] 431 et seq.; 34 Stat.  
37 225) requires protection of historic landmarks, historic and prehistoric structures, and other objects  
38 of historic or scientific interest on federal lands. In accordance with CEQ Regulations (40 CFR  
39 1502.25), as amended, this EIR/EIS discusses the paleontological resources that may be affected by  
40 the BDCP alternatives.

41 Implementation of Mitigation Measures PALEO-1b through PALEO-1d (discussed below), will  
42 ensure that unique or significant paleontological resources in the alternative footprint are  
43 systematically identified, documented, avoided or protected from damage where feasible, or

1 recovered and curated so they remain available for scientific study, which is consistent with the  
2 purpose of the Antiquities Act of 1906 as well as the OPLMA. These measures also further the intent  
3 of the local county plans in ensuring that there is oversight of paleontological resources during  
4 construction activities associated with the BDCP.

## 5 **27.3.3 Effects and Mitigation Approaches**

### 6 **27.3.3.1 No Action Alternative**

7 The No Action Alternative is the future condition that would occur in the Plan Area if none of the  
8 action alternatives were approved and if no change from current management direction or the level  
9 of management intensity occurred as of the year 2060. The No Action Alternative considers changes  
10 in ground disturbance that would take place as a result of the continuation of existing plans, policies,  
11 and operations, as described in Chapter 3, *Description of Alternatives*. The No Action Alternative  
12 includes projects and programs with defined management or operational plans, including facilities  
13 under construction as of February 13, 2009, because those actions would be consistent with the  
14 continuation of existing management direction or level of management for plans, policies, and  
15 operations by the lead agencies and other agencies. The No Action Alternative assumptions also  
16 include projects and programs that received approvals and permits in 2009 to remain consistent  
17 with existing management direction.

#### 18 **Unique or Significant Paleontological Resources**

19 Many of the ongoing projects and programs in the Delta will require ground-disturbing construction  
20 to either construct new facilities or implement restoration and habitat enhancement goals. In  
21 addition, many planning documents that govern portions of the Delta include buildout footprints  
22 that allow development of undisturbed land that is likely to contain paleontological resources.  
23 Examples of these projects, programs, and planning documents are given below.

24 SWP/CVP operations, identified as continuing actions under the No Action Alternative, include  
25 repair, maintenance, or protection of infrastructure such as levees, and may also include actions for  
26 water quality management, habitat and species protection, and flood management. These continuing  
27 actions could occur throughout the Plan Area and could result in effects on paleontological  
28 resources, depending on the type of construction needed for repairs or adjustments to potential  
29 irrigation water and drainage needed for water quality and flood management. The projects  
30 identified in Table 27-9 below may affect paleontological resources. A complete list and description  
31 of programs and plans considered under the No Action Alternative is provided in Appendix 3D,  
32 *Defining Existing Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact*  
33 *Conditions*.

1 **Table 27-9. Effects on Paleontological Resources from the Plans, Policies, and Programs for the No**  
 2 **Action Alternative**

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
California Department of Water Resources and Solano County Water Agency	North Bay Aqueduct Alternative Intake Project	Draft EIR is ongoing	This project will construct an alternative intake on the Sacramento River and a new segment of pipeline to connect it to the North Bay Aqueduct system.	The pipeline segment of the project could have adverse impacts on paleontological resources. Ground-disturbing activities associated with construction of the intake and pipeline could disturb units sensitive for paleontological resources, such as the Modesto and Riverbank Formations.
Reclamation District 2093	Liberty Island Conservation Bank		This project includes the restoration of inaccessible, flood prone land zoned as agriculture but not actively farmed, to area enhancement of wildlife resources.	No known record exists of any paleontological resources on the project site and no known unique geological features were identified or are known to exist on the project site. The presence of paleontological resources is highly unlikely.
California High-Speed Rail Authority and Federal Railroad Administration	California High-Speed Rail System, Sacramento to Merced Section	Briefing on Initial Alternatives completed. Sacramento to Merced section is part of Phase 2.	Development of new high-speed rail service. Near-term improvements could include right-of-way preservation, interim operation on existing tracks, and passing sidings. Future improvements would construct a new rail line.	No paleontological resources are expected to be disturbed within this corridor, based on the sedimentary units occurring between Sacramento and Stockton
Bureau of Reclamation	Delta-Mendota Canal/California Aqueduct Intertie	Completed in 2012	The purpose of the intertie is to better coordinate water delivery operations between the California Aqueduct (state) and the Delta-Mendota Canal (federal) and to provide better pumping capacity for the Jones Pumping Plant. New project facilities include a pipeline and pumping plant.	No impacts to paleontological resources are expected.

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
Yolo Basin Foundation and the Delta Protection Commission	Lower Yolo Bypass Planning Forum	Conservation Measures and a draft of Management Recommendation Planning Goals have been completed.	Documents include recommendations, goals, and strategies for management of the Yolo Bypass.	No impacts to paleontological resources are expected.
City of Stockton	Delta Water Supply Project (Phase 1)	Currently under construction	This project consists of a new intake structure and pumping station adjacent to the San Joaquin River; a water treatment plant along Lower Sacramento Road; and water pipelines along Eight Mile, Davis, and Lower Sacramento Roads.	This project could disturb units sensitive for paleontological resources, such as the Riverbank Formation.
Bureau of Reclamation and California Department of Water Resources	SWP/CVP operations	Continuing actions	Includes repair, maintenance, or protection of imperiled infrastructure such as levees, and may also include actions for water quality management, habitat and species protection, or flood management	Repair, maintenance or protection of levees could disturb paleontological resources.
Zone 7 Water Agency and California Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Completed	The South Bay Aqueduct Improvement and Enlargement Project will improve and expand the existing South Bay Aqueduct. The project will increase the existing capacity of the water conveyance system up to its design capacity of 300 cfs, and expand capacity in a portion of the project to add 130 cfs (total of 430 cfs).	This project could disturb units sensitive for paleontological resources, such as the Panoche and Neroly Formations.
Yolo County	Yolo County General Plan Update	Continuing actions	County of Yolo's 2030 Countywide General Plan allows for additional growth in unincorporated areas of the county of just under 31,000 people, up to 10,462 homes, and 1.5% growth in average annual employment.	Buildout contemplated under the updated general plan will result in ground-disturbing construction that could affect geologic units sensitive for paleontological resources, such as the Modesto and Tehama Formations.

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
CALFED Levee Stability Program	Existing project levees in the Delta	Continuing actions	Protection of resources in the Delta through maintenance and improvement of existing levees	This program will result in the repair of project and non-project levees in the Delta. Ground-disturbing construction and borrow activity necessary to complete typical improvements could disturb geologic units sensitive for paleontological resources, such as the Modesto and Riverbank Formations.
NMFS/USFWS	2008 and 2009 Biological Opinion	Ongoing	The Biological Opinions issued by NMFS and USFWS establish certain RPAs to be implemented. Some of the RPAs require habitat restoration.	The location of the required 8,000 acres of habitat restoration has not yet been identified, but construction of this habitat may disturb geologic units sensitive for paleontological resources.

1

2 These plans and projects are examples of planning frameworks and project-level actions that exist  
3 and are ongoing in the Delta. Because of the ground-disturbing activities associated with these  
4 undertakings, the suite of all ongoing projects and programs in the Delta could both singly and  
5 collectively result in adverse effects on paleontological resources.

#### 6 **Catastrophic Seismic Risks**

7 The Delta and vicinity is within a highly active seismic area, with a generally high potential for major  
8 future earthquake events along nearby and/or regional faults, and with the probability for such  
9 events increasing over time. Based on the location, extent and non-engineered nature of many  
10 existing levee structures in the Delta area, the potential for significant damage to, or failure of, these  
11 structures during a major local seismic event is generally moderate to high. In the instance of a large  
12 seismic event, levees constructed on liquefiable foundations are expected to experience large  
13 deformations (in excess of 10 feet) under a moderate to large earthquake in the region. (See  
14 Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies* for more  
15 detailed discussion). Reclaiming land or rebuilding levees after a catastrophic event due to climate  
16 change or a seismic event could result in the destruction of unique paleontological resources.

17 **CEQA Conclusion:** Under the No Project Alternative, no BDCP-related water conveyance facilities  
18 would be constructed (CM1) and none of the other conservation measures would be implemented  
19 (CM2–CM22). Existing approved projects and programs in the Plan Area would continue. Many of  
20 these programs would result in ground-disturbing work in the Plan Area and surrounding region.  
21 Because the region is sensitive for paleontological resources, these actions could collectively result  
22 in disturbance of paleontological resources and a potentially significant impact.

1 **27.3.3.2 Alternative 1A—Dual Conveyance with Pipeline/Tunnel and**  
2 **Intakes 1–5 (15,000 cfs; Operational Scenario A)**

3 The location of BDCP facilities (and the construction activities associated with those facilities) under  
4 Alternative 1A in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
5 activities are shown in Table 27-10. A detailed depiction of the Pipeline/Tunnel alternative is  
6 provided in Figure M3-1 in the Mapbook Volume.

7 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
8 **of Construction of Water Conveyance Facilities**

9 Construction of water conveyance facilities under Alternative 1A could cause the destruction of  
10 unique paleontological resources as a result of excavation for new intakes, new intake pumping  
11 plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, other  
12 water facility components, roads, and borrow sites.

13 The depth, extent, and location of excavation and other ground-disturbing activities vary greatly  
14 across the Plan Area (Table 27-10). Accordingly, this discussion considers these activities on the  
15 basis of their location and the depth of excavation.

16 The five intakes and the intermediate forebay (Figure 27-2) would entail deep and extensive  
17 excavation in the northern portion of the Plan Area (Table 27-10). The five intakes and the pumping  
18 plant and sedimentation basin associated with each intake would be along the east bank of the  
19 Sacramento River between Clarksburg and Walnut Grove. The intermediate forebay and its  
20 associated pumping plant would be located adjacent to the west of South Stone Lake. Ground-  
21 disturbing activities include clearing and grubbing, rough grading, excavation, pile driving,  
22 constructing foundations, and final grading. Construction of the intakes, pumping plants, and  
23 sedimentation basins would involve excavation to a depth of between 20–35 feet over an area of  
24 330 acres. The staging/storage area and construction zone preparation would involve 76–148 acres  
25 per intake structure. Construction for the intermediate forebay would involve excavation of  
26 approximately 760 acres to a depth of approximately 15–20 feet below existing grade.

1 **Table 27-10. Summary of Conveyance Construction Activities and Geologic Units Sensitive for**  
 2 **Paleontological Resources That Could Be Disturbed under Alternative 1A**

Alternative 1A	Location	Construction/Excavation	Sensitive Units Disturbed
Five new north Delta intakes	East bank Sacramento River between Clarksburg and Walnut Grove	30 ft below existing grade; 330 ac total, including pumping plants and sedimentation basins	Riverbank and Modesto Formations
New intake pumping plants and sedimentation basins	Adjacent to intakes	Sedimentation basin 20–30 ft below existing grade; pumping plant 25–30 ft below existing grade; staging/storage area and construction zone prep (76–148 ac per intake structure, including sedimentation basin and pumping plant)	Riverbank and Modesto Formations
New intermediate pumping plant	South side of Intermediate Forebay	Slab invert 15–20 ft below existing grade; 3 ac total	Riverbank Formation and Modesto Formations
Byron Tract Forebay, canals to Jones and Banks pumping plants	Just south of Clifton Court Forebay	592 ac to a depth of 15–20 ft below existing grade	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
Intermediate forebay	Near Hood	760 ac to a depth of 15–20 ft below existing grade	Riverbank Formation and Modesto Formations
Tunnel 1	Single-bore 29-ft-diameter tunnel, 29,200 ft from intake pumping plants to Intermediate Forebay between South Stone Lake and the Sacramento River	Shaft to 100–150 ft below existing grade; tunnel invert at 150 ft; boring using pressurized face mechanized tunneling machines, including earth pressure balance (EPB) machines and slurry tunneling machines	Riverbank and Modesto Formations
Tunnel 2	Dual-bore 33-ft-diameter tunnel, 176,496 feet from Intermediate Forebay to Byron Tract Forebay	Same as Tunnel 1	Riverbank and Modesto Formations

3  
 4 Excavation for the intakes and intermediate forebay would be conducted in geologic units both  
 5 sensitive and nonsensitive for paleontological resources (Figure 27-2). Although most of the  
 6 surficial geologic units in the area affected by excavation for the intakes and forebays are of  
 7 Holocene age and not sensitive for paleontological resources, the Riverbank Formation, which is of  
 8 Pleistocene age and sensitive for paleontological resources, is exposed at the surface in some  
 9 locations or underlies the Holocene units in the shallow subsurface. The Modesto Formation,  
 10 another Pleistocene-age unit that is sensitive for paleontological resources, also occurs in the area  
 11 and likely is exposed at the surface and in the shallow subsurface. These Pleistocene units likely



1 occur at a depth of less than 5 feet and would therefore be disturbed during excavation of the  
2 intakes and intermediate forebay (Figure 27-3).

3 Pipeline construction would involve excavation in the northern portion of the Plan Area (Figure 27-  
4 2; Table 27-10). The pipelines would extend from the intakes to the sedimentation basin and intake  
5 pumping plants and from the intake pumping plants to the intermediate forebay. Pipeline  
6 excavation would use open trenching to a minimum depth of approximately 30 feet but could be  
7 deeper, depending on local conditions. Trench widths would be approximately 220 feet.

8 Excavation for the pipelines would, like that for the intakes and the intermediate forebay, occur in  
9 both sensitive and nonsensitive units. Although most of the surficial geologic units in the area  
10 affected by excavation for the pipelines are of Holocene age and not sensitive for paleontological  
11 resources, the Riverbank Formation and Modesto Formation are exposed at the surface and occur in  
12 the shallow subsurface. These Pleistocene units likely occur at a depth of 0 to 10 feet and would  
13 therefore be disturbed during excavation for pipelines.

14 Construction of Tunnels 1 and 2 would entail deep excavation using a tunnel-boring machine (TBM)  
15 (Table 27-10). Tunnel 1 would extend from the intake pumping plants to the intermediate forebay  
16 between South Stone Lake and the Sacramento River, just south of Hood. The main construction or  
17 launching shafts for each tunnel would be about 60 feet in diameter. The TBM retrieval shaft would  
18 be approximately 45 feet in diameter, and 12-foot-diameter intermediate ventilation shafts would  
19 be constructed approximately every 3 miles along the tunnel route. The amount of material that  
20 would be excavated, which is the least of the tunnel or canal options, is shown in Table 27-11. The  
21 tunnels would be excavated at a depth of approximately 100–150 feet at the tunnel invert, mainly to  
22 avoid the peaty Holocene soils. The TBMs would be mechanized soft-ground tunneling machines  
23 designed for use in soft soils with high groundwater pressure. The tunnels would be lined with  
24 precast concrete bolted-and-gasketed segments. The tunnel concrete liner would serve as  
25 permanent ground support and would be installed immediately behind the TBM, forming a  
26 continuous watertight vessel.

27 **Table 27-11. Amount of Excavated Material by Feature**

Alternative	Material Excavated (cubic yards)			
	Borrow	Tunnel	Canals	Tunnel and Canal Combined
1A	13,500,000	14,319,000	378,000	14,697,000
1B	200,000,000	475,000	38,427,000	38,902,000
1C	200,000,000	3,379,000	25,282,000	28,660,000
4	13,700,000 <sup>a</sup>	18,744,000	1,897,000	20,640,000
9	2,670,000	0	1,938,000	1,938,000

Note: These numbers are very preliminary and for comparison purposes only.

<sup>a</sup> While the amount of borrow material excavated for this alternative could be up to this amount, it is anticipated that it may be less due to Alternative 4 including only 3 intakes.

28  
29 Shafts and tunnels would be excavated through Holocene and Pleistocene deposits (Figures 27-2  
30 and 27-3). Shafts would be excavated through surficial Holocene deposits and then through  
31 Pleistocene deposits of the Riverbank or Modesto Formations. Tunnels would be bored wholly  
32 through Pleistocene deposits. Construction of the Byron Tract Forebay would involve deep and  
33 extensive excavation directly southeast of Clifton Court Forebay (Figure 27-2). Excavation would

1 involve approximately 592 acres to a depth of approximately 15–20 feet below existing grade,  
2 except locally at the inlet and outlet connections (Table 27-10). The invert of the incoming canal  
3 would be at -28 feet msl before discharging to the tunnel.

4 Excavation for the Byron Tract Forebay would occur in both sensitive and nonsensitive units (Figure  
5 27-2). Although much of the area surrounding the Clifton Court Forebay is covered in surficial units  
6 of Holocene age such as the Holocene alluvial-floodplain deposits (Qfp), which are not sensitive for  
7 paleontological resources, units sensitive for paleontological resources are also exposed at the  
8 surface and underlie the area (Figure 27-2). These units include the Holocene or Upper Pleistocene  
9 alluvium of creeks from the Corral Hollow Drainage to Brushy Creek (Qch), which is sensitive for  
10 paleontological resources.

11 Construction of a new canal, between the Clifton Court Forebay and Union Pacific Railroad, would  
12 connect the forebay to the existing approach canal to the Banks Pumping Plant. The new canal  
13 would be excavated to a depth of 12–15 feet below existing grade. The forebay would be connected  
14 to the existing approach canal to the Jones Pumping Plant by breaching a section of the existing  
15 canal's embankment adjacent to Byron Tract Forebay.

16 Excavation for the Byron Tract Forebay and new approach to the Banks Pumping Plant would  
17 disturb these Pleistocene units. Breaching of the existing canal embankment would not disturb  
18 Pleistocene units.

19 The temporary and permanent access roads required for Alternative 1A would involve shallow  
20 excavation and grading, primarily along existing farm roads or across lands disturbed by  
21 agricultural activity. It is unlikely that this shallow ground disturbance would affect significant  
22 paleontological resources.

23 Borrow material would be needed primarily for forebay embankments and levee reconstruction at  
24 intake sites, but also for access roads. The amount of material that would be needed for borrow,  
25 which is the least of the tunnel or canal options, is shown in Table 27-11. Borrow material would be  
26 excavated from targeted units described in the engineering report (California Department of Water  
27 Resources 2010). Some of these units, including the Modesto and Montezuma Formations, are  
28 sensitive for paleontological resources. Excavation of borrow material from these units could  
29 disturb paleontological resources. In addition, borrow/spoil areas are designated in the area of the  
30 intakes, along the intermediate forebay, and along the Byron Tract Forebay (Figure 27-2). As  
31 described above, units sensitive for paleontological resources in these areas include the Riverbank  
32 and Modesto Formations (potentially in the shallow subsurface) in the area of the intakes and  
33 intermediate forebay, and the alluvium of creeks from the Corral Hollow Drainage to Brushy Creek  
34 along the Byron Tract Forebay. Excavation of borrow material from these units could also disturb  
35 sensitive paleontological resources.

36 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for  
37 paleontological resources have the potential to damage or destroy those resources. Direct or  
38 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
39 represent an adverse effect because conveyance facility construction could directly or indirectly  
40 destroy unknown paleontological resources in geologic units known to be sensitive for these  
41 resources.

1 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 2 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 3 1b and 1d.

4 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 5 surface-related ground disturbance activities described above. However, while these measures  
 6 could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring  
 7 activities because they would be conducted deep underground and could not be monitored.  
 8 Moreover, although boring material could be examined by monitors, such work would be  
 9 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

10 Therefore, excavation for the intakes, pipelines, intermediate forebay, Byron Tract Forebay and the  
 11 new approach to the Banks Pumping Plant necessary for Alternative 1A would most likely destroy  
 12 unique or significant paleontological resources and would constitute an adverse effect under NEPA.

13 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 1A could  
 14 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 15 associated with Alternative 1A would occur in geologic units sensitive for paleontological resources  
 16 and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 17 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 18 significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
 19 PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 20 level, excavation for the tunnels necessary for Alternative 1A would most likely destroy unique or  
 21 significant paleontological resources in the Plan Area and would cause a significant and unavoidable  
 22 impact.

#### 23 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for** 24 **Paleontological Resources**

25 Before ground-breaking construction begins, BDCP proponents will retain a qualified  
 26 paleontologist or geologist (as defined by the SVP Standard Procedures [Society of Vertebrate  
 27 Paleontology 2010]) to develop a comprehensive Paleontological Resources Monitoring and  
 28 Mitigation Plan (PRMMP) for the BDCP, to help avoid directly or indirectly destroying a unique  
 29 or significant paleontological resource.

30 The PRMMP will be consistent with the SVP Standard Procedures (Society of Vertebrate  
 31 Paleontology 2010) and the SVP Conditions of Receivership (Society of Vertebrate Paleontology  
 32 1996) and will require the following.

- 33 • A paleontological resources specialist (PRS) will be designated or retained for construction  
 34 activities. The PRS will have paleontological resources management qualifications  
 35 consistent with the description of a qualified paleontologist in the SVP Standard Procedures  
 36 (Society of Vertebrate Paleontology 2010). The PRS will be responsible for implementing all  
 37 aspects of the PRMMP, managing any additional paleontological monitors needed for  
 38 construction activities, and serving as a qualified resource in the event of unanticipated  
 39 paleontological finds. The PRS may, but need not necessarily, be the same individual who  
 40 prepared the PRMMP. The PRS will be retained or designated prior to the start of ground-  
 41 breaking construction. A qualified PRS is defined as a person with a M.S. or Ph.D. in  
 42 paleontology, paleobiology, or geology, with strong working knowledge of local  
 43 paleontology and geology, and professional expertise with paleontological procedures and

- 1 techniques. The PRS may designate a paleontological monitor to be present during earth-  
 2 moving activities. A paleontological monitor is defined as a person with a BS/BA in geology  
 3 or paleontology and a minimum of 1 year of monitoring experience in local sedimentary  
 4 rocks. Experience may be substituted for academic training on approval from the  
 5 contracting agency. The PRS and paleontological monitor(s) will be notified by the Lead  
 6 Agency or Resident Engineer in advance of the start of construction activity. The PRS and  
 7 paleontological monitor(s) will attend any required safety training programs.
- 8 • Preconstruction surveys (with salvage and/or protection in place, as appropriate) will be  
 9 conducted in areas where construction activities would result in surface disturbance of  
 10 geologic units identified as highly sensitive for paleontological resources.
  - 11 • Preconstruction and construction-period coordination procedures and communications  
 12 protocols will be established, including procedures to alert all construction personnel  
 13 involved with earthmoving activities about the possibility of encountering fossils as set forth  
 14 in Mitigation Measure PALEO-1c and communications regarding the *stop work, evaluate and*  
 15 *treat appropriately response* in the event of a paleontological discovery, as discussed in  
 16 Mitigation Measure PALEO-1d.
  - 17 • All ground-disturbing activities involving highly sensitive units will be monitored by  
 18 qualified monitors. Monitoring will initially be conducted full time for grading and  
 19 excavation, but the PRMMP may provide for monitoring frequency in any given location to  
 20 be reduced once 50% of the ground-disturbing activity in that location has been completed,  
 21 if the reduction is appropriate based on the implementing PRS's professional judgment in  
 22 consideration of actual site conditions. Monitoring will also be conducted throughout  
 23 drilling operations. The monitoring program for tunneling operations will be developed in  
 24 conjunction with the facility design and geotechnical teams, in consideration of the  
 25 tunneling method selected.
  - 26 • Sampling and data recovery procedures that are consistent with the SVP Standard  
 27 Procedures (Society of Vertebrate Paleontology 2010) and the SVP Conditions of  
 28 Receivership (Society of Vertebrate Paleontology 1996) will be established.
  - 29 • A repository plan will be developed that provides for appropriate curation of recovered  
 30 materials, if necessary.
  - 31 • Mitigation monitoring report preparation guidelines will be established that are consistent  
 32 with the SVP Standard Procedures guidelines (Society of Vertebrate Paleontology 2010).  
 33 The report will include, at a minimum, discussions of effects, regulatory requirements,  
 34 purpose of mitigation, regional geologic context, Plan Area stratigraphy, stratigraphic and  
 35 geographic distribution of paleontological resources, field and laboratory methods and  
 36 procedures, fossil recovery, and paleontological significance. The report will also include  
 37 geological cross sections and stratigraphic sections depicting fossil discovery localities and  
 38 excavated rock units; maps showing the activity location and vicinity, as well as geology and  
 39 location of discovered fossil localities; appropriate illustrations depicting monitoring  
 40 conditions, field context of collecting localities, quarry maps, and laboratory activities; and  
 41 appendices including an itemized listing of catalogued fossil specimens, complete  
 42 descriptions of all fossil collecting localities, an explanation of report acronyms and terms,  
 43 and a signed curation agreement with an approved paleontological repository.

- Procedures for preparing, identifying, and analyzing fossil specimens and data recovered will be established, consistent with the SVP Conditions of Receivership (Society of Vertebrate Paleontology 1996 and 2010) and any specific requirements of the designated repository institution.

Implementation of this measure will ensure that unique or scientifically significant paleontological resources in the alternative footprint are systematically identified, documented, avoided or protected from damage where feasible, or recovered and curated so they remain available for scientific study.

### **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific Language Identifying How the Mitigation Measures Will Be Implemented along the Alignment**

To help avoid directly or indirectly destroying a unique or significant paleontological resource, the BDCP proponents will have a qualified individual review the 90% design submittal to finalize the identification of construction activities involving geologic units considered highly sensitive for paleontological resources. Evaluation will consider the anticipated depth of disturbance, the selected construction technique, and the geology of the alignment. This work may be carried out in conjunction with or as part of the development of the PRMMP (Mitigation Measure PALEO-1a). The evaluation may be carried out by the PRS or an individual meeting the SVP's requirements for a qualified vertebrate paleontologist (per Society of Vertebrate Paleontology 2010) and will be conducted in collaboration with the BDCP design and geotechnical teams. If the evaluation is performed by a paleontologist, it will be reviewed and verified by a California-licensed professional geologist. The purpose of this evaluation will be to develop specific language identifying how the mitigation measures will be applied to the various phases of construction along the alignment (e.g., which areas would require monitors). This language will be included in the BDCP construction documents for implementation by BDCP proponents. The language will be based on the following framework.

- One onsite paleontological monitor will likely be sufficient to handle observation of most ground-disturbing activities. However, if additional paleontological monitors are needed, the PRS will coordinate with the Resident Engineer. This communication is imperative and fundamental to the success of this PRMMP and to compliance with CEQA and NEPA.
- Whenever possible, sedimentary rocks exposed during trenching and other deep excavation work will be inspected. Ideally, this monitoring will involve inspection of fresh bedrock exposures. However, observation of some work may not be possible for safety reasons and inspection from these operations will be restricted to spoils. In this case, the monitor will inspect spoils as they are stockpiled and remove any matrix blocks containing paleontological resources. Construction personnel, namely the Resident Engineer/Lead, must communicate depths of excavated materials and their approximate location to the field monitor.
- Recording of stratigraphic data will be an ongoing aspect of excavation monitoring, to provide context for any eventual fossil discoveries. Outcrops exposed in active cuts and finished slopes will be examined and geologic features recorded on grading plans and in field notes. The goal of this work is to delimit the nature of fossiliferous unconsolidated sedimentary deposits within the Plan Area, determine their areal distribution and depositional contacts, and record any evidence of structural deformation. Standard geologic

1 and stratigraphic data collected include lithologic descriptions (e.g., color, sorting, texture,  
2 structures, and grain size), stratigraphic relationships (e.g., bedding type, thickness, and  
3 contacts), and topographic position. Stratigraphic sections will be routinely measured, areas  
4 containing exposures of fossiliferous sedimentary rocks will be documented, and fossil  
5 localities will be recorded on measured stratigraphic sections.

- 6 • If fossils are discovered, the following procedures will be followed. The monitor or PRS will  
7 inform the Resident Engineer who will determine the appropriate course of action. For all  
8 excavations except those relating to the tunnels, mitigation shall consist of one of the  
9 following: diverting, directing, or temporarily halting ground-disturbing activities in the  
10 area of discovery to allow for preliminary evaluation of potentially significant  
11 paleontological resources and to determine whether additional mitigation (i.e., collection,  
12 curation or other preservation) is required. Where excavations relate to construction of the  
13 tunnels, such measures will be infeasible because the fossils will most likely have been  
14 destroyed by the tunnel boring machines before they could have been identified.

15 The significance of the discovered resources will be determined by the PRS in consultation with  
16 appropriate contractor representatives. Because of the infrequency of fossil preservation, fossils  
17 are considered to be nonrenewable resources. Because of their rarity, and because of the  
18 scientific information they provide, fossils can be highly significant records of ancient life. Given  
19 this, fossils can be considered to be of significant scientific interest if one or more of the  
20 following criteria apply.

- 21 • Provide data on the evolutionary relationships and developmental trends among organisms,  
22 both living and extinct.
- 23 • Provide data useful in determining the age(s) of the rock unit or sedimentary stratum,  
24 including data important in determining the depositional history of the region and the  
25 timing of geologic events therein.
- 26 • Provide data regarding the development of biological communities or interaction between  
27 paleobotanical and paleozoological biotas.
- 28 • Demonstrate unusual or spectacular circumstances in the history of life.
- 29 • Are in short supply and/or in danger of being depleted or destroyed by the elements,  
30 vandalism, or commercial exploitation, and are not found in other geographic locations.

31 They can include fossil remains of large to very small aquatic and terrestrial vertebrates  
32 (including animal trackways), remains of plants and animals previously not represented in  
33 certain portions of the stratigraphy, and fossils that might aid stratigraphic correlations,  
34 particularly those offering data for the interpretation of tectonic events, geomorphologic  
35 evolution, paleoclimatology, and the relationships of aquatic and terrestrial species.

- 36 • Recovery methods will vary to some degree depending on the types of fossils discovered  
37 (e.g., invertebrate macrofossils, invertebrate microfossils, vertebrate macrofossils,  
38 vertebrate microfossils, or plant fossils). Many fossil specimens discovered during  
39 excavation monitoring are readily visible to the naked eye and large enough to be easily  
40 recognized and removed. Upon discovery of such macrofossils, the paleontological monitor  
41 will temporarily flag the discovery site for avoidance and evaluation, as described above.  
42 Actual recovery of unearthened macrofossils can involve several techniques, including  
43 immediate collection, hand quarrying, plaster-jacketing, and/or large-scale quarrying. The

1 PRS and the contracting agency representative will evaluate the discovery and take action to  
2 protect or remove the resource within the shortest period of time possible.

- 3 • Many significant vertebrate fossils (e.g., small mammal, bird, reptile, amphibian, or fish  
4 remains) often are too small to be readily visible in the field, but are nonetheless significant  
5 and worthy of attention. The potential discovery of microvertebrate sites is anticipated and  
6 can include sites that produce remains of large vertebrate fossils from fine-grained deposits,  
7 sites with an obvious concentration of small vertebrate fossil remains, and sites that based  
8 on lithology alone (e.g., paleosols) appear to have a potential for producing small vertebrate  
9 fossil remains. Microvertebrate sites will be sampled by collecting bulk quantities of  
10 sedimentary matrix. An adequate sample comprises approximately 12 cubic meters (6,000  
11 lbs or 2,500 kg) of matrix for each formation, or as determined by the PRS (Society of  
12 Vertebrate Paleontology 2010). The uniqueness of the recovered fossils may dictate salvage  
13 of larger amounts. However, conditions in the field may make it impossible to recover such  
14 large samples. To avoid construction delays, bulk matrix samples will be transported to an  
15 offsite location for processing.
- 16 • The discovery of fossil plants is possible in the Plan Area. Paleobotanical specimens typically  
17 occur in fine-grained, laminated strata (e.g., shale) and will require special recovery  
18 techniques. Large blocks (>2 feet) of sedimentary rock are hand quarried from the  
19 temporary outcrop and then split along bedding planes to reveal compressed fossil plant  
20 material (e.g., leaves, stems, and flowers). Individual slabs are then wrapped in newsprint to  
21 minimize destructive desiccation of the fossils. Specimens that are delaminating or flaking  
22 badly may need to be coated with special consolidants.
- 23 • Oriented matrix samples may be collected for paleomagnetic analysis. Such sampling will  
24 likely only be necessary in instances where long, continuous sections of stratified rocks are  
25 producing fossils from several different stratigraphic horizons or where vertebrate fossils  
26 are being collected in stratigraphic sections lacking in biochronologically useful microfossils.  
27 Likewise, it may be necessary to collect stratigraphically positioned samples of fine matrices  
28 pollen analysis or aid in addressing questions of geologic age, depositional environment, or  
29 paleoecology.
- 30 • All fossil discoveries will include the collection of stratigraphic data to delimit the nature of  
31 the fossil-bearing sedimentary rock unit, determine its areal distribution and depositional  
32 contacts, record any evidence of structural deformation, generate lithologic descriptions of  
33 fossil-bearing strata, determine stratigraphic relationships (bedding type, thickness, and  
34 contacts), and topographic position, measure stratigraphic sections, and describe  
35 taphonomic details.

36 Implementation of this measure will ensure that mitigation procedures are followed so that  
37 unique or scientifically significant paleontological resources in the alternative footprint are  
38 systematically identified, documented, avoided or protected from damage where feasible, or  
39 recovered and curated so they remain available for scientific study.

#### 40 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil** 41 **Material**

42 In order to reduce the likelihood of directly or indirectly destroying a unique or significant  
43 paleontological resource, BDCP proponents will require that all construction personnel receive  
44 training provided by a qualified paleontologist experienced in teaching non-specialists, to

1 ensure that they can recognize fossil materials in the event any are discovered during  
 2 construction. Training will include information on the possibility of encountering fossils during  
 3 construction, the types of fossils likely to be seen and how to recognize them, and proper  
 4 procedures in the event fossils are encountered. All field management and supervisory  
 5 personnel and construction workers involved with ground-disturbing activities will be required  
 6 to take this training prior to beginning work. Training materials will include an informational  
 7 brochure that provides contacts and summarizes procedures in the event paleontological  
 8 resources are encountered.

9 Implementation of this measure will ensure that unique or scientifically significant  
 10 paleontological resources have a high likelihood of being identified during construction so they  
 11 can be avoided or treated appropriately.

12 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 13 **Significant Fossil Remains When Encountered**

14 To help avoid directly or indirectly destroying a unique or significant paleontological resource,  
 15 the BDCP proponents will ensure that if substantial potentially unique or significant fossil  
 16 remains (particularly vertebrate remains) are discovered during ground-disturbing activities,  
 17 the construction crew will be directed to immediately cease work in the vicinity of the find and  
 18 notify the PRS, consistent with the PRMMP described under Mitigation Measure PALEO-1a. A  
 19 newly discovered resource may need to be fenced off to protect it from inadvertent intrusions  
 20 by machinery or protect the location from vandalism. If extensive recovery and jacketing is  
 21 needed, the area will be fenced off with temporary fencing and a 3- to 5-meter (10- to 15-foot)  
 22 buffer will be included in the fenced area around the locality. If specific construction activities  
 23 preclude placement of a buffer of this width, the monitor will stake a mutually agreeable buffer  
 24 prior to fencing. The PRS will evaluate the resource and prepare a mitigation plan in accordance  
 25 with SVP guidelines (2010). The mitigation plan may include a field survey, construction  
 26 monitoring, sampling and data recovery procedures, museum storage coordination for any  
 27 specimen recovered, and a report of findings. Recommendations determined by BDCP  
 28 proponents to be necessary and feasible will be implemented before construction can resume at  
 29 the site where the paleontological resources were discovered.

30 Except for the fossils destroyed by tunnel boring machines, implementation of this measure will  
 31 ensure that unique or scientifically significant paleontological resources identified during  
 32 construction are protected from damage or treated and documented appropriately to preserve  
 33 their scientific value.

34 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 35 **with the Implementation of Other Conservation Measures**

36 Ground-disturbing activities associated with other conservation measures (CM2 and CM4–CM10)  
 37 have the potential to affect paleontological resources. These activities are evaluated below by  
 38 conservation measure. Conservation measures to address reduction of other stressors (CM11–  
 39 CM22) would have no effect on paleontological resources because they would not entail ground-  
 40 disturbing activities.

41 ***CM2 (Yolo Bypass Fisheries Enhancement)***

- 42 ● Construct four experimental ramps at the Fremont Weir.



- 1 • Construct up to three sets of up to three fish ladders.
- 2 • Construct fish screens on small Yolo Bypass diversions.
- 3 • Construct new or replacement operable check-structures at Tule Canal/Toe Drain.
- 4 • Replace the Lisbon Weir with a fish-passable gate structure.
- 5 • Realign Putah Creek.
- 6 • Modify a section of the Fremont Weir.
- 7 • Construct and operate nonphysical or physical barriers in the Sacramento River.
- 8 • Construct associated support facilities (operations buildings, parking lots, access facilities such
- 9 as roads and bridges) necessary to provide safe access for maintenance and monitoring.
- 10 • Construct and test flood-neutral fish barriers.

11 Of these ground-disturbing activities, only the realignment of Putah Creek has the potential to  
 12 disturb sensitive paleontological resources. If this realignment includes excavating a new channel,  
 13 Pleistocene deposits associated with the older alluvium of Putah Creek could be disturbed. The  
 14 other CM2 activities would occur in basin deposits of Holocene origin, which have low potential  
 15 sensitivity for paleontological resources, based on age.

16 ***CM4 (approximately 65,000 acres of restored freshwater and brackish tidal habitat within the BDCP***  
 17 ***Restoration Opportunity Areas)***

18 Ground-disturbing activities associated with CM4 range from relatively shallow, localized  
 19 excavation to deep or extensive excavation. Two types of activities involve deeper excavation.

- 20 • Modify existing land elevations through grading and filling or subsidence reversal.
- 21 • Relocate existing roads and utilities to support construction and postconstruction activities at
- 22 the restoration site or services to adjacent lands protected by levees.

23 Sensitive Pleistocene deposits occur at the surface or in the shallow subsurface in all the Restoration  
 24 Opportunity Areas (ROAs), except the South Delta ROA (Figures 27-2 and 3-1). Shallow, localized  
 25 excavation in areas where sensitive units occur at the surface could disturb paleontological  
 26 resources in these units. Deeper or extensive excavation could disturb sensitive units in all of the  
 27 ROAs.

28 ***CM5 (approximately 10,000 acres of seasonally inundated floodplain habitat within the north, east,***  
 29 ***and/or south Delta)***

30 Ground-disturbing activities associated with CM5 include clearing and grubbing, demolition of  
 31 existing structures, setting back levees and removing existing levees, removal of riprap to allow for  
 32 channel meander between setback levees, grading to restore drainage patterns and increase  
 33 inundation frequency and duration, and establishment of riparian habitat. Most of these activities  
 34 would involve shallow excavation or excavation in disturbed materials (levees), but grading to  
 35 restore drainage patterns could involve deeper excavation. This floodplain-related excavation could  
 36 occur in the northern, eastern, or southern sections of the Delta, but the most promising areas for  
 37 paleontological resources are expected along the San Joaquin River in Conservation Zone 7 (for a  
 38 description and map of the Conservation Zones, see Chapter 3, *Description of Alternatives*, and Figure  
 39 3-1). This area includes sensitive Modesto Formation and Corral Hollow/Brushy Creek drainage

1 units at or near the surface (Figures 27-2 and 3-1); sensitive paleontological resources could be  
2 disturbed in this area.

3 ***CM6 (20 linear miles of channel margin habitat enhancement in the Delta)***

4 Ground-disturbing activities associated with CM6 include clearing and grubbing, demolition of  
5 existing structures, modification of levees or setting back levees, removing riprap where levees are  
6 set back, and modifying channel geometry in unconfined channel reaches or along channels where  
7 levees are set back. Most of these activities would involve shallow excavation or excavation in  
8 disturbed materials (levees), but modifying channel geometry could involve deeper excavation.  
9 Sensitive Pleistocene deposits may be encountered at shallow depths along the San Joaquin River in  
10 Conservation Zone 7 (Figures 27-2 and 3-1), should there be channel geometry modification in this  
11 area.

12 ***CM7 (approximately 5,000 acres of restored valley/foothill riparian habitat)***

13 Ground-disturbing activities associated with CM7 include clearing and grubbing, and demolition of  
14 existing structures. Earthwork activities for development of the riparian habitat areas would be  
15 minimal and focused on removal of riprap and minor landform modifications to restore water  
16 circulation. These activities are shallow and unlikely to disturb paleontological resources.

17 ***CM8 (approximately 2,000 acres of restored grassland and 8,000 acres of protected or enhanced  
18 grassland within BDCP Conservation Zones 1, 8, and/or 11)***

19 Ground-disturbing activities associated with CM8 entail little or no ground disturbance. Any grading  
20 for this restoration would be at shallow depths and would not be likely to affect paleontological  
21 resources.

22 ***CM3 and CM9 (approximately 67 acres of restored vernal pool complex and 600 acres of protected  
23 vernal pool complex within Conservation Zones 1, 8, and/or 11)***

24 Ground-disturbing activities associated with CM9 entail some land disturbance, such as minor  
25 grading to improve connectivity between complexes. Any grading for this restoration would be at  
26 shallow depths and would not be likely to affect paleontological resources.

27 ***CM10 (approximately 1,200 acres of restored nontidal marsh within Conservation Zones 2 and 4 and/or  
28 5)***

29 Ground-disturbing activities associated with CM10 entail grading to establish an elevation gradient  
30 to support open water perennial aquatic habitat intermixed with shallower marsh habitat. The  
31 Pleistocene Riverbank and Modesto Formations are exposed throughout Conservation Zone 4 and  
32 may occur in the older alluvium of Putah Creek in Conservation Zone 2. Where sensitive Pleistocene  
33 deposits are exposed at the surface or are overlain by a shallow veneer of Holocene deposits in these  
34 two conservation zones (Figures 27-2 and 3-1), paleontological resources could be disturbed as  
35 grading is undertaken for CM10.

36 ***NEPA Effects:*** Although excavation associated with these conservation measures under Alternative  
37 1A would be shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In  
38 addition, units sensitive for paleontological resources, such as the Riverbank and Modesto  
39 Formations, occur at the surface in several conservation zones and at shallow depth in other zones.  
40 If fossils are present in the Plan Area, they could be damaged during excavation for these  
41 conservation measures. The greater the extent of excavation, the greater the potential effect,

1 although even localized excavation could damage or destroy paleontological resources. Direct or  
 2 indirect destruction of vertebrate or otherwise scientifically significant paleontological resources as  
 3 defined by the SVP (2010) would be an adverse effect.

4 Mitigation Measures PALEO-1b and PALEO-1d would be available to mitigate all shallow ground-  
 5 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 6 address all deeper ground-disturbing conservation measures.

7 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 8 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 9 these conservation measures under Alternative 1A would be fairly shallow, CM2, CM4–CM6, and  
 10 CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 11 resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 12 conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 13 they could be damaged during excavation associated with these conservation measures. The greater  
 14 the extent of excavation, the greater the potential impact, although even localized excavation could  
 15 damage or destroy paleontological resources. Direct or indirect destruction of significant  
 16 paleontological resources as defined by the SVP (2010) would constitute a significant impact.

17 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 18 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 19 ground-disturbing conservations measures would ensure that unique or significant paleontological  
 20 resources in the alternative footprint are systematically identified, documented, avoided or  
 21 protected from damage where feasible, or recovered and curated so they remain available for  
 22 scientific study and would reduce these impacts to a less-than-significant level.

23 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 24 **Paleontological Resources**

25 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of Alternative  
 26 1A.

27 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 28 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 29 **Alignment**

30 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of Alternative  
 31 1A.

32 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 33 **Material**

34 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of Alternative  
 35 1A.

36 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 37 **Significant Fossil Remains When Encountered**

38 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of Alternative  
 39 1A.

### 1 **27.3.3.3 Alternative 1B—Dual Conveyance with East Alignment and** 2 **Intakes 1–5 (15,000 cfs; Operational Scenario A)**

3 The location of BDCP facilities (and the construction activities associated with those facilities) under  
 4 Alternative 1B in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 5 activities are shown in Table 27-12. A detailed depiction of East Alignment alternative is provided in  
 6 Figure M3-2 in the Mapbook Volume.

#### 7 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result** 8 **of Construction of Water Conveyance Facilities**

9 Construction of water conveyance facilities under Alternative 1B could cause the destruction of  
 10 unique paleontological resources as a result of excavation for new intakes, new intake pumping  
 11 plants, pipelines, conveyance canal and intermediate pumping plant, culvert and tunnel siphons,  
 12 Byron Tract Forebay and canals to the Jones and Banks pumping plants, other water facility  
 13 components, roads, and borrow sites.

14 The depth, extent, and location of excavation and other ground-disturbing activities vary greatly  
 15 across the Plan Area (Table 27-12). Therefore, this discussion considers these activities on the basis  
 16 of their location and depth of excavation.

17 **Table 27-12. Summary of Conveyance Construction Activities and Geologic Units Sensitive for**  
 18 **Paleontological Resources that Could be Disturbed under Alternative 1B**

Alternative 1B	Location	Construction/Excavation	Sensitive Units Disturbed
Five new north Delta intakes	Same as 1A	Same as 1A	Same as 1A
New intake pumping plants and sedimentation basin	Same as 1A	Same as 1A	Same as 1A
Conveyance canal	From intakes to Byron Tract Forebay	Excavation depth of 30 ft, top width up to 220 ft (700 ft with right-of-way), bottom width up to 100 feet (340 ft with right-of-way)	Modesto and Riverbank Formations, alluvium of creeks from Corral Hollow Drainage to Brushy Creek
Intermediate pumping plant	Just north of Holt	Excavation 24 ft below ground surface; 8 ac total	
Byron Tract Forebay	Just south of Clifton Court Forebay	Same as 1A	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
26- by 26-foot culvert siphons	Where alignment crosses a major waterway	At least 47 ft below the existing slough invert	Riverbank and Modesto Formations
Tunnel siphons	Lost Slough and Mokelumne River floodway (7,444 ft), San Joaquin River (3,233 ft), and Old River (1,914 ft)	Same as tunnel	Riverbank and Modesto Formations

19

1 The intakes and associated pumping plants and sedimentation basins would be the same under  
2 Alternative 1B as under Alternative 1A. See the discussion under Alternative 1A.

3 The main conveyance feature of Alternative 1B would be a 42-mile-long lined or unlined canal that  
4 would begin at the intakes in the northern end of the Plan Area and follow the eastern edge of the  
5 Plan Area to the Byron Tract Forebay immediately southeast of Clifton Court Forebay (Figure 27-2).  
6 Culvert siphons (discussed below) would be used to convey flow under existing sloughs and a  
7 railroad, and tunnel siphons (discussed below) would be used to convey flow under rivers and  
8 floodways.

9 Canal construction would involve excavating to a depth of 30 feet with a top width of 220 feet (up to  
10 700 feet with right-of-way) and a bottom width of up to 100 feet (340 feet with right-of-way). The  
11 amount of material that would be excavated, which is the greatest of all alternatives, is shown in  
12 Table 27-11. In this alignment, Pleistocene deposits sensitive for paleontological resources occur at  
13 or near the surface from the intakes to the San Joaquin River and at shallow depth from the river to  
14 the Byron Tract Forebay (Figures 27-2 and 27-3). These deposits would therefore be disturbed  
15 during excavation of the canal. In addition, canal construction requires that the organic-rich peaty  
16 soils, which may be up to 25 feet thick, be removed, thereby increasing the likelihood that  
17 Pleistocene deposits would be encountered. At the southern end of the canal, the Holocene or Upper  
18 Pleistocene alluvium of creeks from the Corral Hollow Drainage to Brushy Creek (Qch), which is  
19 sensitive for paleontological resources, is exposed at the surface. Excavation of the canal would  
20 therefore likely disturb several Pleistocene units sensitive for paleontological resources.

21 Where the alignment crosses a major waterway, culvert siphons would be constructed. Culvert  
22 siphons would be constructed using cut-and-cover methods. The depth of trenches for these culvert  
23 siphons would vary by location, but the roof of the 26- by 26-foot concrete structures would be  
24 installed at least 47 feet below the existing slough invert. In most cases, peat soil would be excavated  
25 so that the culvert foundation would be founded on alluvial sand (Pleistocene). Given the depth of  
26 the culverts and the need to remove peat soil in some locations, excavation of the culvert siphons  
27 would therefore likely disturb Pleistocene units sensitive for paleontological resources (Figure 27-  
28 3).

29 Construction of the intermediate pumping plant, which would be located on the canal just north of  
30 Holt, would disturb approximately 8 acres. The area of the pumping plant would be excavated to a  
31 depth of 24 feet below ground surface. In this area, Holocene deposits form a veneer over the  
32 Pleistocene deposits (Figures 27-2 and 27-3). Excavation for the intermediate pumping plant would  
33 therefore likely disturb Pleistocene units sensitive for paleontological resources.

34 Excavation for the conveyance canal, culvert siphons, and intermediate pumping plant would all  
35 likely disturb Pleistocene units sensitive for paleontological resources.

36 Tunnel siphons would be constructed at three locations along the canal: at the Lost Slough and  
37 Mokelumne River floodway (7,444 feet long), at the San Joaquin River (3,233 feet long), and at Old  
38 River (1,914 feet long). Each tunnel siphon would consist of dual bores with finished inside  
39 diameters of 33 feet. The amount of material that would be excavated for the tunnel siphons is  
40 shown in Table 27-11. Although only a fraction of the length of the conveyance tunnels described  
41 under Alternative 1A, these tunnel siphons would use the same construction methods, such as use of  
42 TBM to excavate tunnels at a depth of approximately 150 feet. Shafts and tunnels would be  
43 excavated through Holocene and Pleistocene deposits (Figures 27-2 and 27-3). Shafts would be

1 excavated through surficial Holocene deposits and then through Pleistocene deposits of the  
2 Riverbank or Modesto Formations. Tunnels would be bored wholly through Pleistocene deposits.

3 Pipelines under Alternative 1B would be similar to those under Alternative 1A, except that they  
4 would extend from each of the five intakes to the main conveyance canal. General location,  
5 excavation depth and width, and geologic units that would be encountered would be the same as  
6 under Alternative 1A.

7 The construction and excavation for the Byron Tract Forebay and new approach canals to the Banks  
8 and Jones pumping plants would be the same under Alternative 1B as under 1A. Please refer to the  
9 discussion under Alternative 1A.

10 The effects of road construction under Alternative 1B would be less extensive than those under  
11 Alternative 1A and would not be likely to have adverse effects on sensitive paleontological resources  
12 because of the shallow nature of these ground-disturbing activities.

13 Borrow material would be needed for canal embankment construction, levee reconstruction at  
14 intake sites, and to a lesser extent for access roads under Alternative 1B. Although cut and fill would  
15 be nearly balanced in some segments, other segments would require about 200,000,000 cubic yards  
16 of borrow material, compared to 13,500,000 cubic yards under Alternative 1A (Table 27-11)  
17 (Chapter 26, *Mineral Resources*). The same geologic units would be used for borrow material as  
18 would be used under Alternative 1A (see description under Alternative 1A), but much greater  
19 quantities of borrow material would be needed for the canal embankments, necessitating large  
20 borrow/spoil areas in several locations along the canal alignment. In this alignment, Pleistocene  
21 deposits occur at or near the surface from the intakes to the San Joaquin River and at shallow depth  
22 from the river to the Byron Tract Forebay. Excavation of borrow material from these units could  
23 disturb paleontological resources.

24 **NEPA Effects:** If fossils are present in the Plan Area, the ground-disturbing activities that occur in  
25 geologic units sensitive for paleontological resources have the potential to damage or destroy those  
26 resources. Direct or indirect destruction of significant paleontological resources as defined by the  
27 SVP (2010) would represent an adverse effect under NEPA because conveyance facility construction  
28 could directly or indirectly destroy unknown paleontological resources in geologic units known to  
29 be sensitive for these resources.

30 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
31 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
32 1b and PALEO-1d.

33 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
34 surface-related ground disturbance activities described above. However, while these measures  
35 could be applied to the excavation of the tunnel shafts (for tunnel siphons), no mitigation is available  
36 for the boring activities because they would be conducted deep underground and could not be  
37 monitored. Moreover, although boring material could be examined by monitors, such work would be  
38 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.  
39 Implementing these measures will ensure that mitigation procedures are followed so that unique or  
40 scientifically significant paleontological resources in the alternative footprint are systematically  
41 identified, documented, avoided or protected from damage where feasible, or recovered and curated  
42 so they remain available for scientific study.

1 Excavation for the new intakes, new intake pumping plants, pipelines, conveyance canal and  
 2 intermediate pumping plant, culvert and tunnel siphons, Byron Tract Forebay and canals to the  
 3 Jones and Banks pumping plants necessary for Alternative 1B would most likely destroy unique or  
 4 significant paleontological resources and would constitute an adverse effect under NEPA.

5 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 1B could  
 6 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 7 associated with Alternative 1B would occur in geologic units sensitive for paleontological resources  
 8 and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 9 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 10 significant impact under CEQA. While implementation of Mitigation Measures PALEO 1a through  
 11 PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 12 level, excavation for the intakes, pumping plants, conveyance canal, culvert siphons, intermediate  
 13 pumping plant, Byron Tract Forebay, and the new approach to the Banks Pumping Plant necessary  
 14 for Alternative 1B would most likely destroy unique or significant paleontological resources and  
 15 would cause a significant and unavoidable impact.

16 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 17 **Paleontological Resources**

18 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 19 Alternative 1A.

20 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 21 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 22 **Alignment**

23 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 24 Alternative 1A.

25 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 26 **Material**

27 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 28 Alternative 1A.

29 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 30 **Significant Fossil Remains When Encountered**

31 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 32 Alternative 1A.

33 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 34 **with the Implementation of Other Conservation Measures**

35 **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 36 CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 37 detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 38 stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 39 entail ground-disturbing activities.

1 Although excavation associated with these conservation measures under Alternative 1B would be  
 2 shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 3 sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 4 surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 5 the Plan Area, they could be damaged during excavation for these conservation measures. The  
 6 greater the extent of excavation, the greater the potential effect, although even localized excavation  
 7 could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 8 otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 9 an adverse effect.

10 Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 11 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 12 address all deeper ground-disturbing conservation measures.

13 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 14 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 15 these conservation measures under Alternative 1B would be fairly shallow, CM2, CM4–CM6, and  
 16 CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 17 resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 18 conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 19 they could be damaged during excavation associated with these conservation measures. The greater  
 20 the extent of excavation, the greater the potential impact, although even localized excavation could  
 21 damage or destroy paleontological resources. Direct or indirect destruction of significant  
 22 paleontological resources as defined by the SVP (2010) would constitute a significant impact.

23 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 24 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 25 ground-disturbing conservation measures would ensure that unique or significant paleontological  
 26 resources in the alternative footprint are systematically identified, documented, avoided or  
 27 protected from damage where feasible, or recovered and curated so they remain available for  
 28 scientific study and would reduce these impacts to a less-than-significant level.

29 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 30 **Paleontological Resources**

31 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 32 Alternative 1A.

33 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 34 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 35 **Alignment**

36 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 37 Alternative 1A.

38 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 39 **Material**

40 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 41 Alternative 1A.



1 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 2 **Significant Fossil Remains When Encountered**

3 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 4 Alternative 1A.

5 **27.3.3.4 Alternative 1C—Dual Conveyance with West Alignment and**  
 6 **Intakes W1–W5 (15,000 cfs; Operational Scenario A)**

7 The location of BDCP facilities (and the construction activities associated with those facilities) under  
 8 Alternative 1C in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 9 activities are shown in Table 27-13. A detailed depiction of the West Alignment alternative is  
 10 provided in Figure M3-3 in the Mapbook Volume.

11 **Table 27-13. Summary of BDCP Construction Activities and Geologic Units Sensitive for Paleontological**  
 12 **Resources that Could be Disturbed under Alternative 1C**

Alternative 1C	Location	Construction/Excavation	Sensitive Units Disturbed
Five new north Delta intakes	West bank Sacramento River between Clarksburg and Walnut Grove	Same as 1A except slightly smaller area of 291 ac	Riverbank and Modesto Formations and possibly Putah Creek alluvium
New intake pumping plants and sedimentation basins	Adjacent to intakes	Same as 1A except slightly smaller area of 104–144 ac	
Conveyance canal	Intakes to intermediate pumping plant on Ryer Island and Hotchkiss Slough to Byron Tract Forebay	Excavation depth of 30 ft, top width up to 220 ft (700 ft with right-of-way), bottom width up to 100 feet (340 ft with right-of-way)	Modesto Formation and other Pleistocene units and upper Pleistocene eolian deposits of the Modesto Formation, Holocene and upper Pleistocene younger alluvium of Marsh Creek, and alluvium of creeks from Corral Hollow Drainage to Brushy Creek
Intermediate Pumping Plant		Slab invert 15–20 ft below existing grade; 8 ac total	Upper Pleistocene deposits
Byron Tract Forebay	Just northwest of Clifton Court Forebay	630 ac to a depth of 15–20 ft below existing grade	Holocene or Upper Pleistocene alluvium of creeks from the Corral Hollow Drainage to Brushy Creek and younger alluvium of Marsh Creek
Tunnel	Dual-bore 33-ft-diameter tunnel, 17 mi from Intermediate Pumping Plant to southern section of conveyance canal	Shaft to 100–150 ft; tunnel invert at 150 ft; boring using pressurized face mechanized tunneling machines, including earth pressure balance (EPB) machines and slurry tunneling machines	Riverbank and Modesto Formations
26- by 26-ft culvert siphons	Same as 1B	Same as 1B	Same as 1B

13

## Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result of Construction of Water Conveyance Facilities

Construction of water conveyance facilities under Alternative 1C could cause the destruction of unique paleontological resources as a result of excavation for new intakes, new intake pumping plants, pipelines, conveyance canal and tunnel, intermediate pumping plant, culvert siphons, Byron Tract Forebay and canals to Jones and Banks pumping plants, other water facility components, roads, and borrow sites.

The depth, extent, and location of excavation and other ground-disturbing activities vary greatly across the Plan Area (Table 27-13). Therefore, this discussion considers these activities on the basis of their location and the depth of excavation.

The five intakes would involve deep and extensive excavation in the northern portion of the Plan Area (Table 27-13). The five intakes and the pumping plant and sedimentation basin associated with each intake would be similar to those under Alternative 1A, except that the intakes would be along the west bank of the Sacramento River between Clarksburg and Walnut Grove. Ground-disturbing activities include clearing and grubbing, rough grading, excavation, pile driving, constructing foundations, and final grading. Construction of the intakes, pumping plants, and sedimentation basins would involve excavation to a depth of 20–30 feet over an area of 291 acres. The staging/storage area and construction zone preparation would involve 76–148 acres per intake structure.

As with Alternative 1A, excavation for the intakes would occur in both sensitive and nonsensitive units (Figure 27-2). Although most of the surficial geologic units in the area affected by excavation for the intakes and forebays are of Holocene age and not sensitive for paleontological resources, the Riverbank Formation, which is of Pleistocene age and sensitive for paleontological resources, is exposed at the surface in some locations or underlies the Holocene units in the shallow subsurface (Figure 27-2). Other Pleistocene units that occur in the area include the younger and older alluvium of Putah Creek; whether this unit has the potential to contain fossils is unknown, but nonmarine Pleistocene deposits are generally considered sensitive for paleontological resources. The Riverbank and other Pleistocene units likely occur at a depth of 0–10 feet and would therefore be disturbed during excavation of the intakes (Figure 27-3).

One of the main features of Alternative 1C would be two canals, either lined or unlined (Figure 27-2). The first canal would begin at the intakes in the northern portion of the Plan Area and continue to an intermediate pumping plant on Ryer Island at the tunnel transition structure. The second canal would begin at the second tunnel transition structure at Hotchkiss Slough and continue to the Bryon Tract Forebay in the southern portion of the Plan Area. Culvert siphons (discussed below) would be used to convey flow under existing waterways and a railroad.

Canal construction would involve excavating to a depth of 30 feet with a top width of 220 feet (up to 700 feet with right-of-way) and a bottom width of up to 100 feet (340 feet with right-of-way). The amount of material that would be excavated, which is more than under Alternative 1A but less than under Alternative 1B, is shown in Table 27-11. In the canal alignment between the intakes and intermediate pumping plant, the geologic units exposed at the surface are the Holocene flood-basin and peat and mud deposits (Figure 27-2). These units are estimated to be from 0 to more than 30 feet thick and are not likely to contain fossils (i.e., not sensitive for paleontological resources) (Figure 27-3). Underlying these Holocene deposits are Pleistocene units, such as the Modesto

1 Formation. The Modesto Formation is sensitive for paleontological resources, and the other  
2 Pleistocene units are also likely to be sensitive for paleontological resources.

3 In the canal alignment from Hotchkiss Slough to Byron Tract Forebay, the geologic units exposed at  
4 the surface are the upper Pleistocene eolian deposits of the Modesto Formation and the Holocene  
5 and upper Pleistocene younger alluvium of Marsh Creek and alluvium of creeks from the Corral  
6 Hollow Drainage to Brushy Creek (Figure 27-2). The Modesto Formation is sensitive for  
7 paleontological resources; consequently, sensitive Pleistocene deposits would be disturbed during  
8 excavation of this section of the canal.

9 Culvert siphons would be constructed where canals would cross major waterways. Culvert siphons  
10 would be constructed using cut-and-cover methods. The depth of trenches for these culvert siphons  
11 would vary by location, but the roof of the 26- by 26-foot concrete structures would be installed  
12 47 feet below the existing slough invert. In most cases, peat soil would be excavated so that the  
13 culvert foundation would be founded on alluvial sand (Pleistocene). Given the depth of the culverts  
14 and the need to remove peat soil in some locations, excavation of the culvert siphons would likely  
15 disturb Pleistocene units sensitive for paleontological resources.

16 Construction of the intermediate pumping plant would also involve construction of an approach  
17 channel, and construction of a substation. The slab invert of the pumping plant would be 15–20 feet  
18 below existing grade. Excavation for these facilities would be in both Holocene peat and mud  
19 deposits and flood-basin deposits and in upper Pleistocene deposits (Figures 27-2 and 27-3).  
20 Consequently, excavation for the intermediate pumping plant would likely disturb Pleistocene units  
21 sensitive for paleontological resources.

22 Under Alternative 1C, a 17-mile, 33-ft inside diameter dual-bore tunnel would convey water from  
23 the intermediate pumping plant to the second canal. The amount of material that would be  
24 excavated is shown in Table 27-11. With the exception of its reduced length, construction of this  
25 tunnel would be the same as described under Alternative 1A, such as use of TBM to excavate tunnels  
26 at a depth of approximately 150 feet.

27 As under Alternative 1A, shafts and tunnels would be excavated through Holocene and Pleistocene  
28 deposits. Shafts would be excavated through surficial Holocene deposits and then through  
29 Pleistocene deposits of the Riverbank or Modesto Formations. Tunnels would be bored wholly  
30 through Pleistocene deposits.

31 The construction and excavation for the Byron Tract Forebay north of the Clifton Court Forebay  
32 would take place in the surficial deposits of the Holocene or Upper Pleistocene alluvium of creeks  
33 from the Corral Hollow Drainage to Brushy Creek and younger alluvium of Marsh Creek, which are  
34 sensitive for paleontological resources, and the Holocene younger alluvium of Montezuma Hills and  
35 vicinity and alluvial flood-plain deposits (Figures 27-2 and 27-3). Excavation for the forebay would  
36 disturb Pleistocene units sensitive for paleontological resources.

37 Construction of temporary and permanent access roads would involve shallow excavation and  
38 grading and would not be expected to adversely affect sensitive paleontological resources.

39 Borrow material would be needed for canal embankment construction, levee reconstruction at  
40 intake sites, and access roads under Alternative 1C. The same geologic units would be targeted for  
41 borrow material as under Alternative 1A (see description under Alternative 1A) but much greater  
42 quantities of borrow material would be needed for the canal embankments (200,000,000 cubic  
43 yards compared to 13,500,000 cubic yards tons under Alternative 1A) (Table 27-11). In addition,

1 borrow/spoil areas are designated in several areas along the canal alignment. In the canal alignment  
2 between the intakes and intermediate pumping plant, the geologic units exposed at the surface are  
3 the Holocene flood-basin and peat and mud deposits. These units are estimated to be 5–30 feet thick  
4 and are not likely to contain fossils (i.e., not sensitive for paleontological resources). Underlying  
5 these Holocene deposits are Pleistocene units, such as the Modesto Formation. The Modesto  
6 Formation is sensitive for paleontological resources, and the other Pleistocene units are also likely  
7 to be sensitive for paleontological resources. In the canal alignment from Hotchkiss Slough to Byron  
8 Tract Forebay, the geologic units exposed at the surface are the upper Pleistocene eolian deposits of  
9 the Modesto Formation and the Holocene and upper Pleistocene younger alluvium of Marsh Creek  
10 and alluvium of creeks from the Corral Hollow Drainage to Brushy Creek. The Modesto Formation is  
11 sensitive for paleontological resources; consequently, sensitive Pleistocene deposits would be  
12 disturbed during excavation of the canals.

13 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for  
14 paleontological resources have the potential to damage or destroy those resources. Direct or  
15 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
16 represent an adverse effect because conveyance facility construction could directly or indirectly  
17 destroy unknown paleontological resources in geologic units known to be sensitive for these  
18 resources.

19 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
20 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
21 1b and 1d. The effects associated with the borrow sites would be greater than under Alternative 1A  
22 but less than under Alternative 1B.

23 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
24 surface-related activities described above. However, while these measures could be applied to the  
25 excavation of the tunnel shafts, no mitigation is available for the boring activities because they  
26 would be conducted deep underground and could not be monitored. Moreover, although boring  
27 material could be examined by monitors, such work would be subsequent to boring and the boring  
28 area could not be accessed even if fossils were encountered. Because the length of the dual-bore  
29 tunnel would be considerably less under Alternative 1C than under Alternative 1A, the severity of  
30 this effect would be reduced. However, excavation for new intakes, new intake pumping plants,  
31 pipelines, conveyance canal and tunnel, intermediate pumping plant, culvert siphons, Byron Tract  
32 Forebay and canals to Jones and Banks pumping plants necessary for Alternative 1C would most  
33 likely still destroy unique or significant paleontological resources and would constitute an adverse  
34 effect under NEPA.

35 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 1C could  
36 cause the destruction of unique paleontological resources. Ground-disturbing activities associated  
37 with Alternative 1C in geologic units sensitive for paleontological resources have the potential to  
38 damage or destroy those resources. Direct or indirect destruction of significant paleontological  
39 resources as defined by the SVP (2010) would constitute a significant impact under CEQA. While  
40 implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of  
41 surface-related ground disturbance to a less-than-significant level, excavation for new intakes, new  
42 intake pumping plants, pipelines, conveyance canal and tunnel, intermediate pumping plant, culvert  
43 siphons, Byron Tract Forebay and canals to Jones and Banks pumping plants necessary for  
44 Alternative 1C would most likely destroy unique or significant paleontological resources in the Plan  
45 Area and would cause a significant and unavoidable impact.

1       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 2       **Paleontological Resources**

3       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 4       Alternative 1A.

5       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 6       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 7       **Alignment**

8       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 9       Alternative 1A.

10       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 11       **Material**

12       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 13       Alternative 1A.

14       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 15       **Significant Fossil Remains When Encountered**

16       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 17       Alternative 1A.

18       **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 19       **with the Implementation of Other Conservation Measures**

20       **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 21       CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 22       detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 23       stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 24       entail ground-disturbing activities.

25       Although excavation associated with these conservation measures under Alternative 1C would be  
 26       shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 27       sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 28       surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 29       the Plan Area, they could be damaged during excavation for these conservation measures. The  
 30       greater the extent of excavation, the greater the potential effect, although even localized excavation  
 31       could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 32       otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 33       an adverse effect.

34       Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 35       disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 36       address all deeper ground-disturbing conservation measures.

37       **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 38       and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 39       these conservation measures under Alternative 1 would be fairly shallow, CM2, CM4–CM6, and

1 CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 2 resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 3 conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 4 they could be damaged during excavation associated with these conservation measures. The greater  
 5 the extent of excavation, the greater the potential impact, although even localized excavation could  
 6 damage or destroy paleontological resources. Direct or indirect destruction of significant  
 7 paleontological resources as defined by the SVP (2010) would constitute a significant impact.

8 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 9 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 10 ground-disturbing conservation measures ensure that unique or significant paleontological  
 11 resources in the alternative footprint are systematically identified, documented, avoided or  
 12 protected from damage where feasible, or recovered and curated so they remain available for  
 13 scientific study and would reduce these impacts to a less-than-significant level.

14 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 15 **Paleontological Resources**

16 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 17 Alternative 1A.

18 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 19 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 20 **Alignment**

21 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 22 Alternative 1A.

23 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 24 **Material**

25 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 26 Alternative 1A.

27 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 28 **Significant Fossil Remains When Encountered**

29 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 30 Alternative 1A.

31 **27.3.3.5 Alternative 2A—Dual Conveyance with Pipeline/Tunnel and Five**  
 32 **Intakes (15,000 cfs; Operational Scenario B)**

33 The location of BDCP facilities (and the construction activities associated with those facilities) under  
 34 Alternative 2A in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 35 activities are shown in Table 27-10.

1     **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 2     **of Construction of Water Conveyance Facilities**

3     **NEPA Effects:** Alternative 2A would include the same physical/structural components as Alternative  
 4     1A, but could entail two different intakes and intake pumping plant locations and an operable  
 5     barrier at the head of Old River. The two alternate intakes, if selected, would be downstream of  
 6     Sutter and Steamboat Sloughs. These two intakes are in the same geologic units and would not  
 7     substantially change the effects on paleontological resources. The operable barrier would be  
 8     constructed in units of Holocene age and not sensitive for paleontological resources and, possibly,  
 9     the Modesto Formation, which occurs in the shallow subsurface. The operable barrier is in the same  
 10    geologic units as the canals to Jones and Banks pumping plants and would not substantially change  
 11    the effects on paleontological resources. The effects of Alternative 2A would, therefore, be the same  
 12    as those under Alternative 1A. See the discussion of Impact PALEO-1 under Alternative 1A.

13    The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 14    construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 15    1b and 1d.

16    Mitigation Measures 1a through PALEO-1d are available to mitigate the effects of the surface-related  
 17    ground disturbance activities associated with Alternative 2A. However, while these measures could  
 18    be applied to the excavation of the tunnel shafts, no mitigation is available for the boring activities  
 19    because they would be conducted deep underground and could not be monitored. Moreover,  
 20    although boring material could be examined by monitors, such work would be subsequent to boring,  
 21    and the boring area could not be accessed even if fossils were encountered.

22    Excavation for the intakes, pipelines, intermediate forebay, Byron Tract Forebay and the new  
 23    approach to the Banks Pumping Plant necessary for construction of the tunnels would most likely  
 24    destroy unique or significant paleontological resources and would constitute an adverse effect  
 25    under NEPA.

26    **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 2A could  
 27    cause the destruction of unique paleontological resources. The ground-disturbing activities  
 28    associated with Alternative 2A would occur in geologic units sensitive for paleontological resources  
 29    and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 30    destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 31    significant impact under CEQA. While implementation of Mitigation Measures PALEO 1a through  
 32    PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 33    level, excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels,  
 34    canals to Jones and Banks pumping plants necessary for Alternative 2A would most likely destroy  
 35    unique or significant paleontological resources in the Plan Area and would cause a significant and  
 36    unavoidable impact.

37           **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 38           **Paleontological Resources**

39           Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 40           Alternative 1A.

1           **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 2           **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 3           **Alignment**

4           Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 5           Alternative 1A.

6           **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 7           **Material**

8           Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 9           Alternative 1A.

10          **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 11          **Significant Fossil Remains When Encountered**

12          Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 13          Alternative 1A.

14          **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 15          **with the Implementation of Other Conservation Measures**

16          **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 17          CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 18          detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 19          stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 20          entail ground-disturbing activities.

21          Although excavation associated with these conservation measures under Alternative 2A would be  
 22          shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 23          sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 24          surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 25          the Plan Area, they could be damaged during excavation for these conservation measures. The  
 26          greater the extent of excavation, the greater the potential effect, although even localized excavation  
 27          could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 28          otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 29          an adverse effect.

30          Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 31          disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 32          address all deeper ground-disturbing conservation measures.

33          **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 34          and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 35          these conservation measures under Alternative 2A would be fairly shallow, CM2, CM4–CM6, and  
 36          CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 37          resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 38          conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 39          they could be damaged during excavation associated with these conservation measures. The greater  
 40          the extent of excavation, the greater the potential impact, although even localized excavation could



1 damage or destroy paleontological resources. Direct or indirect destruction of significant  
2 paleontological resources as defined by the SVP (2010) would constitute a significant impact.

3 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
4 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
5 ground-disturbing conservation measures would ensure that unique or significant paleontological  
6 resources in the alternative footprint are systematically identified, documented, avoided or  
7 protected from damage where feasible, or recovered and curated so they remain available for  
8 scientific study and would reduce these impacts to a less-than-significant level.

9 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
10 **Paleontological Resources**

11 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
12 Alternative 1A.

13 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
14 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
15 **Alignment**

16 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
17 Alternative 1A.

18 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
19 **Material**

20 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
21 Alternative 1A.

22 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
23 **Significant Fossil Remains When Encountered**

24 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
25 Alternative 1A.

26 **27.3.3.6 Alternative 2B—Dual Conveyance with East Alignment and Five**  
27 **Intakes (15,000 cfs; Operational Scenario B)**

28 The location of BDCP facilities (and the construction activities associated with those facilities) under  
29 Alternative 2B in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
30 activities are shown in Table 27-12.

31 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
32 **of Construction of Water Conveyance Facilities**

33 **NEPA Effects:** Alternative 2B would include the same physical/structural components as Alternative  
34 1B, but, like Alternative 2A, it could entail two different intakes and intake pumping plant locations  
35 and an operable barrier at the head of Old River. The two alternate intakes, if selected, would be  
36 downstream of Sutter and Steamboat Sloughs. These intake locations, however, would be in the  
37 same geologic units and would not substantially change the effects on paleontological resources. The  
38 operable barrier would be constructed in units of Holocene age and not sensitive for paleontological

1 resources and, possibly, the Modesto Formation, which occurs in the shallow subsurface. The  
2 operable barrier is in the same geologic units as the canals to Jones and Banks pumping plants and  
3 would not substantially change the effects on paleontological resources. The effects of Alternative  
4 2B would, therefore, be the same as those under Alternative 1B. See the discussion of Impact  
5 PALEO-1 under Alternative 1B.

6 If fossils are present in the Plan Area, the ground-disturbing activities that occur in geologic units  
7 sensitive for paleontological resources have the potential to damage or destroy those resources.  
8 Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010)  
9 would represent an adverse effect because conveyance facility construction could directly or  
10 indirectly destroy unknown paleontological resources in geologic units known to be sensitive for  
11 these resources.

12 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
13 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
14 1b and PALEO-1d.

15 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
16 surface-related ground disturbance activities described above. However, while these measures  
17 could be applied to the excavation of the tunnel shafts (for tunnel siphons), no mitigation is available  
18 for the boring activities because they would be conducted deep underground and could not be  
19 monitored. Moreover, although boring material could be examined by monitors, such work would be  
20 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.  
21 Implementing these measures will ensure that mitigation procedures are followed so that unique or  
22 scientifically significant paleontological resources in the alternative footprint are systematically  
23 identified, documented, avoided or protected from damage where feasible, or recovered and curated  
24 so they remain available for scientific study.

25 Excavation for the new intakes, new intake pumping plants, pipelines, conveyance canal and  
26 intermediate pumping plant, culvert and tunnel siphons, Byron Tract Forebay and canals to the  
27 Jones and Banks pumping plants necessary for Alternative 2B would most likely destroy unique or  
28 significant paleontological resources and would constitute an adverse effect under NEPA.

29 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 2B could  
30 cause the destruction of unique paleontological resources. The ground-disturbing activities  
31 associated with Alternative 2B would occur in geologic units sensitive for paleontological resources  
32 and could therefore have the potential to damage or destroy those resources. Direct or indirect  
33 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
34 significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
35 PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
36 level, excavation for the new intakes, new intake pumping plants, pipelines, conveyance canal and  
37 intermediate pumping plant, culvert and tunnel siphons, Byron Tract Forebay and canals to the  
38 Jones and Banks pumping plants necessary for Alternative 2B would most likely destroy unique or  
39 significant paleontological resources in the Plan Area and would constitute a significant and  
40 unavoidable impact.

1       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 2       **Paleontological Resources**

3       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 4       Alternative 1A.

5       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 6       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 7       **Alignment**

8       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 9       Alternative 1A.

10       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 11       **Material**

12       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 13       Alternative 1A.

14       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 15       **Significant Fossil Remains When Encountered**

16       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 17       Alternative 1A.

18       **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 19       **with the Implementation of Other Conservation Measures**

20       **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 21       CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 22       detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 23       stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 24       entail ground-disturbing activities.

25       Although excavation associated with these conservation measures under Alternative 2B would be  
 26       shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 27       sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 28       surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 29       the Plan Area, they could be damaged during excavation for these conservation measures. The  
 30       greater the extent of excavation, the greater the potential effect, although even localized excavation  
 31       could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 32       otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 33       an adverse effect.

34       Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 35       disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 36       address all deeper ground-disturbing conservation measures.

37       **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 38       and CM4–CM6, and CM10) could affect paleontological resources. Although most excavation  
 39       associated with these conservation measures under Alternative 2B would be fairly shallow, CM2,

1 CM4–CM6, and CM10 require deeper or more extensive excavation. Units sensitive for  
 2 paleontological resources, such as the Riverbank and Modesto Formations, occur at the surface in  
 3 several conservation zones and occur at shallow depth in other zones. If fossils are present in the  
 4 Plan Area, they could be damaged during excavation associated with these conservation measures.  
 5 The greater the extent of excavation, the greater the potential impact, although even localized  
 6 excavation could damage or destroy paleontological resources. Direct or indirect destruction of  
 7 significant paleontological resources as defined by the SVP (2010) would constitute a significant  
 8 impact.

9 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 10 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 11 ground-disturbing conservation measures would ensure that unique or significant paleontological  
 12 resources in the alternative footprint are systematically identified, documented, avoided or  
 13 protected from damage where feasible, or recovered and curated so they remain available for  
 14 scientific study and would reduce these impacts to a less-than-significant level.

15 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 16 **Paleontological Resources**

17 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 18 Alternative 1A.

19 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 20 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 21 **Alignment**

22 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 23 Alternative 1A.

24 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 25 **Material**

26 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 27 Alternative 1A.

28 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 29 **Significant Fossil Remains When Encountered**

30 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 31 Alternative 1A.

32 **27.3.3.7 Alternative 2C—Dual Conveyance with West Alignment Intakes**  
 33 **W1–W5 (15,000 cfs; Operational Scenario B)**

34 The location of BDCP facilities (and the construction activities associated with those facilities) under  
 35 Alternative 2C in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 36 activities are shown in Table 27-13.

## 1 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result** 2 **of Construction of Water Conveyance Facilities**

3 Alternative 2C would include the same physical/structural components as Alternative 1C, but like  
4 Alternative 2A, it could entail two different intakes and intake pumping plant locations and an  
5 operable barrier at the head of Old River. The two alternate intakes, if selected, would be  
6 downstream of Sutter and Steamboat Sloughs. These intake locations, however, would be in the  
7 same geologic units and would not substantially change the effects on paleontological resources. The  
8 operable barrier would be constructed in units of Holocene age and not sensitive for paleontological  
9 resources and, possibly, the Modesto Formation, which occurs in the shallow subsurface. The  
10 operable barrier is in the same geologic units as the canals to Jones and Banks pumping plants and  
11 would not substantially change the effects on paleontological resources. The effects of Alternative 2C  
12 would, therefore, be the same as those under Alternative 1C. See the discussion of Impact PALEO-1  
13 under Alternative 1C.

14 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for  
15 paleontological resources have the potential to damage or destroy those resources. Direct or  
16 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
17 represent an adverse effect because conveyance facility construction could directly or indirectly  
18 destroy unknown paleontological resources in geologic units known to be sensitive for these  
19 resources.

20 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
21 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
22 1b and PALEO-1d. The effects associated with the borrow sites would be greater than under  
23 Alternative 2A but less than under Alternative 2B.

24 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
25 surface-related ground disturbance activities associated with Alternative 2C. However, while these  
26 measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
27 boring activities because they would be conducted deep underground and could not be monitored.  
28 Moreover, although boring material could be examined by monitors, such work would be  
29 subsequent to boring and the boring area could not be accessed even if fossils were encountered.

30 Because the length of the dual-bore tunnel would be considerably less under Alternative 2C than  
31 under Alternatives 1A and 2A, the severity of this effect would be reduced. However, excavation for  
32 new intakes, new intake pumping plants, pipelines, conveyance canal and intermediate pumping  
33 plant, culvert siphons, tunnel, Byron Tract Forebay and canals to Jones and Banks pumping plants  
34 would still most likely destroy unique or significant paleontological resources and would constitute  
35 an adverse effect under NEPA.

36 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 2C could  
37 cause the destruction of unique paleontological resources. Ground-disturbing activities associated  
38 with Alternative 2C in geologic units sensitive for paleontological resources have the potential to  
39 damage or destroy those resources. Direct or indirect destruction of significant paleontological  
40 resources as defined by the SVP (2010) would constitute a significant impact under CEQA. While  
41 implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of  
42 surface-related ground disturbance to a less-than-significant level, excavation for new intakes, new  
43 intake pumping plants, new forebays, pipelines and tunnels, canals to Jones and Banks pumping  
44 plants, and other water facility components necessary for Alternative 2C would most likely destroy

1 unique or significant paleontological resources in the Plan Area and would cause a significant and  
2 unavoidable impact.

3 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
4 **Paleontological Resources**

5 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
6 Alternative 1A.

7 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
8 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
9 **Alignment**

10 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
11 Alternative 1A.

12 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
13 **Material**

14 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
15 Alternative 1A.

16 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
17 **Significant Fossil Remains When Encountered**

18 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
19 Alternative 1A.

20 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
21 **with the Implementation of Other Conservation Measures**

22 **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
23 CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
24 detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
25 stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
26 entail ground-disturbing activities.

27 Although excavation associated with these conservation measures under Alternative 2C would be  
28 shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units sensitive for  
29 paleontological resources, such as the Riverbank and Modesto Formations, occur at the surface in  
30 several conservation zones and at shallow depth in other zones. If fossils are present in the Plan  
31 Area, they could be damaged during excavation for these conservation measures. The greater the  
32 extent of excavation, the greater the potential effect, although even localized excavation could  
33 damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
34 otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
35 an adverse effect.

36 Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
37 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
38 address all deeper ground-disturbing conservation measures.

1 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 2 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 3 these conservation measures under Alternative 2C would be fairly shallow, CM2, CM4–CM6, and  
 4 CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 5 resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 6 conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 7 they could be damaged during excavation associated with these conservation measures. The greater  
 8 the extent of excavation, the greater the potential impact, although even localized excavation could  
 9 damage or destroy paleontological resources. Direct or indirect destruction of significant  
 10 paleontological resources as defined by the SVP (2010) would constitute a significant impact.

11 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 12 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 13 ground-disturbing conservation measures would ensure that unique or significant paleontological  
 14 resources in the alternative footprint are systematically identified, documented, avoided or  
 15 protected from damage where feasible, or recovered and curated so they remain available for  
 16 scientific study and would reduce these impacts to a less-than-significant level.

17 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 18 **Paleontological Resources**

19 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 20 Alternative 1A.

21 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 22 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 23 **Alignment**

24 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 25 Alternative 1A.

26 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 27 **Material**

28 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 29 Alternative 1A.

30 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 31 **Significant Fossil Remains When Encountered**

32 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 33 Alternative 1A.

34 **27.3.3.8 Alternative 3—Dual Conveyance with Pipeline/Tunnel and**  
 35 **Intakes 1 and 2 (6,000 cfs; Operational Scenario A)**

36 The location of BDCP facilities (and the construction activities associated with those facilities) under  
 37 Alternative 3 in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 38 activities are shown in Table 27-10.

1       **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 2       **of Construction of Water Conveyance Facilities**

3       ***NEPA Effects:*** Alternative 3 would include the same physical/structural components as Alternative  
 4       1A, but would entail only two intakes and two intake pumping plants. The effects of Alternative 3  
 5       would, therefore, be the same as those under Alternative 1A but of a lesser magnitude. See the  
 6       discussion of Impact PALEO-1 under Alternative 1A.

7       The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 8       construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 9       1b and 1d.

10       Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 11       surface-related ground disturbance activities associated with Alternative 3. However, while these  
 12       measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 13       boring activities because they would be conducted deep underground and could not be monitored.  
 14       Moreover, although boring material could be examined by monitors, such work would be  
 15       subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

16       Excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, and  
 17       canals to Jones and Banks pumping plants would most likely destroy unique or significant  
 18       paleontological resources and would constitute an adverse effect under NEPA.

19       ***CEQA Conclusion:*** Construction of water conveyance facilities proposed under Alternative 3 could  
 20       cause the destruction of unique paleontological resources. The ground-disturbing activities  
 21       associated with Alternative 3 would occur in geologic units sensitive for paleontological resources  
 22       and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 23       destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 24       significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
 25       PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 26       level, excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels,  
 27       canals to Jones and Banks pumping plants, and other water facility components necessary for  
 28       Alternative 3 would most likely destroy unique or significant paleontological resources in the Plan  
 29       Area and would cause a significant and unavoidable impact.

30       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 31       **Paleontological Resources**

32       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 33       Alternative 1A.

34       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 35       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 36       **Alignment**

37       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 38       Alternative 1A.



1       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 2       **Material**

3       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 4       Alternative 1A.

5       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 6       **Significant Fossil Remains When Encountered**

7       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 8       Alternative 1A.

9       **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 10       **with the Implementation of Other Conservation Measures**

11       **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 12       CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 13       detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 14       stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 15       entail ground-disturbing activities.

16       Although excavation associated with these conservation measures under Alternative 3 would be  
 17       shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 18       sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 19       surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 20       the Plan Area, they could be damaged during excavation for these conservation measures. The  
 21       greater the extent of excavation, the greater the potential effect, although even localized excavation  
 22       could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 23       otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 24       an adverse effect.

25       Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 26       disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 27       address all deeper ground-disturbing conservation measures.

28       **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 29       and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 30       these conservation measures under Alternative 3 would be fairly shallow, CM2, CM4–CM6, and  
 31       CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 32       such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 33       and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 34       damaged during excavation associated with these conservation measures. The greater the extent of  
 35       excavation, the greater the potential impact, although even localized excavation could damage or  
 36       destroy paleontological resources. Direct or indirect destruction of significant paleontological  
 37       resources as defined by the SVP (2010) would constitute a significant impact.

38       Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 39       conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 40       ground-disturbing conservation measures ensure that unique or significant paleontological  
 41       resources in the alternative footprint are systematically identified, documented, avoided or

1 protected from damage where feasible, or recovered and curated so they remain available for  
 2 scientific study and would reduce these impacts to a less-than-significant level.

3 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 4 **Paleontological Resources**

5 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 6 Alternative 1A.

7 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 8 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 9 **Alignment**

10 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 11 Alternative 1A.

12 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 13 **Material**

14 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 15 Alternative 1A.

16 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 17 **Significant Fossil Remains When Encountered**

18 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 19 Alternative 1A.

20 **27.3.3.9 Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel**  
 21 **and Intakes 2, 3, and 5 (9,000 cfs; Operational Scenario H)**

22 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 23 **of Construction of Water Conveyance Facilities**

24 Construction of water conveyance facilities under Alternative 4 could cause the destruction of  
 25 unique paleontological resources as a result of excavation for new intakes, new intake pumping  
 26 plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an  
 27 operable barrier at the head of Old River, other water facility components, roads, and borrow sites.

28 The depth, extent, and location of excavation and other ground-disturbing activities vary greatly  
 29 across the Plan Area (as shown in Table 27-14). Accordingly, this discussion considers these  
 30 activities on the basis of their location and the depth of excavation.

1 **Table 27-14. Summary of Conveyance Construction Activities and Geologic Units Sensitive for**  
 2 **Paleontological Resources That Could Be Disturbed under Alternative 4**

Alternative 4	Location	Construction/Excavation	Sensitive Units Disturbed
Three new north Delta intakes	East bank Sacramento River between Clarksburg and Walnut Grove	30 ft below existing grade; 330 ac total, including pumping plants and sedimentation basins	Riverbank and Modesto Formations
New intake pumping plants and sedimentation basins	Adjacent to intakes	Sedimentation basin 20–30 ft below existing grade; pumping plant 25–30 ft below existing grade; staging/storage area and construction zone prep (76–148 ac per intake structure, including sedimentation basin and pumping plant)	Riverbank and Modesto Formations
Expanded Clifton Court Forebay, canals to Jones and Banks pumping plants	Just south of existing Clifton Court Forebay	592 ac to a depth of 15–20 ft below existing grade	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
Intermediate forebay	Glannvale Tract	245 ac to a depth of 6–11 ft below existing grade	Riverbank Formation
Tunnel 1a	Single-bore 20-ft-diameter tunnel, 46,700 ft from Intakes 2 and 3 to Intermediate Forebay	Shaft to 75 ft below existing grade; tunnel invert at 125 ft; boring using pressurized face mechanized tunneling machines, including earth pressure balance (EPB) machines and slurry tunneling machines	Riverbank and Modesto Formations
Tunnel 1b	Single-bore 20-ft-diameter tunnel, 25,100 ft from Intake 5 to Intermediate Forebay	Same as Tunnel 1a	Riverbank Formation
Tunnel 2	Dual-bore 40-ft-diameter tunnel, 159,000 ft from Intermediate Forebay to Clifton Court Forebay	Same as Tunnel 1a and 1b but tunnel invert depth down to 163 ft	Riverbank and Modesto Formations

3  
 4 The three intakes and the intermediate forebay (Figure 27-2) would entail deep and extensive  
 5 excavation in the northern portion of the Plan Area (Table 27-14). The three intakes and the  
 6 pumping plant and sedimentation basin associated with each intake would be along the east bank of  
 7 the Sacramento River between Clarksburg and Walnut Grove. The intermediate forebay would be  
 8 located on the west side of Glannvale Tract. No pumping plant is associated with the intermediate  
 9 forebay due to the fact that water would flow via gravity to the south Delta. Ground-disturbing  
 10 activities include clearing and grubbing, rough grading, excavation, pile driving, constructing  
 11 foundations, and final grading. Construction of the intakes, pumping plants, and sedimentation  
 12 basins would involve excavation to a depth of between 20–35 feet over an area of 330 acres. The

1 staging/storage area and construction zone preparation would involve 70–114 acres per intake  
2 structure. Construction for the intermediate forebay would involve excavation of approximately 245  
3 acres to a depth of approximately 6-11 feet below existing grade.

4 Excavation for the intakes and intermediate forebay would be conducted in geologic units both  
5 sensitive and nonsensitive for paleontological resources (Figure 27-2). Although most of the  
6 surficial geologic units in the area affected by excavation for the intakes and forebays are of  
7 Holocene age and not sensitive for paleontological resources, the Riverbank Formation, which is of  
8 Pleistocene age and sensitive for paleontological resources, is exposed at the surface in some  
9 locations or underlies the Holocene units in the shallow subsurface. The Modesto Formation,  
10 another Pleistocene-age unit that is sensitive for paleontological resources, also occurs in the area  
11 and likely is exposed at the surface and in the shallow subsurface. These Pleistocene units likely  
12 occur at a depth of less than 5 feet and would therefore be disturbed during excavation of the  
13 intakes and intermediate forebay (Figure 27-3).

14 Pipeline construction would involve excavation in the northern portion of the Plan Area (Figure 27-  
15 2; Table 27-10). The pipelines would extend from the intakes to the sedimentation basin and intake  
16 pumping plants and from the intake pumping plants to the intermediate forebay. Pipeline  
17 excavation would use open trenching to a minimum depth of approximately 30 feet but could be  
18 deeper, depending on local conditions. Trench widths would be approximately 220 feet. The Tunnel  
19 2 segment as shown in Table 27-14, would be a dual-bore with finished inside diameters of 40 feet.  
20 The amount of material that would be excavated for the tunnels is shown in Table 27-14. The  
21 distance between the two bores of the tunnel would increase, as would the width of the retrieval  
22 shaft. The effects of tunneling under Alternative 4 would be greater than those under Alternative 1A  
23 due to the larger tunnel diameters and therefore an increased likelihood of disturbing sensitive  
24 paleontological units, but of a lesser magnitude than alternatives along the East or West alignment.

25 Excavation for the pipelines would, like that for the intakes and the intermediate forebay, occur in  
26 both sensitive and nonsensitive units. Although most of the surficial geologic units in the area  
27 affected by excavation for the pipelines are of Holocene age and not sensitive for paleontological  
28 resources, the Riverbank Formation and Modesto Formation are exposed at the surface and occur in  
29 the shallow subsurface. These Pleistocene units likely occur at a depth of 0 to 10 feet and would  
30 therefore be disturbed during excavation for pipelines.

31 Construction of Tunnels 1a, 1b and 2 would entail deep excavation using a tunnel-boring machine  
32 (TBM) (Table 27-10). Tunnel 1a would connect a pipeline adjacent to Intake Pumping Plant 2, a  
33 pipeline adjacent to Intake Pumping Plant 3 to the intermediate forebay on Glannvale Tract. Tunnel  
34 1b would run between Intake Pumping Plant 5 and the intermediate forebay. Tunnel 2 would extend  
35 between the intermediate forebay and Clifton Court Forebay. The main construction or launching  
36 shafts for each tunnel would be about 60 feet in diameter. The TBM retrieval shaft would be  
37 approximately 45 feet in diameter, and 12-foot-diameter intermediate ventilation shafts would be  
38 constructed approximately every 3 miles along the tunnel route. The amount of material that would  
39 be excavated, which is the least of the tunnel or canal options, is shown in Table 27-11. The tunnels  
40 would be excavated at a depth of approximately 100–150 feet at the tunnel invert, mainly to avoid  
41 the peaty Holocene soils. The TBMs would be mechanized soft-ground tunneling machines designed  
42 for use in soft soils with high groundwater pressure. The tunnels would be lined with precast  
43 concrete bolted-and-gasketed segments. The tunnel concrete liner would serve as permanent  
44 ground support and would be installed immediately behind the TBM, forming a continuous  
45 watertight vessel.

1 Shafts and tunnels would be excavated through Holocene and Pleistocene deposits (Figures 27-2  
2 and 27-3). Shafts would be excavated through surficial Holocene deposits and then through  
3 Pleistocene deposits of the Riverbank or Modesto Formations. Tunnels would be bored wholly  
4 through Pleistocene deposits. Construction of the expanded Clifton Court Forebay would involve  
5 deep and extensive excavation directly southeast of Clifton Court Forebay (Figure 27-2). Excavation  
6 would involve approximately 592 acres to a depth of approximately 15–20 feet below existing  
7 grade, except locally at the inlet and outlet connections (Table 27-10). The invert of the incoming  
8 canal would be at -28 feet msl before discharging to the tunnel.

9 Excavation for the expanded Clifton Court Forebay would occur in both sensitive and nonsensitive  
10 units (Figure 27-2). Although much of the area surrounding the Clifton Court Forebay is covered in  
11 surficial units of Holocene age such as the Holocene alluvial-floodplain deposits (Qfp), which are not  
12 sensitive for paleontological resources, units sensitive for paleontological resources are also  
13 exposed at the surface and underlie the area (Figure 27-2). These units include the Holocene or  
14 Upper Pleistocene alluvium of creeks from the Corral Hollow Drainage to Brushy Creek (Qch), which  
15 is sensitive for paleontological resources.

16 A new section of canal, approximately 800 feet long and situated between Clifton Court Forebay and  
17 Union Pacific Railroad, will connect the expanded Clifton Court Forebay to the existing approach  
18 channel to the Banks Pumping Plant.

19 Excavation for the expanded Clifton Court Forebay and new approach to the Banks Pumping Plant  
20 would disturb these Pleistocene units. Breaching of the existing canal embankment would not  
21 disturb Pleistocene units.

22 An operable barrier would be constructed at the head of Old River. The operable barrier would be  
23 constructed in units of Holocene age and not sensitive for paleontological resources and, possibly,  
24 the Modesto Formation, which occurs in the shallow subsurface. The operable barrier is in the same  
25 geologic units as the canals to Jones and Banks pumping plants.

26 The temporary and permanent access roads required for Alternative 4 would involve shallow  
27 excavation and grading, primarily along existing farm roads or across lands disturbed by  
28 agricultural activity. It is unlikely that this shallow ground disturbance would affect significant  
29 paleontological resources.

30 Borrow material would be needed primarily for forebay embankments and levee reconstruction at  
31 intake sites, but also for access roads. The amount of material that would be needed for borrow,  
32 which is the least of the tunnel or canal options, is shown in Table 27-11. Borrow material would be  
33 excavated from targeted units described in the engineering report (California Department of Water  
34 Resources 2010). Some of these units, including the Modesto and Montezuma Formations, are  
35 sensitive for paleontological resources. Excavation of borrow material from these units could  
36 disturb paleontological resources. In addition, borrow/spoil areas are designated in the area of the  
37 intakes, along the intermediate forebay, and along the expanded Clifton Court Forebay (Figure 27-  
38 2). As described above, units sensitive for paleontological resources in these areas include the  
39 Riverbank and Modesto Formations (potentially in the shallow subsurface) in the area of the intakes  
40 and intermediate forebay, and the alluvium of creeks from the Corral Hollow Drainage to Brushy  
41 Creek along the expanded Clifton Court Forebay. Excavation of borrow material from these units  
42 could also disturb sensitive paleontological resources.

1 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for  
 2 paleontological resources have the potential to damage or destroy those resources. Direct or  
 3 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
 4 represent an adverse effect because conveyance facility construction could directly or indirectly  
 5 destroy unknown paleontological resources in geologic units known to be sensitive for these  
 6 resources.

7 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 8 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 9 1b and 1d.

10 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 11 surface-related ground disturbance activities associated with Alternative 4. However, while these  
 12 measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 13 boring activities because they would be conducted deep underground and could not be monitored.  
 14 Moreover, although boring material could be examined by monitors, such work would be  
 15 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

16 Excavation for new intakes, new intake pumping plants, new/expanded forebays, pipelines and  
 17 tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary  
 18 for Alternative 4 would most likely destroy unique or significant paleontological resources and  
 19 would constitute an adverse effect under NEPA.

20 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 4 could  
 21 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 22 associated with Alternative 4 would occur in geologic units sensitive for paleontological resources  
 23 and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 24 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 25 significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
 26 PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 27 level, excavation for the tunnels necessary for Alternative 4 would most likely destroy unique or  
 28 significant paleontological resources in the Plan Area and would potentially cause a significant and  
 29 unavoidable impact.

### 30 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for** 31 **Paleontological Resources**

32 Before ground-breaking construction begins, BDCP proponents will retain a qualified  
 33 paleontologist or geologist (as defined by the SVP Standard Procedures [Society of Vertebrate  
 34 Paleontology 2010]) to develop a comprehensive Paleontological Resources Monitoring and  
 35 Mitigation Plan (PRMMP) for the BDCP, to help avoid directly or indirectly destroying a unique  
 36 or significant paleontological resource.

37 The PRMMP will be consistent with the SVP Standard Procedures (Society of Vertebrate  
 38 Paleontology 2010) and the SVP Conditions of Receivership (Society of Vertebrate Paleontology  
 39 1996) and will require the following.

- 40 • A paleontological resources specialist (PRS) will be designated or retained for construction  
 41 activities. The PRS will have paleontological resources management qualifications  
 42 consistent with the description of a qualified paleontologist in the SVP Standard Procedures  
 43 (Society of Vertebrate Paleontology 2010). The PRS will be responsible for implementing all

- 1 aspects of the PRMMP, managing any additional paleontological monitors needed for  
 2 construction activities, and serving as a qualified resource in the event of unanticipated  
 3 paleontological finds. The PRS may, but need not necessarily, be the same individual who  
 4 prepared the PRMMP. The PRS will be retained or designated prior to the start of ground-  
 5 breaking construction. A qualified PRS is defined as a person with a M.S. or Ph.D. in  
 6 paleontology, paleobiology, or geology, with strong working knowledge of local  
 7 paleontology and geology, and professional expertise with paleontological procedures and  
 8 techniques. The PRS may designate a paleontological monitor to be present during earth-  
 9 moving activities. A paleontological monitor is defined as a person with a BS/BA in geology  
 10 or paleontology and a minimum of 1 year of monitoring experience in local sedimentary  
 11 rocks. Experience may be substituted for academic training on approval from the  
 12 contracting agency. The PRS and paleontological monitor(s) will be notified by the Lead  
 13 Agency or Resident Engineer in advance of the start of construction activity. The PRS and  
 14 paleontological monitor(s) will attend any required safety training programs.
- 15 ● Preconstruction surveys (with salvage and/or protection in place, as appropriate) will be  
 16 conducted in areas where construction activities would result in surface disturbance of  
 17 geologic units identified as highly sensitive for paleontological resources.
  - 18 ● Preconstruction and construction-period coordination procedures and communications  
 19 protocols will be established, including procedures to alert all construction personnel  
 20 involved with earthmoving activities about the possibility of encountering fossils as set forth  
 21 in Mitigation Measure PALEO-1c and communications regarding the *stop work, evaluate and*  
 22 *treat appropriately response* in the event of a paleontological discovery, as discussed in  
 23 Mitigation Measure PALEO-1d.
  - 24 ● All ground-disturbing activities involving highly sensitive units will be monitored by  
 25 qualified monitors. Monitoring will initially be conducted full time for grading and  
 26 excavation, but the PRMMP may provide for monitoring frequency in any given location to  
 27 be reduced once 50% of the ground-disturbing activity in that location has been completed,  
 28 if the reduction is appropriate based on the implementing PRS's professional judgment in  
 29 consideration of actual site conditions. Monitoring will also be conducted throughout  
 30 drilling operations. The monitoring program for tunneling operations will be developed in  
 31 conjunction with the facility design and geotechnical teams, in consideration of the  
 32 tunneling method selected.
  - 33 ● Sampling and data recovery procedures that are consistent with the SVP Standard  
 34 Procedures (Society of Vertebrate Paleontology 2010) and the SVP Conditions of  
 35 Receivership (Society of Vertebrate Paleontology 1996) will be established.
  - 36 ● A repository plan will be developed that provides for appropriate curation of recovered  
 37 materials, if necessary.
  - 38 ● Mitigation monitoring report preparation guidelines will be established that are consistent  
 39 with the SVP Standard Procedures guidelines (Society of Vertebrate Paleontology 2010).  
 40 The report will include, at a minimum, discussions of effects, regulatory requirements,  
 41 purpose of mitigation, regional geologic context, Plan Area stratigraphy, stratigraphic and  
 42 geographic distribution of paleontological resources, field and laboratory methods and  
 43 procedures, fossil recovery, and paleontological significance. The report will also include  
 44 geological cross sections and stratigraphic sections depicting fossil discovery localities and  
 45 excavated rock units; maps showing the activity location and vicinity, as well as geology and

1 location of discovered fossil localities; appropriate illustrations depicting monitoring  
 2 conditions, field context of collecting localities, quarry maps, and laboratory activities; and  
 3 appendices including an itemized listing of catalogued fossil specimens, complete  
 4 descriptions of all fossil collecting localities, an explanation of report acronyms and terms,  
 5 and a signed curation agreement with an approved paleontological repository.

- 6 • Procedures for preparing, identifying, and analyzing fossil specimens and data recovered  
 7 will be established, consistent with the SVP Conditions of Receivership (Society of  
 8 Vertebrate Paleontology 1996 and 2010) and any specific requirements of the designated  
 9 repository institution.

10 Implementation of this measure will ensure that unique or scientifically significant  
 11 paleontological resources in the alternative footprint are systematically identified, documented,  
 12 avoided or protected from damage where feasible, or recovered and curated so they remain  
 13 available for scientific study.

14 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 15 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 16 **Alignment**

17 To help avoid directly or indirectly destroying a unique or significant paleontological resource,  
 18 the BDCP proponents will have a qualified individual review the 90% design submittal to  
 19 finalize the identification of construction activities involving geologic units considered highly  
 20 sensitive for paleontological resources. Evaluation will consider the anticipated depth of  
 21 disturbance, the selected construction technique, and the geology of the alignment. This work  
 22 may be carried out in conjunction with or as part of the development of the PRMMP (Mitigation  
 23 Measure PALEO-1a). The evaluation may be carried out by the PRS or an individual meeting the  
 24 SVP's requirements for a qualified vertebrate paleontologist (per Society of Vertebrate  
 25 Paleontology 2010) and will be conducted in collaboration with the BDCP design and  
 26 geotechnical teams. If the evaluation is performed by a paleontologist, it will be reviewed and  
 27 verified by a California-licensed professional geologist. The purpose of this evaluation will be to  
 28 develop specific language identifying how the mitigation measures will be applied to the various  
 29 phases of construction along the alignment (e.g., which areas would require monitors). This  
 30 language will be included in the BDCP construction documents for implementation by BDCP  
 31 proponents. The language will be based on the following framework.

- 32 • One onsite paleontological monitor will likely be sufficient to handle observation of most  
 33 ground-disturbing activities. However, if additional paleontological monitors are needed,  
 34 the PRS will coordinate with the Resident Engineer. This communication is imperative and  
 35 fundamental to the success of this PRMMP and to compliance with CEQA and NEPA.
- 36 • Whenever possible, sedimentary rocks exposed during trenching and other deep excavation  
 37 work will be inspected. Ideally, this monitoring will involve inspection of fresh bedrock  
 38 exposures. However, observation of some work may not be possible for safety reasons and  
 39 inspection from these operations will be restricted to spoils. In this case, the monitor will  
 40 inspect spoils as they are stockpiled and remove any matrix blocks containing  
 41 paleontological resources. Construction personnel, namely the Resident Engineer/Lead,  
 42 must communicate depths of excavated materials and their approximate location to the field  
 43 monitor.



- 1           • Recording of stratigraphic data will be an ongoing aspect of excavation monitoring, to  
 2 provide context for any eventual fossil discoveries. Outcrops exposed in active cuts and  
 3 finished slopes will be examined and geologic features recorded on grading plans and in  
 4 field notes. The goal of this work is to delimit the nature of fossiliferous unconsolidated  
 5 sedimentary deposits within the Plan Area, determine their areal distribution and  
 6 depositional contacts, and record any evidence of structural deformation. Standard geologic  
 7 and stratigraphic data collected include lithologic descriptions (e.g., color, sorting, texture,  
 8 structures, and grain size), stratigraphic relationships (e.g., bedding type, thickness, and  
 9 contacts), and topographic position. Stratigraphic sections will be routinely measured, areas  
 10 containing exposures of fossiliferous sedimentary rocks will be documented, and fossil  
 11 localities will be recorded on measured stratigraphic sections.
- 12           • If fossils are discovered, the following procedures will be followed. The monitor or PRS will  
 13 inform the Resident Engineer who will determine the appropriate course of action. For all  
 14 excavations except those relating to the tunnels, mitigation shall consist of one of the  
 15 following: diverting, directing, or temporarily halting ground-disturbing activities in the  
 16 area of discovery to allow for preliminary evaluation of potentially significant  
 17 paleontological resources and to determine whether additional mitigation (i.e., collection,  
 18 curation or other preservation) is required. Where excavations relate to construction of the  
 19 tunnels, such measures will be infeasible because the fossils will most likely have been  
 20 destroyed by the tunnel boring machines before they could have been identified.

21           The significance of the discovered resources will be determined by the PRS in consultation with  
 22 appropriate contractor representatives. Because of the infrequency of fossil preservation, fossils  
 23 are considered to be nonrenewable resources. Because of their rarity, and because of the  
 24 scientific information they provide, fossils can be highly significant records of ancient life. Given  
 25 this, fossils can be considered to be of significant scientific interest if one or more of the  
 26 following criteria apply.

- 27           • Provide data on the evolutionary relationships and developmental trends among organisms,  
 28 both living and extinct.
- 29           • Provide data useful in determining the age(s) of the rock unit or sedimentary stratum,  
 30 including data important in determining the depositional history of the region and the  
 31 timing of geologic events therein.
- 32           • Provide data regarding the development of biological communities or interaction between  
 33 paleobotanical and paleozoological biotas.
- 34           • Demonstrate unusual or spectacular circumstances in the history of life.
- 35           • Are in short supply and/or in danger of being depleted or destroyed by the elements,  
 36 vandalism, or commercial exploitation, and are not found in other geographic locations.

37           They can include fossil remains of large to very small aquatic and terrestrial vertebrates  
 38 (including animal trackways), remains of plants and animals previously not represented in  
 39 certain portions of the stratigraphy, and fossils that might aid stratigraphic correlations,  
 40 particularly those offering data for the interpretation of tectonic events, geomorphologic  
 41 evolution, paleoclimatology, and the relationships of aquatic and terrestrial species.

- 42           • Recovery methods will vary to some degree depending on the types of fossils discovered  
 43 (e.g., invertebrate macrofossils, invertebrate microfossils, vertebrate macrofossils,

1 vertebrate microfossils, or plant fossils). Many fossil specimens discovered during  
 2 excavation monitoring are readily visible to the naked eye and large enough to be easily  
 3 recognized and removed. Upon discovery of such macrofossils, the paleontological monitor  
 4 will temporarily flag the discovery site for avoidance and evaluation, as described above.  
 5 Actual recovery of unearthened macrofossils can involve several techniques, including  
 6 immediate collection, hand quarrying, plaster-jacketing, and/or large-scale quarrying. The  
 7 PRS and the contracting agency representative will evaluate the discovery and take action to  
 8 protect or remove the resource within the shortest period of time possible.

- 9 • Many significant vertebrate fossils (e.g., small mammal, bird, reptile, amphibian, or fish  
 10 remains) often are too small to be readily visible in the field, but are nonetheless significant  
 11 and worthy of attention. The potential discovery of microvertebrate sites is anticipated and  
 12 can include sites that produce remains of large vertebrate fossils from fine-grained deposits,  
 13 sites with an obvious concentration of small vertebrate fossil remains, and sites that based  
 14 on lithology alone (e.g., paleosols) appear to have a potential for producing small vertebrate  
 15 fossil remains. Microvertebrate sites will be sampled by collecting bulk quantities of  
 16 sedimentary matrix. An adequate sample comprises approximately 12 cubic meters (6,000  
 17 lbs or 2,500 kg) of matrix for each formation, or as determined by the PRS (Society of  
 18 Vertebrate Paleontology 2010). The uniqueness of the recovered fossils may dictate salvage  
 19 of larger amounts. However, conditions in the field may make it impossible to recover such  
 20 large samples. To avoid construction delays, bulk matrix samples will be transported to an  
 21 offsite location for processing.
- 22 • The discovery of fossil plants is possible in the Plan Area. Paleobotanical specimens typically  
 23 occur in fine-grained, laminated strata (e.g., shale) and will require special recovery  
 24 techniques. Large blocks (>2 feet) of sedimentary rock are hand quarried from the  
 25 temporary outcrop and then split along bedding planes to reveal compressed fossil plant  
 26 material (e.g., leaves, stems, and flowers). Individual slabs are then wrapped in newsprint to  
 27 minimize destructive desiccation of the fossils. Specimens that are delaminating or flaking  
 28 badly may need to be coated with special consolidants.
- 29 • Oriented matrix samples may be collected for paleomagnetic analysis. Such sampling will  
 30 likely only be necessary in instances where long, continuous sections of stratified rocks are  
 31 producing fossils from several different stratigraphic horizons or where vertebrate fossils  
 32 are being collected in stratigraphic sections lacking in biochronologically useful microfossils.  
 33 Likewise, it may be necessary to collect stratigraphically positioned samples of fine matrices  
 34 for pollen analysis or aid in addressing questions of geologic age, depositional environment, or  
 35 paleoecology.
- 36 • All fossil discoveries will include the collection of stratigraphic data to delimit the nature of  
 37 the fossil-bearing sedimentary rock unit, determine its areal distribution and depositional  
 38 contacts, record any evidence of structural deformation, generate lithologic descriptions of  
 39 fossil-bearing strata, determine stratigraphic relationships (bedding type, thickness, and  
 40 contacts), and topographic position, measure stratigraphic sections, and describe  
 41 taphonomic details.

42 Implementation of this measure will ensure that mitigation procedures are followed so that  
 43 unique or scientifically significant paleontological resources in the alternative footprint are  
 44 systematically identified, documented, avoided or protected from damage where feasible, or  
 45 recovered and curated so they remain available for scientific study.

1           **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 2           **Material**

3           In order to reduce the likelihood of directly or indirectly destroying a unique or significant  
 4           paleontological resource, BDCP proponents will require that all construction personnel receive  
 5           training provided by a qualified paleontologist experienced in teaching non-specialists, to  
 6           ensure that they can recognize fossil materials in the event any are discovered during  
 7           construction. Training will include information on the possibility of encountering fossils during  
 8           construction, the types of fossils likely to be seen and how to recognize them, and proper  
 9           procedures in the event fossils are encountered. All field management and supervisory  
 10          personnel and construction workers involved with ground-disturbing activities will be required  
 11          to take this training prior to beginning work. Training materials will include an informational  
 12          brochure that provides contacts and summarizes procedures in the event paleontological  
 13          resources are encountered.

14          Implementation of this measure will ensure that unique or scientifically significant  
 15          paleontological resources have a high likelihood of being identified during construction so they  
 16          can be avoided or treated appropriately.

17          **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 18          **Significant Fossil Remains When Encountered**

19          To help avoid directly or indirectly destroying a unique or significant paleontological resource,  
 20          the BDCP proponents will ensure that if substantial potentially unique or significant fossil  
 21          remains (particularly vertebrate remains) are discovered during ground-disturbing activities,  
 22          the construction crew will be directed to immediately cease work in the vicinity of the find and  
 23          notify the PRS, consistent with the PRMMP described under Mitigation Measure PALEO-1a. A  
 24          newly discovered resource may need to be fenced off to protect it from inadvertent intrusions  
 25          by machinery or protect the location from vandalism. If extensive recovery and jacketing is  
 26          needed, the area will be fenced off with temporary fencing and a 3- to 5-meter (10- to 15-foot)  
 27          buffer will be included in the fenced area around the locality. If specific construction activities  
 28          preclude placement of a buffer of this width, the monitor will stake a mutually agreeable buffer  
 29          prior to fencing. The PRS will evaluate the resource and prepare a mitigation plan in accordance  
 30          with SVP guidelines (2010). The mitigation plan may include a field survey, construction  
 31          monitoring, sampling and data recovery procedures, museum storage coordination for any  
 32          specimen recovered, and a report of findings. Recommendations determined by BDCP  
 33          proponents to be necessary and feasible will be implemented before construction can resume at  
 34          the site where the paleontological resources were discovered.

35          Except for the fossils destroyed by tunnel boring machines, implementation of this measure will  
 36          ensure that unique or scientifically significant paleontological resources identified during  
 37          construction are protected from damage or treated and documented appropriately to preserve  
 38          their scientific value.

39          **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 40          **with the Implementation of Other Conservation Measures**

41          Ground-disturbing activities associated with other conservation measures (CM2 and CM4–CM10)  
 42          have the potential to affect paleontological resources. These activities are evaluated below by  
 43          conservation measure. Conservation measures to address reduction of other stressors (CM11–

1 CM22) would have no effect on paleontological resources because they would not entail ground-  
2 disturbing activities.

3 **CM2 (Yolo Bypass Fisheries Enhancement)**

- 4 • Construct four experimental ramps at the Fremont Weir.
- 5 • Construct up to three sets of up to three fish ladders.
- 6 • Construct fish screens on small Yolo Bypass diversions.
- 7 • Construct new or replacement operable check-structures at Tule Canal/Toe Drain.
- 8 • Replace the Lisbon Weir with a fish-passable gate structure.
- 9 • Realign Putah Creek.
- 10 • Modify a section of the Fremont Weir.
- 11 • Construct and operate nonphysical or physical barriers in the Sacramento River.
- 12 • Construct associated support facilities (operations buildings, parking lots, access facilities such  
13 as roads and bridges) necessary to provide safe access for maintenance and monitoring.
- 14 • Construct and test flood-neutral fish barriers.

15 Of these ground-disturbing activities, only the realignment of Putah Creek has the potential to  
16 disturb sensitive paleontological resources. If this realignment includes excavating a new channel,  
17 Pleistocene deposits associated with the older alluvium of Putah Creek could be disturbed. The  
18 other CM2 activities would occur in basin deposits of Holocene origin, which have low potential  
19 sensitivity for paleontological resources, based on age.

20 **CM4 (approximately 65,000 acres of restored freshwater and brackish tidal habitat within the BDCP  
21 Restoration Opportunity Areas)**

22 Ground-disturbing activities associated with CM4 range from relatively shallow, localized  
23 excavation to deep or extensive excavation. Two types of activities involve deeper excavation.

- 24 • Modify existing land elevations through grading and filling or subsidence reversal.
- 25 • Relocate existing roads and utilities to support construction and postconstruction activities at  
26 the restoration site or services to adjacent lands protected by levees.

27 Sensitive Pleistocene deposits occur at the surface or in the shallow subsurface in all the Restoration  
28 Opportunity Areas (ROAs), except the South Delta ROA (Figures 27-2 and 3-1). Shallow, localized  
29 excavation in areas where sensitive units occur at the surface could disturb paleontological  
30 resources in these units. Deeper or extensive excavation could disturb sensitive units in all of the  
31 ROAs.

32 **CM5 (approximately 10,000 acres of seasonally inundated floodplain habitat within the north, east,  
33 and/or south Delta)**

34 Ground-disturbing activities associated with CM5 include clearing and grubbing, demolition of  
35 existing structures, setting back levees and removing existing levees, removal of riprap to allow for  
36 channel meander between setback levees, grading to restore drainage patterns and increase  
37 inundation frequency and duration, and establishment of riparian habitat. Most of these activities  
38 would involve shallow excavation or excavation in disturbed materials (levees), but grading to

1 restore drainage patterns could involve deeper excavation. This floodplain-related excavation could  
 2 occur in the northern, eastern, or southern sections of the Delta, but the most promising areas for  
 3 paleontological resources are expected along the San Joaquin River in Conservation Zone 7. This  
 4 area includes sensitive Modesto Formation and Corral Hollow/Brushy Creek drainage units at or  
 5 near the surface (Figures 27-2 and 3-1); sensitive paleontological resources could be disturbed in  
 6 this area.

7 ***CM6 (20 linear miles of channel margin habitat enhancement in the Delta)***

8 Ground-disturbing activities associated with CM6 include clearing and grubbing, demolition of  
 9 existing structures, modification of levees or setting back levees, removing riprap where levees are  
 10 set back, and modifying channel geometry in unconfined channel reaches or along channels where  
 11 levees are set back. Most of these activities would involve shallow excavation or excavation in  
 12 disturbed materials (levees), but modifying channel geometry could involve deeper excavation.  
 13 Sensitive Pleistocene deposits may be encountered at shallow depths along the San Joaquin River in  
 14 Conservation Zone 7 (Figures 27-2 and 3-1), should there be channel geometry modification in this  
 15 area.

16 ***CM7 (approximately 5,000 acres of restored valley/foothill riparian habitat)***

17 Ground-disturbing activities associated with CM7 include clearing and grubbing, and demolition of  
 18 existing structures. Earthwork activities for development of the riparian habitat areas would be  
 19 minimal and focused on removal of riprap and minor landform modifications to restore water  
 20 circulation. These activities are shallow and unlikely to disturb paleontological resources.

21 ***CM8 (approximately 2,000 acres of restored grassland and 8,000 acres of protected or enhanced  
 22 grassland within BDCP Conservation Zones 1, 8, and/or 11)***

23 Ground-disturbing activities associated with CM8 entail little or no ground disturbance. Any grading  
 24 for this restoration would be at shallow depths and would not be likely to affect paleontological  
 25 resources.

26 ***CM3 and CM9 (approximately 67 acres of restored vernal pool complex and 600 acres of protected  
 27 vernal pool complex within Conservation Zones 1, 8, and/or 11)***

28 Ground-disturbing activities associated with CM9 entail some land disturbance, such as minor  
 29 grading to improve connectivity between complexes. Any grading for this restoration would be at  
 30 shallow depths and would not be likely to affect paleontological resources.

31 ***CM10 (approximately 1,200 acres of restored nontidal marsh within Conservation Zones 2 and 4 and/or  
 32 5)***

33 Ground-disturbing activities associated with CM10 entail grading to establish an elevation gradient  
 34 to support open water perennial aquatic habitat intermixed with shallower marsh habitat. The  
 35 Pleistocene Riverbank and Modesto Formations are exposed throughout Conservation Zone 4 and  
 36 may occur in the older alluvium of Putah Creek in Conservation Zone 2. Where sensitive Pleistocene  
 37 deposits are exposed at the surface or are overlain by a shallow veneer of Holocene deposits in these  
 38 two conservation zones (Figures 27-2 and 3-1), paleontological resources could be disturbed as  
 39 grading is undertaken for CM10.

40 ***NEPA Effects:*** Although excavation associated with these conservation measures under Alternative  
 41 4 would be shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units

1 sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 2 surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 3 the Plan Area, they could be damaged during excavation for these conservation measures. The  
 4 greater the extent of excavation, the greater the potential effect, although even localized excavation  
 5 could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 6 otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 7 an adverse effect.

8 Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 9 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 10 address all deeper ground-disturbing conservation measures.

11 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 12 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 13 these conservation measures under Alternative 4 would be fairly shallow, CM2, CM4–CM6, and  
 14 CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 15 such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 16 and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 17 damaged during excavation associated with these conservation measures. The greater the extent of  
 18 excavation, the greater the potential impact, although even localized excavation could damage or  
 19 destroy paleontological resources. Direct or indirect destruction of significant paleontological  
 20 resources as defined by the SVP (2010) would constitute a significant impact.

21 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 22 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 23 ground-disturbing conservation measures ensure that unique or significant paleontological  
 24 resources in the alternative footprint are systematically identified, documented, avoided or  
 25 protected from damage where feasible, or recovered and curated so they remain available for  
 26 scientific study and would reduce these impacts to a less-than-significant level.

27 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 28 **Paleontological Resources**

29 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 30 Alternative 4.

31 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 32 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 33 **Alignment**

34 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 35 Alternative 4.

36 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 37 **Material**

38 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 39 Alternative 4.

1           **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 2           **Significant Fossil Remains When Encountered**

3           Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 4           Alternative 4.

5   **27.3.3.10           Alternative 5—Dual Conveyance with Pipeline/Tunnel and**  
 6           **Intake 1 (3,000 cfs; Operational Scenario C)**

7           The location of BDCP facilities (and the construction activities associated with those facilities) under  
 8           Alternative 5 in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 9           activities are shown in Table 27-10.

10          **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 11          **of Construction of Water Conveyance Facilities**

12          ***NEPA Effects:*** Alternative 5 would include the same physical/structural components as Alternative  
 13          1A, but would entail only one intake and one intake pumping plant. The effects of Alternative 5  
 14          would, therefore, be the same as 1A but of a lesser magnitude. See the discussion of Impact PALEO-1  
 15          under Alternative 1A.

16          The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 17          construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 18          1b and 1d.

19          Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 20          surface-related ground disturbance activities associated with Alternative 5. However, while these  
 21          measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 22          boring activities because they would be conducted deep underground and could not be monitored.  
 23          Moreover, although boring material could be examined by monitors, such work would be  
 24          subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

25          Excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, canals  
 26          to Jones and Banks pumping plants, and other water facility components would most likely destroy  
 27          unique or significant paleontological resources and would constitute an adverse effect under NEPA.

28          ***CEQA Conclusion:*** Construction of water conveyance facilities proposed under Alternative 5 could  
 29          cause the destruction of unique paleontological resources. The ground-disturbing activities  
 30          associated with Alternative 5 would occur in geologic units sensitive for paleontological resources  
 31          and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 32          destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 33          significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
 34          PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 35          level, excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels,  
 36          canals to Jones and Banks pumping plants, and other water facility components necessary for  
 37          Alternative 5 would most likely destroy unique or significant paleontological resources in the Plan  
 38          Area and would constitute a significant and unavoidable impact.

1       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 2       **Paleontological Resources**

3       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 4       Alternative 1A.

5       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 6       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 7       **Alignment**

8       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 9       Alternative 1A.

10       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 11       **Material**

12       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 13       Alternative 1A.

14       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 15       **Significant Fossil Remains When Encountered**

16       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 17       Alternative 1A.

18       **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 19       **with the Implementation of Other Conservation Measures**

20       *NEPA Effects:* Ground-disturbing activities associated with other conservation measures (CM2 and  
 21       CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 22       detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 23       stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 24       entail ground-disturbing activities.

25       Although excavation associated with these conservation measures under Alternative 5 would be  
 26       shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units sensitive for  
 27       paleontological resources, such as the Riverbank and Modesto Formations, occur at the surface in  
 28       several conservation zones and at shallow depth in other zones. If fossils are present in the Plan  
 29       Area, they could be damaged during excavation for these conservation measures. The greater the  
 30       extent of excavation, the greater the potential effect, although even localized excavation could  
 31       damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 32       otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 33       an adverse effect.

34       Under Alternative 5, approximately 25,000 acres of tidal habitat restoration would take place,  
 35       compared to approximately 65,000 acres of tidal habitat restoration under Alternatives 1A through  
 36       4. The type of effects would be the same, but the magnitude of potential effects associated with  
 37       breaching and modifying levees would be substantially reduced under Alternative 5.



1 Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 2 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 3 address all deeper ground-disturbing conservation measures.

4 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 5 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 6 these conservation measures under Alternative 5 would be fairly shallow, CM2, CM4–CM6, and  
 7 CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 8 such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 9 and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 10 damaged during excavation associated with these conservation measures. The greater the extent of  
 11 excavation, the greater the potential impact, although even localized excavation could damage or  
 12 destroy paleontological resources. Direct or indirect destruction of significant paleontological  
 13 resources as defined by the SVP (2010) would constitute a significant impact.

14 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 15 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 16 ground-disturbing conservation measures ensure that unique or significant paleontological  
 17 resources in the alternative footprint are systematically identified, documented, avoided or  
 18 protected from damage where feasible, or recovered and curated so they remain available for  
 19 scientific study and would reduce these impacts to a less-than-significant level.

20 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 21 **Paleontological Resources**

22 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 23 Alternative 1A.

24 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 25 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 26 **Alignment**

27 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 28 Alternative 1A.

29 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 30 **Material**

31 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 32 Alternative 1A.

33 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 34 **Significant Fossil Remains When Encountered**

35 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 36 Alternative 1A.

### 27.3.3.11 Alternative 6A—Isolated Conveyance with Pipeline/Tunnel and Intakes 1–5 (15,000 cfs; Operational Scenario D)

The location of BDCP facilities (and the construction activities associated with those facilities) under Alternative 6A in relation to geologic units is shown in Figure 27-2. The depth and extent of these activities are shown in Table 27-10.

#### Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result of Construction of Water Conveyance Facilities

**NEPA Effects:** Alternative 6A would include the same physical/structural components as Alternative 1A, but existing connections between the SWP and CVP south Delta export facilities would be severed. These connections would be in the same geologic units and would not substantially change the effects on paleontological resources. The effects of Alternative 6A would, therefore, be the same as those under Alternative 1A. See the discussion of Impact PALEO-1 under Alternative 1A.

The shallow excavation and grading in surficial Holocene deposits that would take place for the construction of roads could be addressed through implementation of Mitigation Measures PALEO-1b and 1d.

Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the surface-related ground disturbance activities associated with Alternative 6A. However, while these measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring activities because they would be conducted deep underground and could not be monitored. Moreover, although boring material could be examined by monitors, such work would be subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

Excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components would most likely destroy unique or significant paleontological resources and would constitute an adverse effect under NEPA.

**CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 6A could cause the destruction of unique paleontological resources. The ground-disturbing activities associated with Alternative 6A would occur in geologic units sensitive for paleontological resources and could therefore have the potential to damage or destroy those resources. Direct or indirect destruction of significant paleontological resources as defined by the SVP (2010) would constitute a significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant level, as a result of excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for Alternative 6A would most likely destroy unique or significant paleontological resources in the Plan Area and would constitute a significant and unavoidable impact.

#### Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for Paleontological Resources

Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of Alternative 1A.

1           **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 2           **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 3           **Alignment**

4           Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 5           Alternative 1A.

6           **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 7           **Material**

8           Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 9           Alternative 1A.

10          **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 11          **Significant Fossil Remains When Encountered**

12          Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 13          Alternative 1A.

14          **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 15          **with the Implementation of Other Conservation Measures**

16          **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 17          CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 18          detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 19          stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 20          entail ground-disturbing activities.

21          Although excavation associated with these conservation measures under Alternative 6A would be  
 22          shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 23          sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 24          surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 25          the Plan Area, they could be damaged during excavation for these conservation measures. The  
 26          greater the extent of excavation, the greater the potential effect, although even localized excavation  
 27          could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 28          otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 29          an adverse effect.

30          Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 31          disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 32          address all deeper ground-disturbing conservation measures.

33          **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 34          and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 35          these conservation measures under Alternative 6A would be fairly shallow, CM2, CM4–CM6, and  
 36          CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 37          such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 38          and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 39          damaged during excavation associated with these conservation measures. The greater the extent of  
 40          excavation, the greater the potential impact, although even localized excavation could damage or

1 destroy paleontological resources. Direct or indirect destruction of significant paleontological  
2 resources as defined by the SVP (2010) would constitute a significant impact.

3 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
4 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
5 ground-disturbing conservation measures ensure that unique or significant paleontological  
6 resources in the alternative footprint are systematically identified, documented, avoided or  
7 protected from damage where feasible, or recovered and curated so they remain available for  
8 scientific study and would reduce these impacts to a less-than-significant level.

9 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
10 **Paleontological Resources**

11 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
12 Alternative 1A.

13 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
14 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
15 **Alignment**

16 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
17 Alternative 1A.

18 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
19 **Material**

20 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
21 Alternative 1A.

22 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
23 **Significant Fossil Remains When Encountered**

24 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
25 Alternative 1A.

26 **27.3.3.12 Alternative 6B—Isolated Conveyance with East Alignment and**  
27 **Intakes 1–5 (15,000 cfs; Operational Scenario D)**

28 The location of BDCP facilities (and the construction activities associated with those facilities) under  
29 Alternative 6B in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
30 activities are shown in Table 27-12.

31 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
32 **of Construction of Water Conveyance Facilities**

33 **NEPA Effects:** Alternative 6B would include the same physical/structural components as Alternative  
34 1B, but existing connections between the SWP and CVP south Delta export facilities would be  
35 severed. These connections would be in the same geologic units and would not substantially change  
36 the effects on paleontological resources. The effects of Alternative 6B would, therefore, be the same  
37 as those under 1B. See the discussion of Impact PALEO-1 under Alternative 1B.

1 The ground-disturbing activities that occur in geologic units sensitive for paleontological resources  
 2 have the potential to damage or destroy those resources. Direct or indirect destruction of significant  
 3 paleontological resources as defined by the SVP (2010) would represent an adverse effect because  
 4 conveyance facility construction could directly or indirectly destroy unknown paleontological  
 5 resources in geologic units known to be sensitive for these resources.

6 The shallow excavation and grading in surficial Holocene deposits that would occur with  
 7 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 8 1b and 1d.

9 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 10 surface-related ground disturbance activities described above. However, while these measures  
 11 could be applied to the excavation of the tunnel shafts, no mitigation is available for the boring  
 12 activities because they would be conducted deep underground and could not be monitored.  
 13 Moreover, although boring material could be examined by monitors, such work would be  
 14 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

15 Excavation for the new intakes, new intake pumping plants, new forebays, pipelines and tunnels,  
 16 canals to Jones and Banks pumping plants necessary for construction of the tunnels would most  
 17 likely destroy unique or significant paleontological resources and would constitute an adverse effect  
 18 under NEPA.

19 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 6B could  
 20 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 21 associated with construction of these facilities would occur in geologic units sensitive for  
 22 paleontological resources and could therefore have the potential to damage or destroy those  
 23 resources. Direct or indirect destruction of significant paleontological resources as defined by the  
 24 SVP (2010) would constitute a significant impact under CEQA. While implementation of Mitigation  
 25 Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground  
 26 disturbance to a less-than-significant level, excavation for new intakes, new intake pumping plants,  
 27 new forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water  
 28 facility components necessary for Alternative 6B would most likely destroy unique or significant  
 29 paleontological resources in the Plan Area and would constitute a significant and unavoidable  
 30 impact.

31 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 32 **Paleontological Resources**

33 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 34 Alternative 1A.

35 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 36 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 37 **Alignment**

38 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 39 Alternative 1A.

1           **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 2           **Material**

3           Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 4           Alternative 1A.

5           **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 6           **Significant Fossil Remains When Encountered**

7           Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 8           Alternative 1A.

9           **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 10          **with the Implementation of Other Conservation Measures**

11          **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 12          CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 13          detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 14          stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 15          entail ground-disturbing activities.

16          Although excavation associated with these conservation measures under Alternative 6B would be  
 17          shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In addition, units  
 18          sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 19          surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 20          the Plan Area, they could be damaged during excavation for these conservation measures. The  
 21          greater the extent of excavation, the greater the potential effect, although even localized excavation  
 22          could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 23          otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 24          an adverse effect.

25          Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 26          disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 27          address all deeper ground-disturbing conservation measures.

28          **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 29          and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 30          these conservation measures under Alternative 6B would be fairly shallow, CM2, CM4–CM, and  
 31          CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
 32          resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
 33          conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
 34          they could be damaged during excavation associated with these conservation measures. The greater  
 35          the extent of excavation, the greater the potential impact, although even localized excavation could  
 36          damage or destroy paleontological resources. Direct or indirect destruction of significant  
 37          paleontological resources as defined by the SVP (2010) would constitute a significant impact.

38          Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 39          conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 40          ground-disturbing conservation measures would ensure that unique or significant paleontological  
 41          resources in the alternative footprint are systematically identified, documented, avoided or

1 protected from damage where feasible, or recovered and curated so they remain available for  
2 scientific study and would reduce these impacts to a less-than-significant level.

3 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
4 **Paleontological Resources**

5 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
6 Alternative 1A.

7 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
8 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
9 **Alignment**

10 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
11 Alternative 1A.

12 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
13 **Material**

14 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
15 Alternative 1A.

16 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
17 **Significant Fossil Remains When Encountered**

18 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
19 Alternative 1A.

20 **27.3.3.13 Alternative 6C—Isolated Conveyance with West Alignment and**  
21 **Intakes W1–W5 (15,000 cfs; Operational Scenario D)**

22 The location of BDCP facilities (and the construction activities associated with those facilities) under  
23 Alternative 6C in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
24 activities are shown in Table 27-13.

25 **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
26 **of Construction of Water Conveyance Facilities**

27 *NEPA Effects:* Alternative 6C would include the same physical/structural components as Alternative  
28 1C, but existing connections between the SWP and CVP south Delta export facilities would be  
29 severed. These connections would be in the same geologic units and would not substantially change  
30 the effects on paleontological resources. The effects of Alternative 6C would, therefore, be the same  
31 as 1C. See the discussion of Impact PALEO-1 under Alternative 1C.

32 The ground-disturbing activities that occur in geologic units sensitive for paleontological resources  
33 have the potential to damage or destroy those resources. Direct or indirect destruction of significant  
34 paleontological resources as defined by the SVP (2010) would represent an adverse effect because  
35 conveyance facility construction could directly or indirectly destroy unknown paleontological  
36 resources in geologic units known to be sensitive for these resources.

1 The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 2 construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 3 1b and 1d. The effects associated with the borrow sites would be greater than under Alternative 6A  
 4 but less than under Alternative 6B.

5 Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 6 surface-related ground disturbance activities associated with Alternative 6C. However, while these  
 7 measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 8 boring activities because they would be conducted deep underground and could not be monitored.  
 9 Moreover, although boring material could be examined by monitors, such work would be  
 10 subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

11 Because the length of the dual-bore tunnel would be considerably less under Alternative 6C than  
 12 under Alternatives 1A, 2A, and 6A, the severity of this effect would be reduced. However, excavation  
 13 for new intakes, new intake pumping plants, pipelines, conveyance canal and intermediate pumping  
 14 plant, culvert siphons, tunnel, Byron Tract Forebay and canals to Jones and Banks pumping plants,  
 15 and other water facility components would most likely still destroy unique or significant  
 16 paleontological resources and would constitute an adverse effect under NEPA.

17 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 6C could  
 18 cause the destruction of unique paleontological resources. Ground-disturbing activities in geologic  
 19 units sensitive for paleontological resources have the potential to damage or destroy those  
 20 resources. Direct or indirect destruction of significant paleontological resources as defined by the  
 21 SVP (2010) would constitute a significant impact under CEQA. While implementation of Mitigation  
 22 Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground  
 23 disturbance to a less-than-significant level, excavation for new intakes, new intake pumping plants,  
 24 pipelines, conveyance canal and intermediate pumping plant, culvert siphons, tunnel, Byron Tract  
 25 Forebay and canals to Jones and Banks pumping plants, and other water facility components  
 26 necessary for Alternative 6C would most likely destroy unique or significant paleontological  
 27 resources in the Plan Area and would constitute a significant and unavoidable impact.

28 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 29 **Paleontological Resources**

30 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 31 Alternative 1A.

32 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 33 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 34 **Alignment**

35 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 36 Alternative 1A.

37 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 38 **Material**

39 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 40 Alternative 1A.



1           **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 2           **Significant Fossil Remains When Encountered**

3           Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 4           Alternative 1A.

5           **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 6           **with the Implementation of Other Conservation Measures**

7           **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 8           CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 9           detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 10          stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 11          entail ground-disturbing activities.

12          Most excavation associated with these conservation measures under Alternative 6C would be  
 13          shallow. However, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units  
 14          sensitive for paleontological resources, such as the Riverbank and Modesto Formations, occur at the  
 15          surface in several conservation zones and at shallow depth in other zones. If fossils are present in  
 16          the Plan Area, they could be damaged during excavation for these conservation measures. The  
 17          greater the extent of excavation, the greater the potential effect, although even localized excavation  
 18          could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 19          otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 20          an adverse effect.

21          Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
 22          disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
 23          address all deeper ground-disturbing conservation measures.

24          **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 25          and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 26          these conservation measures under Alternative 6C would be fairly shallow, CM2, CM4–CM6, and  
 27          CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 28          such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 29          and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 30          damaged during excavation associated with these conservation measures. The greater the extent of  
 31          excavation, the greater the potential impact, although even localized excavation could damage or  
 32          destroy paleontological resources. Direct or indirect destruction of significant paleontological  
 33          resources as defined by the SVP (2010) would constitute a significant impact.

34          Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 35          conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 36          ground-disturbing conservation measures would ensure that unique or significant paleontological  
 37          resources in the alternative footprint are systematically identified, documented, avoided or  
 38          protected from damage where feasible, or recovered and curated so they remain available for  
 39          scientific study and would reduce these impacts to a less-than-significant level.

1       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 2       **Paleontological Resources**

3       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 4       Alternative 1A.

5       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 6       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 7       **Alignment**

8       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 9       Alternative 1A.

10       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 11       **Material**

12       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 13       Alternative 1A.

14       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 15       **Significant Fossil Remains When Encountered**

16       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 17       Alternative 1A.

18       **27.3.3.14       Alternative 7—Dual Conveyance with Pipeline/Tunnel, Intakes 2,**  
 19       **3, and 5, and Enhanced Aquatic Conservation (9,000 cfs;**  
 20       **Operational Scenario E)**

21       The location of BDCP facilities (and the construction activities associated with those facilities) under  
 22       Alternative 7 in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 23       activities are shown in Table 27-10.

24       **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 25       **of Construction of Water Conveyance Facilities**

26       *NEPA Effects:* Alternative 7 would include the same physical/structural components as Alternative  
 27       1A, but would, like Alternative 4, entail only three intakes and three intake pumping plants. The  
 28       effects of Alternative 7 would, therefore, be the same as those under Alternative 4, although the  
 29       intake locations would be different. See the discussion of Impact PALEO-1 under Alternative 1A.

30       The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 31       construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 32       1b and 1d.

33       Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 34       surface-related ground disturbance activities associated with Alternative 7. However, while these  
 35       measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 36       boring activities because they would be conducted deep underground and could not be monitored.  
 37       Moreover, although boring material could be examined by monitors, such work would be  
 38       subsequent to boring and the boring area could not be accessed even if fossils were encountered.

1 Excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, canals  
 2 to Jones and Banks pumping plants, and other water facility components necessary for Alternative 7  
 3 would most likely destroy unique or significant paleontological resources in the Plan Area and  
 4 would constitute an adverse effect under NEPA.

5 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 7 could  
 6 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 7 associated with construction of these facilities would occur in geologic units sensitive for  
 8 paleontological resources and could therefore have the potential to damage or destroy those  
 9 resources. Direct or indirect destruction of significant paleontological resources as defined by the  
 10 SVP (2010) would constitute a significant impact under CEQA. While implementation of Mitigation  
 11 Measures PALEO-1a through PALEO-1d would reduce the effects of surface-related ground  
 12 disturbance to a less-than-significant level, excavation for new intakes, new intake pumping plants,  
 13 new forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water  
 14 facility components necessary for Alternative 7 would most likely destroy unique or significant  
 15 paleontological resources in the Plan Area and would constitute a significant and unavoidable  
 16 impact.

17 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 18 **Paleontological Resources**

19 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 20 Alternative 1A.

21 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 22 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 23 **Alignment**

24 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 25 Alternative 1A.

26 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 27 **Material**

28 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 29 Alternative 1A.

30 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 31 **Significant Fossil Remains When Encountered**

32 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 33 Alternative 1A.

34 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 35 **with the Implementation of Other Conservation Measures**

36 **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 37 CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 38 detail in the discussion of Alternative 1A. Conservation measures to address reduction of other

1 stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
2 entail ground-disturbing activities.

3 Conservation measures under Alternative 7 would be similar to those under 1A except that  
4 Alternative 7 would include significantly more channel margin habitat enhancement and more  
5 seasonally inundated floodplain restoration (double that under Alternative 1A). The habitat  
6 enhancement and floodplain restoration do not, however, substantially change the effects of these  
7 conservation measures because most of this additional enhancement and restoration would likely  
8 involve fairly shallow excavation along the lower San Joaquin River in the south Delta (Conservation  
9 Zone 7), which is covered in nonsensitive Holocene deposits.

10 Most excavation associated with these conservation measures under Alternative 7 would be  
11 shallow. However, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. In  
12 addition, units sensitive for paleontological resources, such as the Riverbank and Modesto  
13 Formations, occur at the surface in several conservation zones and at shallow depth in other zones.  
14 If fossils are present in the Plan Area, they could be damaged during excavation for these  
15 conservation measures. The greater the extent of excavation, the greater the potential effect,  
16 although even localized excavation could damage or destroy paleontological resources. Direct or  
17 indirect destruction of vertebrate or otherwise scientifically significant paleontological resources as  
18 defined by the SVP (2010) would be an adverse effect.

19 Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
20 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
21 address all deeper ground-disturbing conservation measures.

22 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
23 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
24 these conservation measures under Alternative 7 would be fairly shallow, CM2, CM4–CM6, and  
25 CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
26 such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
27 and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
28 damaged during excavation associated with these conservation measures. The greater the extent of  
29 excavation, the greater the potential impact, although even localized excavation could damage or  
30 destroy paleontological resources. Direct or indirect destruction of significant paleontological  
31 resources as defined by the SVP (2010) would constitute a significant impact.

32 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
33 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
34 ground-disturbing conservation measures ensure that unique or significant paleontological  
35 resources in the alternative footprint are systematically identified, documented, avoided or  
36 protected from damage where feasible, or recovered and curated so they remain available for  
37 scientific study and would reduce these impacts to a less-than-significant level.

### 38 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for** 39 **Paleontological Resources**

40 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
41 Alternative 1A.

1           **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 2           **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 3           **Alignment**

4           Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 5           Alternative 1A.

6           **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 7           **Material**

8           Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 9           Alternative 1A.

10          **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 11          **Significant Fossil Remains When Encountered**

12          Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 13          Alternative 1A.

14   **27.3.3.15           Alternative 8—Dual Conveyance with Pipeline/Tunnel, Intakes 2,**  
 15                           **3, and 5, and Increased Delta Outflow (9,000 cfs; Operational**  
 16                           **Scenario F)**

17          The location of BDCP facilities (and the construction activities associated with those facilities) under  
 18          Alternative 8 in relation to geologic units is shown in Figure 27-2. The depth and extent of these  
 19          activities are shown in Table 27-10.

20          **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 21          **of Construction of Water Conveyance Facilities**

22          **NEPA Effects:** Alternative 8 would include the same physical/structural components as Alternative  
 23          1A, but would entail only three intakes and three intake pumping plants. The effects of Alternative 8  
 24          would, therefore, be the same as those under Alternatives 4 and 7. Alternative 8 would entail the  
 25          same three intakes as Alternative 7. See the discussion of Impact PALEO-1 under Alternative 1A.

26          The shallow excavation and grading in surficial Holocene deposits that would take place for the  
 27          construction of roads could be addressed through implementation of Mitigation Measures PALEO-  
 28          1b and 1d.

29          Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the  
 30          surface-related ground disturbance activities associated with Alternative 8. However, while these  
 31          measures could be applied to the excavation of the tunnel shafts, no mitigation is available for the  
 32          boring activities because they would be conducted deep underground and could not be monitored.  
 33          Moreover, although boring material could be examined by monitors, such work would be  
 34          subsequent to boring, and the boring area could not be accessed even if fossils were encountered.

35          Excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels, canals  
 36          to Jones and Banks pumping plants, and other water facility components necessary for Alternative 8  
 37          would most likely destroy unique or significant paleontological resources in the Plan Area and  
 38          would constitute an adverse effect under NEPA.

1 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 8 could  
 2 cause the destruction of unique paleontological resources. The ground-disturbing activities  
 3 associated with Alternative 8 would occur in geologic units sensitive for paleontological resources  
 4 and could therefore have the potential to damage or destroy those resources. Direct or indirect  
 5 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a  
 6 significant impact under CEQA. While implementation of Mitigation Measures PALEO-1a through  
 7 PALEO-1d would reduce the effects of surface-related ground disturbance to a less-than-significant  
 8 level, excavation for new intakes, new intake pumping plants, new forebays, pipelines and tunnels,  
 9 canals to Jones and Banks pumping plants, and other water facility components necessary for  
 10 Alternative 8 would most likely destroy unique or significant paleontological resources in the Plan  
 11 Area and would constitute a significant and unavoidable impact.

12 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 13 **Paleontological Resources**

14 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 15 Alternative 1A.

16 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 17 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 18 **Alignment**

19 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 20 Alternative 1A.

21 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 22 **Material**

23 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 24 Alternative 1A.

25 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 26 **Significant Fossil Remains When Encountered**

27 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 28 Alternative 1A.

29 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
 30 **with the Implementation of Other Conservation Measures**

31 **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
 32 CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
 33 detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
 34 stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
 35 entail ground-disturbing activities.

36 Conservation measures would under Alternative 8 would be similar to those under 1A. Most  
 37 excavation associated with these conservation measures under Alternative 8 would be shallow.  
 38 However, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units sensitive  
 39 for paleontological resources, such as the Riverbank and Modesto Formations, occur at the surface

1 in several conservation zones and at shallow depth in other zones. If fossils are present in the Plan  
 2 Area, they could be damaged during excavation for these conservation measures. The greater the  
 3 extent of excavation, the greater the potential effect, although even localized excavation could  
 4 damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
 5 otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
 6 an adverse effect.

7 Mitigation Measures PALEO-1b and PALEO-2d are available to mitigate all shallow ground-  
 8 disturbing conservation measures. Mitigation Measures PALEO-2a through PALEO-2d would  
 9 address all deeper ground-disturbing conservation measures.

10 **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
 11 and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
 12 these conservation measures under Alternative 7 would be fairly shallow, CM2, CM4–CM6, and  
 13 CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,  
 14 such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones  
 15 and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be  
 16 damaged during excavation associated with these conservation measures. The greater the extent of  
 17 excavation, the greater the potential impact, although even localized excavation could damage or  
 18 destroy paleontological resources. Direct or indirect destruction of significant paleontological  
 19 resources as defined by the SVP (2010) would constitute a significant impact.

20 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
 21 conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
 22 ground-disturbing conservation measures ensure that unique or significant paleontological  
 23 resources in the alternative footprint are systematically identified, documented, avoided or  
 24 protected from damage where feasible, or recovered and curated so they remain available for  
 25 scientific study and would reduce these impacts to a less-than-significant level.

26 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
 27 **Paleontological Resources**

28 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
 29 Alternative 1A.

30 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
 31 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
 32 **Alignment**

33 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
 34 Alternative 1A.

35 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
 36 **Material**

37 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
 38 Alternative 1A.

1           **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
 2           **Significant Fossil Remains When Encountered**

3           Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
 4           Alternative 1A.

5   **27.3.3.16           Alternative 9—Through Delta/Separate Corridors (15,000 cfs;**  
 6           **Operational Scenario G)**

7           The location of BDCP construction activities under Alternative 9 in relation to geologic units is  
 8           shown in Figure 27-2. The depth and extent of these activities are shown in Table 27-15. A detailed  
 9           depiction of the through Delta/separate corridors alternative is provided in Figure M3-5 in the  
 10          Mapbook Volume.

11   **Table 27-15. Summary of BDCP Construction Activities and Geologic Units Sensitive for Paleontological**  
 12   **Resources that Could be Disturbed under Alternative 9**

Alternative 9	Location	Construction/Excavation	Sensitive Units Disturbed
Two new Delta intakes	Delta Cross Channel, Georgiana Slough	Excavation of 30 ac total, including plants and basins	Riverbank and Modesto Formations
Pumping plants	San Joaquin River at Head of Old River and Middle River upstream of Victoria Canal	Excavation of 8–10 ac (3 permanent)	Pleistocene units
19- by 19-ft, 23- by 23-ft, and 26- by 26-ft culvert siphons	Where alignment crosses major waterways	Same as 1B but different dimensions	

13  
 14   **Impact PALEO-1: Destruction of Unique or Significant Paleontological Resources as a Result**  
 15   **of Construction of Water Conveyance Facilities**

16          Construction of water conveyance facilities under Alternative 9 could cause the destruction of  
 17          unique paleontological resources as a result of excavation for new intakes and pumping plants,  
 18          channel enlargement, culvert siphons, canal, and Old River and Middle River diversion pumping  
 19          plants.

20          The construction of water conveyance facilities associated with Alternative 9 varies from the other  
 21          action alternatives in two main respects: the location of the intakes is south of the intake locations in  
 22          the other alternatives, and there is no new large-scale conveyance structure (i.e., tunnel or canal).

23          The depth, extent, and location of excavation and other ground-disturbing activities vary greatly  
 24          across the Plan Area (Table 27-15). Accordingly, this discussion considers these activities on the  
 25          basis of their location and the depth of excavation. The two intakes would involve deep and  
 26          extensive excavation in the northern portion of the Plan Area (Table 27-15). The intakes would be  
 27          located at the Delta Cross Channel and the Georgiana Slough. Ground-disturbing activities include  
 28          clearing and grubbing, rough grading, excavation, pile driving, constructing foundations, and final



1 grading. Construction of the intakes would involve an area of approximately 30 acres. Each intake  
2 would be approximately 85 feet wide and 45 feet long.

3 Excavation for the intakes would occur in both sensitive and nonsensitive units (Figure 27-2).  
4 Although most of the surficial geologic units in the area affected by excavation for the intakes are of  
5 Holocene age and not sensitive for paleontological resources, the Riverbank Formation, which is of  
6 Pleistocene age and sensitive for paleontological resources, is exposed at the surface nearby or  
7 underlies the Holocene units in the shallow subsurface (Figure 27-3). The Modesto Formation,  
8 another Pleistocene age unit that is sensitive for paleontological resources, also occurs in the area  
9 and is likely exposed at the surface and in the shallow subsurface. These Pleistocene units likely  
10 occur at a depth of 5–15 feet and would therefore be disturbed during excavation of the intakes.

11 New canals would be excavated in the southernmost part of the Plan Area at Victoria Canal. The  
12 amount of material that would be excavated, which is the least of all alternatives, is shown in Table  
13 27-11. These canals would be similar to those under Alternative 1B but only 1.5 miles long. Water  
14 flowing through Victoria Canal would lead into two new canal segments and pass under two existing  
15 watercourses through culvert siphons (discussed below), eventually reaching Clifton Court Forebay.  
16 A new intertie canal would be constructed to connect the forebay to CVP facilities.

17 Construction of the two new canal segments would involve excavating with a bottom width of up to  
18 65 feet. In this alignment, Pleistocene deposits may occur at shallow depth (Figure 27-3). These  
19 deposits would therefore be disturbed during excavation of the canal. In addition, canal construction  
20 requires that the organic-rich peaty soils, which may be up to 25 feet thick, be removed, thereby  
21 increasing the likelihood that Pleistocene deposits would be encountered. As with Alternative 1B,  
22 the Holocene or Upper Pleistocene alluvium of creeks from the Corral Hollow Drainage to Brushy  
23 Creek (Qch), which is sensitive for paleontological resources, is exposed at the surface (Figures 27-2  
24 and 27-3). Excavation of the canal would therefore likely disturb Pleistocene units sensitive for  
25 paleontological resources.

26 Culvert siphons would be constructed where the alignment crosses major waterways. As under  
27 Alternative 1B, culvert siphons would be constructed using cut-and-cover methods, but the  
28 dimensions would differ: a 19- by 19-foot, 23- by 23-foot, and 26-foot by 26-foot concrete structure.  
29 The depth of trenches for these culvert siphons would vary by location, but the roof of the structures  
30 would be installed 47 feet below the existing slough invert. In most cases, peat soil would be  
31 excavated so that the culvert foundation would be founded on alluvial sand (Pleistocene). Given the  
32 depth of the culverts and the need to remove peat soil in some locations, excavation of the culvert  
33 siphons would likely disturb Pleistocene units sensitive for paleontological resources.

34 Construction of the diversion pumping plants would take place on the San Joaquin River at the Head  
35 of Old River and on Middle River upstream of Victoria Canal. The area of the pumping plants would  
36 be excavated to a depth of 25–30 feet below ground surface. At these locations, Holocene deposits  
37 form a veneer over the Pleistocene deposits (Figures 27-2 and 27-3). The Modesto Formation, which  
38 is sensitive for paleontological resources, occurs in the shallow subsurface, likely at a depth of 10–20  
39 feet, and would therefore be disturbed during excavation of the pumping plants.

40 Channel enlargement would take place in four locations along Middle River: between Mildred Island  
41 and Railroad Cut (enlarged area 4,777 square feet), between Railroad Cut and Woodward Canal  
42 (enlarged area 4,319 square feet), between Woodward Canal and Victoria Canal (enlarged area  
43 3,201 square feet), and Victoria Canal (enlarged area 8,145 square feet). Hydraulic or mechanical

1 dredgers would be used to dredge in already disturbed and young deposits and therefore would not  
2 affect units sensitive for paleontological resources.

3 The effects of construction of the access roads would be similar to those under Alternative 1A, but of  
4 lesser magnitude because fewer roads would be needed. The shallow excavation and grading in  
5 surficial Holocene deposits that would occur with construction of roads could be addressed through  
6 implementation of Mitigation Measures PALEO-1b and 1d.

7 The effects of excavation of borrow material would be much less than under all other alternatives  
8 (Table 27-11). Impacts, however, would be mitigated with the same mitigation measures described  
9 under Alternative 1A.

10 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for  
11 paleontological resources have the potential to damage or destroy those resources. Direct or  
12 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
13 represent an adverse effect because conveyance facility construction could directly or indirectly  
14 destroy unknown paleontological resources in geologic units known to be sensitive for these  
15 resources. However, Mitigation Measures PALEO-1a through PALEO-1d would be available to  
16 mitigate the effects of the activities described above. No adverse effects would be expected.

17 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 9 could  
18 cause the destruction of unique paleontological resources as a result of excavation for new intakes  
19 and pumping plants, channel enlargement, culvert siphons, canal segments, and Old River and  
20 Middle River diversion pumping plants. Ground-disturbing activities in geologic units sensitive for  
21 paleontological resources have the potential to damage or destroy those resources. Direct or  
22 indirect destruction of significant paleontological resources as defined by the SVP (2010) would  
23 constitute a significant impact under CEQA. Implementation of Mitigation Measures PALEO 1a  
24 through PALEO-1d would reduce these effects to a less-than-significant level because they would  
25 ensure that unique or significant paleontological resources in the alternative footprint are  
26 systematically identified, documented, avoided or protected from damage where feasible, or  
27 recovered and curated so they remain available for scientific study.

28 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
29 **Paleontological Resources**

30 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
31 Alternative 1A.

32 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
33 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
34 **Alignment**

35 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
36 Alternative 1A.

37 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
38 **Material**

39 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
40 Alternative 1A.

1           **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
2           **Significant Fossil Remains When Encountered**

3           Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
4           Alternative 1A.

5           **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**  
6           **with the Implementation of Other Conservation Measures**

7           **NEPA Effects:** Ground-disturbing activities associated with other conservation measures (CM2 and  
8           CM4–CM10) have the potential to affect paleontological resources. These activities are addressed in  
9           detail in the discussion of Alternative 1A. Conservation measures to address reduction of other  
10          stressors (CM11–CM22) would have no effect on paleontological resources because they would not  
11          entail ground-disturbing activities.

12          Although excavation associated with these conservation measures under Alternative 1B would be  
13          shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. Units sensitive for  
14          paleontological resources, such as the Riverbank and Modesto Formations, occur at the surface in  
15          several conservation zones and at shallow depth in other zones. If fossils are present in the Plan  
16          Area, they could be damaged during excavation for these conservation measures. The greater the  
17          extent of excavation, the greater the potential effect, although even localized excavation could  
18          damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or  
19          otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be  
20          an adverse effect.

21          Mitigation Measures PALEO-1b and PALEO-1d are available to mitigate all shallow ground-  
22          disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d would  
23          address all deeper ground-disturbing conservation measures.

24          **CEQA Conclusion:** Ground-disturbing activities associated with other conservation measures (CM2  
25          and CM4–CM10) could affect paleontological resources. Although most excavation associated with  
26          these conservation measures under Alternative 1B would be fairly shallow, CM2, CM4–CM6, and  
27          CM10 require deeper or more extensive excavation. In addition, units sensitive for paleontological  
28          resources, such as the Riverbank and Modesto Formations, occur at the surface in several  
29          conservation zones and occur at shallow depth in other zones. If fossils are present in the Plan Area,  
30          they could be damaged during excavation associated with these conservation measures. The greater  
31          the extent of excavation, the greater the potential impact, although even localized excavation could  
32          damage or destroy paleontological resources. Direct or indirect destruction of significant  
33          paleontological resources as defined by the SVP (2010) would constitute a significant impact.

34          Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing  
35          conservation measures and Mitigation Measures PALEO-1a through PALEO-1d for all deeper  
36          ground-disturbing conservation measures would ensure that scientifically significant  
37          paleontological resources in the alternative footprint are systematically identified, documented,  
38          avoided or protected from damage where feasible, or recovered and curated so they remain  
39          available for scientific study and would reduce these impacts to a less-than-significant level.

1       **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
2       **Paleontological Resources**

3       Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
4       Alternative 1A.

5       **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
6       **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
7       **Alignment**

8       Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
9       Alternative 1A.

10       **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
11       **Material**

12       Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
13       Alternative 1A.

14       **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
15       **Significant Fossil Remains When Encountered**

16       Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
17       Alternative 1A.

18       **27.3.4       Cumulative Analysis**

19       The cumulative analysis for paleontological resources considers the effects of BDCP implementation  
20       in combination with the potential effects of other past, present, and reasonably foreseeable projects  
21       and programs. The analysis focuses on projects and programs within the Plan Area and the broader  
22       Delta region that involve substantial ground-disturbing activities in geologic units with a high  
23       potential for containing significant paleontological resources (the Modesto, Tulare, Tehama,  
24       Montezuma, Riverbank, Neroly, and Markley Formations). The principal programs and projects  
25       considered in the analysis are listed in Table 27-16. This list has been drawn from a more  
26       substantial compilation of past, present, and reasonably foreseeable programs and projects included  
27       in Appendix 3D, *Defining Existing Conditions, the No Action/No Project Alternative, and Cumulative*  
28       *Impact Conditions.*

1 **Table 27-16. Programs and Projects Considered in Paleontological Resources Cumulative Analysis**

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
California Department of Water Resources and Solano County Water Agency	North Bay Aqueduct Alternative Intake Project	Draft EIR is ongoing	This project will construct an alternative intake on the Sacramento River and a new segment of pipeline to connect it to the North Bay Aqueduct system.	The pipeline segment of the project could have adverse impacts on paleontological resources. Ground-disturbing activities associated with construction of the intake and pipeline could disturb units sensitive for paleontological resources, such as the Modesto and Riverbank Formations.
California High Speed Rail Authority and Federal Railroad Administration	California High-Speed Rail System, Sacramento to Merced Section	Briefing on Initial Alternatives completed. Sacramento to Merced section is part of Phase 2.	Development of new high-speed rail service. Near-term improvements could include right-of-way preservation, interim operation on existing tracks, and passing sidings. Future improvements would construct a new rail line.	No paleontological resources are expected to be disturbed within this corridor, based on the sedimentary units occurring between Sacramento and Stockton
Bureau of Reclamation	Delta-Mendota Canal/California Aqueduct Intertie	Completed in 2012	The purpose of the intertie is to better coordinate water delivery operations between the California Aqueduct (state) and the Delta-Mendota Canal (federal) and to provide better pumping capacity for the Jones Pumping Plant. New project facilities include a pipeline and pumping plant.	No impacts to paleontological resources are expected.
City of Stockton	Delta Water Supply Project (Phase 1)	Currently under construction	This project consists of a new intake structure and pumping station adjacent to the San Joaquin River; a water treatment plant along Lower Sacramento Road; and water pipelines along Eight Mile, Davis, and Lower Sacramento Roads.	This project could disturb units sensitive for paleontological resources, such as the Riverbank Formation.

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
Zone 7 Water Agency and California Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Completed	The South Bay Aqueduct Improvement and Enlargement Project will improve and expand the existing South Bay Aqueduct. The project will increase the existing capacity of the water conveyance system up to its design capacity of 300 cfs, and expand capacity in a portion of the project to add 130 cfs (total of 430 cfs).	This project could disturb units sensitive for paleontological resources, such as the Panoche and Neroly Formations.
Yolo County	Yolo County General Plan Update	Continuing actions	County of Yolo's 2030 Countywide General Plan allows for additional growth in unincorporated areas of the county of just under 31,000 people, up to 10,462 homes, and 1.5% growth in average annual employment.	Buildout contemplated under the updated general plan will result in ground-disturbing construction that could affect geologic units sensitive for paleontological resources, such as the Modesto and Tehama Formations.
CALFED Levee Stability Program	Existing project levees in the Delta	Continuing actions	Protection of resources in the Delta through maintenance and improvement of existing levees	This program will result in the repair of project and non-project levees in the Delta. Ground-disturbing construction and borrow activity necessary to complete typical improvements could disturb geologic units sensitive for paleontological resources, such as the Modesto and Riverbank Formations.

1

## 2 **No Action Alternative**

3 The ongoing projects and programs in the Delta under the No Action Alternative in addition to the  
4 cumulative projects would require ground-disturbing construction to either construct new facilities  
5 or implement restoration and habitat enhancement goals. SWP/CVP operations would require  
6 repair, maintenance, or protection of infrastructure such as levees, and may also include actions for  
7 water quality management, habitat and species protection, and flood management. These continuing  
8 actions could occur throughout the Plan Area and could result in effects on paleontological  
9 resources, depending on the type of construction needed for repairs or adjustments to potential  
10 irrigation water and drainage needed for water quality and flood management. In addition, many  
11 planning documents that govern portions of the Delta include buildout footprints that allow  
12 development of undisturbed land that is likely to contain paleontological resources. Because of the  
13 ground-disturbing activities associated with the cumulative set of plans and projects, the suite of all

1 ongoing projects and programs in the Delta could both singly and collectively result in adverse  
2 effects on paleontological resources.

3 The Delta and vicinity is within a highly active seismic area, with a generally high potential for major  
4 future earthquake events along nearby and/or regional faults, and with the probability for such  
5 events increasing over time. Based on the location, extent and non-engineered nature of many  
6 existing levee structures in the Delta area, the potential for significant damage to, or failure of, these  
7 structures during a major local seismic event is generally moderate to high. In the instance of a large  
8 seismic event, levees constructed on liquefiable foundations are expected to experience large  
9 deformations (in excess of 10 feet) under a moderate to large earthquake in the region. (See  
10 Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies* for more  
11 detailed discussion). Reclaiming land or rebuilding levees after a catastrophic event due to climate  
12 change or a seismic event could result in the destruction of unique paleontological resources. While  
13 similar risks would occur under implementation of the action alternatives, these risks may be  
14 reduced by BDCP-related levee improvements along with those projects identified in Table 27-16.

### 15 **Impact PALEO-3: Cumulative Effect on Paleontological Resources from Construction** 16 **Activities in the Plan Area and Delta Region**

17 **NEPA Effects:** Implementation of the BDCP and other local and regional projects as presented in  
18 Table 27-16, could contribute to regional impacts on paleontological resources. Construction of the  
19 BDCP alternatives would take place in geologic units sensitive for paleontological resources, such as  
20 the Riverbank and Modesto Formations. The greater the extent of excavation, the greater the  
21 potential effect, although even localized excavation could damage or destroy important  
22 paleontological resources. Other past, present, and probable future projects and programs in the  
23 region that are identified in Table 27-16 and Appendix 3D, *Defining Existing Conditions, the No*  
24 *Action/No Project Alternative, and Cumulative Impact Conditions* have the potential to destroy unique  
25 or significant paleontological resources.

26 Alternatives 1A-9 involve surface excavation for both water conveyance construction and  
27 restoration implementation. Additionally, Alternatives 1A-8 would entail subsurface tunneling in  
28 geologic units sensitive for paleontological resources. Excavation into sensitive geologic units—  
29 extensive grading, trenching, structure foundation excavation, levee construction, and dredging—in  
30 combination with other projects listed in Table 27-16 that require similar surface excavation in  
31 sensitive geologic units, in addition to tunneling, which would disturb a large volume of sensitive  
32 Pleistocene deposits that may contain sensitive resources would create an adverse cumulative effect  
33 on paleontological resources.

34 Because none of the projects listed in Table 27-16 involve tunneling, and no other tunneling projects  
35 that could have unavoidable and unmitigable effects are known to be permitted, under construction,  
36 recently completed, or reasonably foreseeable in the Plan Area or surrounding Delta region, BDCP's  
37 incremental contribution to the adverse cumulative effect on paleontological resources is significant.

38 The subsurface effect caused by BDCP cannot be mitigated because the technology used to bore the  
39 tunnels does not allow access for monitoring or recovery, even if fossils are present in the boring  
40 cuttings. Mitigation Measures PALEO-1a through PALEO-1d, which include monitoring,  
41 identification, and recovery of paleontological resources during ground-disturbing activities, are  
42 available to address the effect resulting from surface excavation.

1 Consequently, Alternatives 1A-8 would contribute to a cumulatively considerable adverse effect on  
2 sensitive paleontological resources.

3 Alternative 9 does not involve any tunneling. The surface impacts of Alternative 9 would be  
4 cumulatively significant when taken in conjunction with the effects of the projects listed in Table 27-  
5 16. However, with Mitigation Measures PALEO-1a through PALEO-1d, the incremental effect of  
6 Alternative 9 is not considered cumulatively considerable.

7 **CEQA Conclusion:** All BDCP alternatives involve surface excavation for both water conveyance  
8 construction and restoration implementation. Excavation into sensitive geologic units in  
9 combination with other past, present and probable future projects and programs that require  
10 similar surface excavation in the Plan Area (identified in Table 27-16) could result in a substantial  
11 cumulatively significant impact on paleontological resources.

12 Alternatives 1A-8 involve both surface excavation and tunneling. While surface excavation has been  
13 shown to have a less-than-significant impact with implementation of Mitigation Measures PALEO-1a  
14 through PALEO-1d, tunneling has been shown to have a significant and unavoidable impact on  
15 sensitive paleontological resources. Alternatives 1A-8 would entail subsurface tunneling in geologic  
16 units sensitive for paleontological resources. Combined with other past, present and probable future  
17 projects and programs in the Plan Area, the impacts of Alternatives 1A-8 would be cumulatively  
18 significant. Since none of the projects identified in Table 27-16 involves tunneling, the incremental  
19 impact from Alternatives 1A-8 is cumulatively considerable and cannot be mitigated.

20 Alternative 9 would not involve tunneling and because Mitigation Measures PALEO-1a through  
21 PALEO-1d for surface excavation in sensitive geologic units associated with this alternative reduce  
22 the level of impact, it would not be a considerable contribution to a cumulatively significant impact.

23 **Mitigation Measure PALEO-1a: Prepare a Monitoring and Mitigation Plan for**  
24 **Paleontological Resources**

25 Please see Mitigation Measure PALEO-1a under Impact PALEO-1 in the discussion of  
26 Alternative 1A.

27 **Mitigation Measure PALEO-1b: Review 90% Design Submittal and Develop Specific**  
28 **Language Identifying How the Mitigation Measures Will Be Implemented along the**  
29 **Alignment**

30 Please see Mitigation Measure PALEO-1b under Impact PALEO-1 in the discussion of  
31 Alternative 1A.

32 **Mitigation Measure PALEO-1c: Educate Construction Personnel in Recognizing Fossil**  
33 **Material**

34 Please see Mitigation Measure PALEO-1c under Impact PALEO-1 in the discussion of  
35 Alternative 1A.

36 **Mitigation Measure PALEO-1d: Collect and Preserve Substantial Potentially Unique or**  
37 **Significant Fossil Remains When Encountered**

38 Please see Mitigation Measure PALEO-1d under Impact PALEO-1 in the discussion of  
39 Alternative 1A.



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