

27.0 Summary Comparison of Alternatives

A summary comparison of a number of important impacts on paleontological resources is provided in Figure 27-0. This figure provides information on the magnitude of the most pertinent and quantifiable impacts on paleontological resources that are expected to result from all alternatives. An important impact to consider is the potential destruction of significant paleontological resources due to excavation for borrow and construction of tunnels and canals.

As depicted in Figure 27-0, each alternative, with the exception of the No Action Alternative, would potentially result in the destruction of unique or significant paleontological resources as a result of the construction of the water conveyance facilities. During construction, Alternatives 1B, 2B, and 6B would result in the greatest amount of material excavated, at approximately 239 million cubic yards, whereas Alternative 9 would result in the least amount of material excavated, at approximately 4.6 million cubic yards. Alternatives 4 and 4A would fall in the lower middle portion of this range, at approximately 56 million cubic yards.

Table ES-8 in the Executive Summary provides a summary of all impacts disclosed in this chapter.

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 (Figure 27-1).

27.1.1 Potential Environmental Effects Area

This section addresses paleontological resources and the potential effects of the action 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.

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

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

10 **27.1.1.1 Physiographic Setting**

11 The Delta encompasses the northern and lowest portion of the San Joaquin Valley and the southern
12 and lowest portion of the Sacramento Valley, which together contain the axial streams of the Central
13 Valley of California: the San Joaquin River to the south and the Sacramento River to the north. The
14 northwest- to southeast-trending Great Valley geomorphic province (also known as the Central
15 Valley physiographic province) is a geologically long-lived structural trough, approximately
16 400 miles long and 50 miles wide (California Geological Survey 2002). This nearly flat alluvial plain
17 lies between the Sierra Nevada on the east and the Coast Ranges on the west and extends from the
18 Tehachapi Mountains north of Los Angeles to the Klamath Mountains (e.g., Norris and Webb
19 1990:412–414; Bartow 1991).

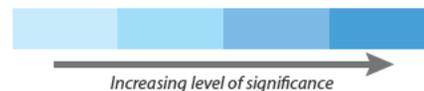
20 The Great Valley is floored by a thick sequence of sedimentary deposits that range in age from
21 Jurassic (about 144 to 208 million years before present [BP]) through Quaternary (present to 1.6
22 million BP. Under the eastern and central portions of the valley, the base of the sequence likely rests
23 on Mesozoic crystalline rock related to the plutons of the Sierra Nevada; to the west, basement rocks
24 are believed to be Franciscan metasediments (sediments that have undergone metamorphism)
25 and/or mélangé (large-scale breccia) similar to exposures in the Coast Ranges. Mesozoic
26 sedimentary rocks now in the subsurface record marine deposition. They are overlain by Tertiary
27 strata reflecting marine, estuarine, and terrestrial conditions, which are in turn overlain by
28 Quaternary fluvial and alluvial strata (river and floodplain deposits) recording uplift and erosion of
29 the Sierra Nevada and Coast Ranges to approximately their present shape (e.g., Norris and Webb
30 1990:412–414; Bartow 1991).

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

Chapter 27 – Paleontological Resources	Alternative																			
	Existing Condition	No Action	1A	1B	1C	2A	2B	2C	3	4	5	6A	6B	6C	7	8	9	4A	2D	5A
PALEO-1: Amount of excavation that could potentially result in the destruction of unique or significant paleontological resources as a result of construction of water conveyance facilities (thousand cubic yards of material excavated for borrow, tunnels, and canals)	n/a	n/a	28,197	238,902	228,660	28,197	238,902	228,660	<28,197	56,000	<28,197	28,197	238,902	228,660	56,000	56,000	4,608	56,000	>56,000	<56,000
	n/a	S/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	SU/A	LTS/NA	SU/A	SU/A	SU/A

Key

Level of significance or effect **before** mitigation
(Quantity of impact: number of sites, structures, acres, etc. affected)



n/a not applicable
> greater than
< less than
≈ about equal to

Level of significance or effect **after** mitigation
(CEQA Finding / NEPA Finding)

CEQA Finding

- NI No Impact
- LTS Less than significant
- S Significant
- SU Significant and unavoidable

NEPA Finding

- B Beneficial
- NE No Effect
- NA Not Adverse
- A Adverse

**Figure 27-0
Comparison of Impacts on Paleontological Resources**

1 **27.1.1.2 Geologic and Stratigraphic Setting**

2 **Near-Surface, Unconsolidated Geologic Units**

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

10 **Recent Overburden and Artificial Fill**

11 Recent overburden and artificial fill are typically considered to have no paleontological sensitivity
12 because there is no potential for these sediments to yield scientifically significant fossils. Recent
13 overburden and artificial fill includes agricultural soils, the sediments of artificially constructed
14 levees, historical flood basin deposits, and the historical “pulse” of outwash sediment from higher
15 elevations resulting not only from hydraulic gold mining in the late nineteenth century, but also
16 from grazing and agricultural land clearance (Florsheim and Mount 2003). The effects of historical
17 land management practices on sedimentation in the Delta have been pronounced, with many areas
18 displaying 5–10 feet of recent sediment immediately below the surface. Other areas immediately
19 outside the Delta on the distal reaches of the alluvial fan plains of the Sierra Nevada and Coast
20 Ranges did not experience this pulse of sedimentation because of their somewhat elevated
21 topographic position.

22 **Delta and Estuarine Sediments**

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

37 As sea level rose at the end of the last glacial age, the eastward transgression of estuarine and deltaic
38 environments began. Atwater et al. (1977) noted that estuarine, and then marine, sedimentation
39 began in San Francisco Bay about 10,000 BP. Shlemon (1971) noted the beginning of estuarine
40 habitats in the western portion of the Delta area at about the same time. These authors concluded
41 that, by about 6,000 BP, habitats that characterize the historic Delta occupied much of the area.
42 Geographically, estuarine sediments are more common farther west in the vicinity of Suisun Marsh,

1 and the channels and basins are subject to periodic inundation, especially during the spring and fall
 2 high tides. Older, middle Pleistocene delta and estuarine sediment dating to past sea-level high
 3 stands are assumed to occur at some depth below the surface of the current Delta. Data from
 4 Shlemon (1971; Shlemon and Begg 1975) suggest that this older sediment would occur below about
 5 80 feet below sea level.

6 **Younger Deposits of the Alluvial Fans**

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

- 16 • Qm₁, Qm₁: Lower member of the Modesto Formation consisting of arkosic alluvium of the Sierra
 17 Nevada alluvial fans; chiefly sand; probably glacial outwash. Finer-grained facies include the
 18 silts and clays of flood-basin deposits.
- 19 • Qm₂, Qm₂: Upper member of the Modesto Formation also consisting of arkosic alluvium of the
 20 alluvial fan of tributary rivers issuing from the Sierra Nevada; chiefly sand; probably glacial
 21 outwash. Finer-grained facies include the silts and clays of flood-basin deposits. Eolian facies
 22 include isolated, relict dune fields on both Delta islands and the broad plains of the alluvial fans.

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

24 **Older Alluvium**

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

38 South of Suisun Marsh/Bay and along the southwestern margin of the Delta, an older alluvial unit
 39 crops out at the foot of the Coast Ranges. This is the Plio-Pleistocene Tulare Formation, which lies
 40 below the Riverbank Formation through much of the San Joaquin Valley (Lettis and Unruh 1991).
 41 Although it is normally found at depths exceeding 150 feet in the valley, uplift along the margin of
 42 the Coast Ranges has brought it to the surface. It is a poorly consolidated, nonmarine, gray to
 43 maroon siltstone, sandstone, and conglomerate. Near its base, the Tulare Formation contains a tuff

1 (volcanic ash) correlated with the Putah Tuff, which has a potassium/argon age of 3.3±0.1 million
 2 BP (Graymer et al. 1994), while the upper member of the Tulare Formation contains the Corcoran
 3 Clay member, dated as early as 0.62 million BP. The Corcoran clay is a widespread lake deposit that
 4 formed approximately 800,000 to 600,000 BP when much of the Central Valley was filled by the
 5 Pleistocene Lake Clyde. The lake was drained by the down-cutting that created the modern day
 6 Carquinez Straits (Negrini et al. 2008).

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

15 The Montezuma Formation is another, older alluvial unit of early Pleistocene age, exposed by the
 16 local uplift of the Montezuma Hills. This poorly consolidated unit consists of orange-weathering,
 17 brown, poorly sorted quartz-lithic sand, silt, and pebble gravel. Pebbles include red chert and
 18 volcanics. It is mapped nowhere other than the uplift between Suisun Marsh on the west and the
 19 Sacramento River channel and Brannan Island on the east (Graymer et al. 1994). Given its apparent
 20 age, it must be at least in part contemporaneous with the Tehama and Tulare Formations.

21 **Bedrock Sedimentary Units**

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

30 **Neogene Units**

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

38 **Paleogene and Mesozoic Units**

39 The Paleogene and Mesozoic sedimentary units of the eastern and northern margin of the Coast
 40 Ranges represent a sequence of increasingly deep ocean basins with increasing age. The Paleogene
 41 units are the Eocene Markley and Domengine Formations and the Paleocene Meganos Formation.
 42 These overlie and, in the tectonic setting of the eastern Coast Ranges south of Suisun Bay and west

1 of the lower San Joaquin River, occur farther out into the valley than the marine sandstones,
2 limestones, and shales that comprise the Great Valley Sequence. The sedimentary units that make up
3 the Mesozoic and earliest Paleogene Great Valley Sequence reflect deep-water conditions when this
4 area was an abyssal plain at the bottom of the ocean, some tens of miles west of an arc of volcanic
5 islands that were situated where the Sierra Nevada is now located.

6 **27.1.1.3 Paleontological Sensitivity of Potentially Affected Units**

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

15 The assessment of the paleontological productivity of different stratigraphic units in the study area
16 was based on the number of paleontological records attributed to those units. This determination
17 was made through queries of the UCMP online database. In these database searches, invertebrate
18 and microfossil collecting sites were discriminated from the paleobotanical and vertebrate records
19 because there have been many microfossil studies (pollen, radiolaria, diatoms, foraminifera)
20 conducted on Cretaceous and Cenozoic sediments in this area. The associated collection sites are
21 listed in the UCMP database, along with localities where more traditional paleontological “finds”
22 have been made. Many sedimentary exposures that yield microfossils, or isolated invertebrate
23 remains, lack plant or vertebrate megafossils. In addition, many invertebrate and microfossil
24 localities in the UCMP database have no associated catalogued specimens (University of California
25 Museum of Paleontology 2009). Finally, invertebrate localities include sites where a molluscan
26 fauna has yielded important data and sites where only sponge spicules or echinoderm plates were
27 noted. When microfossil and invertebrate localities are excluded, the resultant number of plant
28 megafossil and vertebrate fossil sites is smaller and more reflective of the paleontological potential
29 of the sedimentary unit.

1 **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.

2

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

5 **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

6

1 **Recent Overburden and Artificial Fill**

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

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

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

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

29 **Quaternary Alluvium**

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

1 Modesto Formation Sediments

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

12 **Table 27-3. Paleontological Localities Attributed to the Modesto Formation and Undifferentiated**
 13 **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.

14
 15 The generally higher numbers of fossil localities in Alameda and Contra Costa Counties in this
 16 summary partly reflect the fact that these counties extend across the Coast Ranges to San Francisco
 17 Bay and, therefore, encompass many fossiliferous exposures sampled by scientists for decades, as
 18 well as many sites where construction-related excavations have exposed fossils. Based on this data,
 19 undifferentiated Quaternary sediment and sediment assigned to the Modesto Formation possess
 20 high paleontological sensitivity. Consideration of the data indicates that most fossil localities are
 21 from Late Pleistocene or older contexts.

22 Older Alluvium

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

1 **Table 27-4. Paleontological Localities Attributed to the Older Alluvium of the Riverbank,**
 2 **Montezuma, 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.

3
 4 This tabulation of fossil sites found in older alluvium does not include those localities from the
 5 Irvington Gravels near Hayward or the Livermore Gravels, because they are well removed from the
 6 Delta and its periphery and have no bearing on the paleontological sensitivity of the area. However,
 7 consistent with the prevailing standard of care, California's Pleistocene nonmarine strata have
 8 yielded a wealth of stratigraphically important vertebrate fossils, including the assemblages that
 9 defined both the Rancholabrean and Irvingtonian Stages of the North American Land Mammal
 10 Chronology (Figure 27-1), which is used as a reference by paleontologists and stratigraphers across
 11 the country. Because of this wealth of information, continental deposits of Pleistocene age are
 12 almost universally treated as paleontologically sensitive in California. Therefore, older alluvium in
 13 the area possesses high paleontological sensitivity. Examples of vertebrate fossils found in the
 14 counties of the Plan Area in these units include mammoth, horses, rodents, reptiles, bony fish in the
 15 Tehama Formation; mammoth, bison, camel, horse, deer, ground sloth, rodents, birds, reptiles,
 16 amphibians, cartilaginous fish, bony fish in the Montezuma Formation; birds and bony fish in the
 17 Tulare Formation; and mammoth, bison, camel, horse, ground sloth, dire wolf, rodents, moles, and
 18 bony fish in the Riverbank Formation (University of California Museum of Paleontology 2012).

19 **Bedrock Sedimentary Units**

20 The Tertiary and Mesozoic sedimentary units of the eastern and northern margin of the Coast
 21 Ranges south of Suisun Bay, and also exposed in the Potrero Hills just north of Suisun Marsh,
 22 represent a sequence of increasingly shallow ocean basins with decreasing age. Some units are
 23 largely devoid of fossils, while others are quite fossiliferous. There is some correlation between
 24 inferred depth at time of deposition and paleontological sensitivity, with sediments from abyssal
 25 plains (water depth exceeding 6,000 feet) generally lacking megafossils.

1 **Tertiary Marine Sediments**

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

9 **Table 27-5. Paleontological Localities Attributed to Tertiary Marine Sediments of the Neroly,**
 10 **Markley, 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.

11

12 The Neroly and Markley Formations have yielded megafossils and plant remains, while the
 13 Domengine has yielded microfossils and some invertebrates. No fossil localities are ascribed to the
 14 Meganos Formation in the UCMF database for the seven counties under consideration here. The
 15 Neroly and Markley Formations possess high paleontological sensitivity depending on location, and
 16 the Domengine and Meganos Formations possess low paleontological sensitivity because they do
 17 not appear to yield megafossils of either plants or vertebrates. Examples of vertebrate fossils found
 18 in the counties of the Plan Area in these units include early canid, horse, and early pronghorn in the
 19 Neroly Formation and bony fish in the Markley Formation (University of California Museum of
 20 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**
 11 **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.

12

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

23 Units Considered for Borrow Material

24 Several geologic units, some outside the Plan Area, are being considered for borrow material, as
 25 described in the conceptual engineering reports. These units are briefly described, and a
 26 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

1 category by many federal agencies, such as the Bureau of Land Management. In addition, NEPA (USC
 2 4321 et seq.; 40 Code of Federal Regulations [CFR] 1502.25), as amended, requires federal agencies
 3 to consider the impact of their actions (including the issuance of entitlements or permits, or
 4 financial support, to a project) on important historic, cultural, and natural aspects of our national
 5 heritage. Because federally managed lands may be affected by the alternatives and because federal
 6 entitlement or permits will be required, these statutes extend to paleontological resources in the
 7 Delta. A characterization of paleontological resources that may be affected by project construction
 8 activities and an assessment of effects of the action alternatives are required.

9 **27.2.1.2 Omnibus Public Land Management Act of 2009**

10 On March 31, 2009, President Obama signed into law the Omnibus Public Land Management Act of
 11 2009 (H.R. 146) (OPLMA). Title 6, Subtitle D of the OPLMA, *Paleontological Resources Preservation*,
 12 requires the secretaries of the Department of the Interior (exclusive of Indian trust lands) and the
 13 Department of Agriculture (insofar as U.S. Forest System lands are concerned) to “... manage and
 14 protect paleontological resources on Federal land using scientific principals and expertise... [and]
 15 develop appropriate plans for inventory, monitoring, and the scientific and educational use of
 16 paleontological resources ...” The OPLMA further excludes casual collection from restrictions under
 17 the law, and then describes the requirements for permitting collection on federal lands, stipulations
 18 regarding the use of paleontological resources in education, continued federal ownership of
 19 recovered paleontological resources, and standards for acceptable repositories of collected
 20 specimens and associated data (Sections 6303–6305). The OPLMA also provides for criminal and
 21 civil penalties for unauthorized removal of paleontological resources from federal land, and for
 22 rewards for reporting the theft of fossils (Sections 6306–6309).

23 **27.2.1.3 Federal Land Policy and Management Act (1976)**

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

32 **27.2.1.4 Code of Federal Regulations, Title 43**

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

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

38 **27.2.1.5 Secretarial of the Interior Order 3104**

39 This grants the Bureau of Land Management the authority to issue paleontological resource use
 40 permits for lands under its jurisdiction.

27.2.2 State Plans, Policies, and Regulations

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

27.2.3 Regional and Local Plans, Policies, and Regulations

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

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

27.2.3.1 Alameda County

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

27.2.3.2 Sacramento County

The Conservation Element *Sacramento County General Plan of 2005–2030* (Sacramento County 2011) emphasizes the educational, historic, and scientific importance of paleontological resources and notes that there are at least five recorded sites in Sacramento County which have revealed fossil remains dating back to 100,000 years ago. Policies within the Conservation Element that help to ensure that future finds of paleontological resources are protected include the following:

- **Policy CO-161:** As a condition of approval for discretionary projects, require appropriate mitigation to reduce potential impacts where development could adversely affect paleontological resources.
- **Policy CO-162:** Projects located within areas known to be sensitive for paleontological resources, should be monitored to ensure proper treatment of resources and to ensure crews follow proper reporting, safeguards and procedures.

- **Policy CO-163:** Require that a certified geologist or paleoresources consultant determine appropriate protection measures when resources are discovered during the course of development and land altering activities.

27.2.3.3 San Joaquin County

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

27.2.3.4 Solano County

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

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

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

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

1 **27.2.3.5 Yolo County**

2 The Conservation and Open Space Element of the *Yolo County 2030 Countywide General Plan* (County
3 of Yolo 2009) includes policies to protect cultural resources, including paleontological resources. In
4 particular, the Conservation and Open Space Element includes the following implementation actions
5 related to paleontological resources:

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

17 **27.3 Environmental Consequences**

18 **27.3.1 Methods for Analysis**

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

23 *SVP's Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological*
24 *Resources* provides standard guidelines that are widely followed (Society of Vertebrate Paleontology
25 2010). These guidelines reflect the accepted standard of care for paleontological resources. The SVP
26 guidelines identify two key phases in the process for protecting paleontological resources from
27 project impacts.

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

32 An important strength of SVP's approach to assessing potential impacts on paleontological
33 resources is that the SVP guidelines provide some standardization in evaluating a Plan Area's
34 paleontological sensitivity. Table 27-8 defines the SVP's sensitivity categories for paleontological
35 resources and summarizes SVP's recommended treatments to avoid adverse effects in each
36 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"> • An intensive field survey and surface salvage prior to earth moving, if applicable. • Monitoring by a qualified paleontological resource monitor of excavations. • Salvage of unearthed fossil remains and/or traces (e.g., tracks, trails, burrows). • Screen washing to recover small specimens, if applicable. • Preliminary survey and surface salvage before construction begins. • 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). • Identification, cataloging, curation, and provision for repository storage of prepared fossil specimens. • A final report of the finds and their significance.
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 Public Resources Code Section 5020.1 [b]). CEQA Guidelines define
 8 procedures, types of activities, persons, and public agencies required to comply with CEQA.
 9 Appendix G in Section 15023 provides an Environmental Checklist of questions that a lead agency
 10 should normally address to comply with CEQA. One of the questions to be answered in the
 11 Environmental Checklist (Section 15023, Appendix G, Section V, part c) is: “Would the project
 12 directly or indirectly destroy a unique 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 project 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 and implementing CM2–CM21 or
26 Environmental Commitments 3, 4, 6–12, 15, and 16 could potentially result in incompatibilities with
27 plans and policies related to paleontological resources. Section 27.2, *Regulatory Setting*, provides an
28 overview of federal, state, regional and agency-specific plans and policies applicable to
29 paleontological resources. This section summarizes ways in which the proposed project is
30 compatible or incompatible with those plans and policies. Potential incompatibilities with local
31 plans or policies, or with those not binding on the state or federal governments, do not necessarily
32 translate into adverse environmental effects under NEPA or CEQA. Even where an incompatibility
33 “on paper” exists, it does not by itself constitute an adverse physical effect on the environment, but
34 rather may indicate the potential for a proposed activity to have a physical effect on the
35 environment. The relationship between plans, policies, and regulations and impacts on the physical
36 environment is discussed in Chapter 13, *Land Use*, Section 13.2.3.

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

42 Implementation of Mitigation Measures PALEO-1b through PALEO-1d (discussed below), will
43 ensure that unique or significant paleontological resources in the alternative footprint are

1 systematically identified, documented, avoided or protected from damage where feasible, or
2 recovered and curated so they remain available for scientific study, which is consistent with the
3 purpose of the Antiquities Act of 1906 as well as the OPLMA. These measures also further the intent
4 of the local county plans in ensuring that there is oversight of paleontological resources during
5 construction activities associated with the proposed project.

6 **27.3.3 Effects and Mitigation Approaches**

7 **27.3.3.1 No Action Alternative**

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

19 **Unique or Significant Paleontological Resources**

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

25 State Water Project (SWP) and Central Valley Project (CVP) operations, identified as continuing
26 actions under the No Action Alternative, include repair, maintenance, or protection of infrastructure
27 such as levees, and may also include actions for water quality management, habitat and species
28 protection, and flood management. These continuing actions could occur throughout the Plan Area
29 and could result in effects on paleontological resources, depending on the type of construction
30 needed for repairs or adjustments to potential irrigation water and drainage needed for water
31 quality and flood management. The projects identified in Table 27-9 below may affect
32 paleontological resources. A complete list and description of programs and plans considered under
33 the No Action Alternative is provided in Appendix 3D, *Defining Existing Conditions, No Action*
34 *Alternative, No Project Alternative, and Cumulative Impact 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, Fresno to Merced Section	FEIR/FEIS completed on May 3, 2012. Record of Decision issued on September 18, 2012.	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	Yolo County 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
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 project-related water conveyance facilities
18 would be constructed and none of the other restoration actions would be implemented. Existing
19 approved projects and programs in the Plan Area would continue. Many of these programs would
20 result in ground-disturbing work in the Plan Area and surrounding region. Because the region is
21 sensitive for paleontological resources, these actions could collectively result in disturbance of
22 paleontological resources and a potentially significant impact.

23 **27.3.3.2 Alternative 1A—Dual Conveyance with Pipeline/Tunnel and** 24 **Intakes 1–5 (15,000 cfs; Operational Scenario A)**

25 The location of BDCP facilities (and the construction activities associated with those facilities) under
26 Alternative 1A in relation to geologic units is shown in Figure 27-2. The depth and extent of these
27 activities are shown in Table 27-10. A detailed depiction of the Pipeline/Tunnel alignment is
28 provided in Figure M3-1 in Chapter 3, *Description of Alternatives*.

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

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

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

10 The five intakes and the intermediate forebay would entail deep and extensive excavation in the
11 northern portion of the Plan Area (Table 27-10). The five intakes and the pumping plant and
12 sedimentation basin associated with each intake would be along the east bank of the Sacramento
13 River between Clarksburg and Walnut Grove. The intermediate forebay and its associated pumping
14 plant would be located adjacent to the west of South Stone Lake. Ground-disturbing activities
15 include clearing and grubbing, rough grading, excavation, pile driving, constructing foundations, and
16 final grading. Construction of the intakes, pumping plants, and sedimentation basins would involve
17 excavation to a depth of between 20 and 35 feet over an area of 330 acres. The staging/storage area
18 and construction zone preparation would involve 76–148 acres per intake structure. Construction
19 for the intermediate forebay would involve excavation of approximately 760 acres to a depth of
20 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 along the Pipeline/Tunnel Alignment (Alternatives**
 3 **1A, 2A, 3, 5, 6A, 7, and 8)**

Feature	Location	Construction/Excavation	Sensitive Units Disturbed
Five new north Delta intakes	East bank Sacramento River between Clarksburg and Walnut Grove	30 feet below existing grade; 330 acres 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 feet below existing grade; pumping plant 25–30 feet below existing grade; staging/storage area and construction zone prep (76–148 acres 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 feet 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 acres to a depth of 15–20 feet below existing grade	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
Intermediate forebay	Near Hood	760 acres to a depth of 15–20 feet below existing grade	Riverbank Formation and Modesto Formations
Tunnel 1	Single-bore 29-foot-diameter tunnel, 29,200 feet from intake pumping plants to Intermediate Forebay between South Stone Lake and the Sacramento River	Shaft to 100–150 feet below existing grade; tunnel invert at 150 feet; boring using pressurized face mechanized tunneling machines, including earth pressure balance machines and slurry tunneling machines	Riverbank and Modesto Formations
Tunnel 2	Dual-bore 33-foot-diameter tunnel, 176,496 ft from Intermediate Forebay to Byron Tract Forebay	Same as Tunnel 1	Riverbank and Modesto Formations

4

5 Excavation for the intakes and intermediate forebay would be conducted in geologic units both
 6 sensitive and nonsensitive for paleontological resources (Figure 27-2). Although most of the
 7 surficial geologic units in the area affected by excavation for the intakes and forebays are of
 8 Holocene age and not sensitive for paleontological resources, the Riverbank Formation, which is of
 9 Pleistocene age and sensitive for paleontological resources, is exposed at the surface in some
 10 locations or underlies the Holocene units in the shallow subsurface. The Modesto Formation,
 11 another Pleistocene-age unit that is sensitive for paleontological resources, also occurs in the area
 12 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	23,400,000 ^a	25,000,000	7,600,000 ^b	32,600,000
9	2,670,000	0	1,938,000	1,938,000

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

^a 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.

^b Includes canal and all other features requiring excavation.

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

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

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

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

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

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

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

37 **NEPA Effects:** The ground-disturbing activities that occur in geologic units sensitive for
38 paleontological resources have the potential to damage or destroy those resources. Direct or
39 indirect destruction of significant paleontological resources as defined by the SVP (2010) would
40 represent an adverse effect because conveyance facility construction could directly or indirectly
41 destroy unknown paleontological resources in geologic units known to be sensitive for these
42 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 CM2–CM21**

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 CM21) 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 27-3 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. This effect would not be adverse.

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
 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.

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 Chapter 3, *Description of Alternatives*.

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 along the Eastern Alignment (Alternatives 1B, 2B,**
 19 **and 6B)**

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 feet, top width up to 220 feet (700 feet with right-of-way), bottom width up to 100 feet (340 feet 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 feet below ground surface; 8 acres 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 feet below the existing slough invert	Riverbank and Modesto Formations
Tunnel siphons	Lost Slough and Mokelumne River floodway (7,444 feet), San Joaquin River (3,233 feet), and Old River (1,914 feet)	Same as tunnel	Riverbank and Modesto Formations

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 CM2–CM21**

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–CM21) 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. This effect would not be adverse.

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 Chapter 3, *Description of Alternatives*.

11 **Table 27-13. Summary of BDCP Construction Activities and Geologic Units Sensitive for Paleontological**
 12 **Resources that could be Disturbed along the Western Alignment (Alternatives 1C, 2C, and 6C)**

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 acres	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 acres	
Conveyance canal	Intakes to intermediate pumping plant on Ryer Island and Hotchkiss Slough to Byron Tract Forebay	Excavation depth of 30 feet, top width up to 220 feet (700 feet with right-of-way), bottom width up to 100 feet (340 feet 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 feet below existing grade; 8 acres total	Upper Pleistocene deposits
Byron Tract Forebay	Just northwest of Clifton Court Forebay	630 ac to a depth of 15–20 feet 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-foot-diameter tunnel, 17 mi from Intermediate Pumping Plant to southern section of conveyance canal	Shaft to 100–150 feet; tunnel invert at 150 feet; boring using pressurized face mechanized tunneling machines, including earth pressure balance machines and slurry tunneling machines	Riverbank and Modesto Formations
26- by 26-foot culvert siphons	Same as 1B	Same as 1B	Same as 1B

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

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

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

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

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

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

36 Canal construction would involve excavating to a depth of 30 feet with a top width of 220 feet (up to
37 700 feet with right-of-way) and a bottom width of up to 100 feet (340 feet with right-of-way). The
38 amount of material that would be excavated, which is more than under Alternative 1A but less than
39 under Alternative 1B, is shown in Table 27-11. In the canal alignment between the intakes and
40 intermediate pumping plant, the geologic units exposed at the surface are the Holocene flood-basin
41 and peat and mud deposits (Figure 27-2). These units are estimated to be from 0 to more than 30
42 feet thick and are not likely to contain fossils (i.e., not sensitive for paleontological resources).
43 Underlying these Holocene deposits are Pleistocene units, such as the Modesto Formation. The

1 Modesto Formation is sensitive for paleontological resources, and the other Pleistocene units are
2 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-foot 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 CM2–CM21**

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–CM21) 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. This effect would not be adverse.

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 CM2–CM21**

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–CM21) 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. This effect would not be adverse.

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 CM2–CM21**

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–CM21) 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 and**
 33 **Intakes 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 CM2–CM21**

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–CM21) 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 CM2–CM21**

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–CM21) 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 feet below existing grade; 88–106 acres per intake, including sedimentation basins	Riverbank and Modesto Formations
New pumping plants	Northeast of the Clifton Court Forebay	Pumping plant 50 feet below existing grade; staging/storage area and construction zone prep (0.74 acre for each pumping plant)	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
Expanded Clifton Court Forebay, canals to Jones and Banks pumping plants	Just south of existing Clifton Court Forebay	2,600 acres to a depth of 15–20 feet below existing grade	Modesto Formation eolian deposits, alluvium from Corral Hollow Drainage to Brushy Creek
Intermediate forebay	Glannvale Tract	243 ac to a depth of 12–16 feet below existing grade	Riverbank Formation
Tunnel 1a	Single-bore 28- to 40-foot-diameter tunnel, 8.73 miles from Intakes 2 and 3 to Intermediate Forebay	Shaft to 75 feet below existing grade; tunnel invert at 125 feet; boring using pressurized face mechanized tunneling machines, including earth pressure balance machines and slurry tunneling machines	Riverbank and Modesto Formations
Tunnel 1b	Single-bore 28-foot-diameter tunnel, 4.77 miles from Intake 5 to Intermediate Forebay	Same as Tunnel 1a	Riverbank Formation
Tunnel 2	Dual-bore 40-foot-diameter tunnel, 30.1 miles from Intermediate Forebay to Clifton Court Forebay	Same as Tunnel 1a and 1b but tunnel invert depth down to 163 feet	Riverbank and Modesto Formations

3
 4 The three intakes and the intermediate forebay would entail deep and extensive excavation in the
 5 northern portion of the Plan Area (Table 27-14). The three intakes and sedimentation basin
 6 associated with each intake would be along the east bank of the Sacramento River between
 7 Clarksburg and Walnut Grove. The intermediate forebay would be located on the west side of
 8 Glannvale Tract. No pumping plant is associated with the intermediate forebay due to the fact that
 9 water would flow via gravity to the south Delta. Ground-disturbing activities include clearing and
 10 grubbing, rough grading, excavation, pile driving, constructing foundations, and final grading.
 11 Construction of the intakes and sedimentation basins would involve excavation to a depth of
 12 between 20–35 feet over an area of 330 acres. Construction of the pumping plant would involve
 13 excavation to a depth of 50 feet over 1.48 acres. The staging/storage area and construction zone
 14 preparation would involve 70–114 acres per intake structure. Construction for the intermediate

1 forebay would involve excavation of approximately 245 acres to a depth of approximately 6-11 feet
2 below existing grade.

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

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

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

29 Construction of Tunnels 1a, 1b and 2 would entail deep excavation using a tunnel-boring machine
30 (TBM) (Table 27-10). Tunnel 1a would connect a pipeline adjacent to Intake Pumping Plant 2, a
31 pipeline adjacent to Intake Pumping Plant 3 to the intermediate forebay on Glannvale Tract. Tunnel
32 1b would run between Intake Pumping Plant 5 and the intermediate forebay. Tunnel 2 would extend
33 between the intermediate forebay and Clifton Court Forebay. The main construction or launching
34 shafts for each tunnel would be about 60 feet in diameter. The TBM retrieval shaft would be
35 approximately 45 feet in diameter, and 12-foot-diameter intermediate ventilation shafts would be
36 constructed approximately every 3 miles along the tunnel route. The amount of material that would
37 be excavated, which is the least of the tunnel or canal options, is shown in Table 27-11. The tunnels
38 would be excavated at a depth of approximately 100–150 feet at the tunnel invert, mainly to avoid
39 the peaty Holocene soils. The TBMs would be mechanized soft-ground tunneling machines designed
40 for use in soft soils with high groundwater pressure. The tunnels would be lined with precast
41 concrete bolted-and-gasketed segments. The tunnel concrete liner would serve as permanent
42 ground support and would be installed immediately behind the TBM, forming a continuous
43 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 and pumping plants would occur in both
10 sensitive and nonsensitive units (Figure 27-2). Although much of the area surrounding the Clifton
11 Court Forebay is covered in surficial units of Holocene age such as the Holocene alluvial-floodplain
12 deposits (Qfp), which are not sensitive for paleontological resources, units sensitive for
13 paleontological resources are also exposed at the surface and underlie the area (Figure 27-2). These
14 units include the Holocene or Upper Pleistocene alluvium of creeks from the Corral Hollow Drainage
15 to Brushy Creek (Qch), which is sensitive for paleontological resources. The Modesto Formation also
16 likely occurs in the shallow subsurface of the northeast edge of Clifton Court Forebay.

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

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

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

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

31 Borrow material would be needed primarily for forebay embankments and levee reconstruction at
32 intake sites, but also for access roads. The amount of material that would be needed for borrow,
33 which is the least of the tunnel or canal options, is shown in Table 27-11. Borrow material would be
34 excavated from targeted units described in the engineering report (California Department of Water
35 Resources 2010). Some of these units, including the Modesto and Montezuma Formations, are
36 sensitive for paleontological resources. Excavation of borrow material from these units could
37 disturb paleontological resources. In addition, borrow/spoil areas are designated in the area of the
38 intakes, along the intermediate forebay, and along the expanded Clifton Court Forebay (Figure 27-
39 2). As described above, units sensitive for paleontological resources in these areas include the
40 Riverbank and Modesto Formations (potentially in the shallow subsurface) in the area of the intakes
41 and intermediate forebay, and the alluvium of creeks from the Corral Hollow Drainage to Brushy
42 Creek and the Modesto Formation along the expanded Clifton Court Forebay and pumping plants.
43 Excavation of borrow material from these units could also disturb sensitive paleontological
44 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.

26 Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of
 27 surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels
 28 necessary for Alternative 4 would most likely destroy unique or significant paleontological
 29 resources in the Plan Area and would potentially cause a significant and 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

1 (Society of Vertebrate Paleontology 2010). The PRS will be responsible for implementing all
 2 aspects of the PRMMP, managing any additional paleontological monitors needed for
 3 construction activities, and serving as a qualified resource in the event of unanticipated
 4 paleontological finds. The PRS may, but need not necessarily, be the same individual who
 5 prepared the PRMMP. The PRS will be retained or designated prior to the start of ground-
 6 breaking construction. A qualified PRS is defined as a person with a M.S. or Ph.D. in
 7 paleontology, paleobiology, or geology, with strong working knowledge of local
 8 paleontology and geology, and professional expertise with paleontological procedures and
 9 techniques. The PRS may designate a paleontological monitor to be present during earth-
 10 moving activities. A paleontological monitor is defined as a person with a BS/BA in geology
 11 or paleontology and a minimum of 1 year of monitoring experience in local sedimentary
 12 rocks. Experience may be substituted for academic training on approval from the
 13 contracting agency. The PRS and paleontological monitor(s) will be notified by the Lead
 14 Agency or Resident Engineer in advance of the start of construction activity. The PRS and
 15 paleontological monitor(s) will attend any required safety training programs.

- 16 • Preconstruction surveys (with salvage and/or protection in place, as appropriate) will be
 17 conducted in areas where construction activities would result in surface disturbance of
 18 geologic units identified as highly sensitive for paleontological resources.
- 19 • Preconstruction and construction-period coordination procedures and communications
 20 protocols will be established, including procedures to alert all construction personnel
 21 involved with earthmoving activities about the possibility of encountering fossils as set forth
 22 in Mitigation Measure PALEO-1c and communications regarding the *stop work, evaluate and*
 23 *treat appropriately response* in the event of a paleontological discovery, as discussed in
 24 Mitigation Measure PALEO-1d.
- 25 • All ground-disturbing activities involving highly sensitive units will be monitored by
 26 qualified monitors. Monitoring will initially be conducted full time for grading and
 27 excavation, but the PRMMP may provide for monitoring frequency in any given location to
 28 be reduced once 50% of the ground-disturbing activity in that location has been completed,
 29 if the reduction is appropriate based on the implementing PRS's professional judgment in
 30 consideration of actual site conditions. Monitoring will also be conducted throughout
 31 drilling operations. The monitoring program for tunneling operations will be developed in
 32 conjunction with the facility design and geotechnical teams, in consideration of the
 33 tunneling method selected.
- 34 • Sampling and data recovery procedures that are consistent with the SVP Standard
 35 Procedures (Society of Vertebrate Paleontology 2010) and the SVP Conditions of
 36 Receivership (Society of Vertebrate Paleontology 1996) will be established.
- 37 • A repository plan will be developed that provides for appropriate curation of recovered
 38 materials, if necessary.
- 39 • Mitigation monitoring report preparation guidelines will be established that are consistent
 40 with the SVP Standard Procedures guidelines (Society of Vertebrate Paleontology 2010).
 41 The report will include, at a minimum, discussions of effects, regulatory requirements,
 42 purpose of mitigation, regional geologic context, Plan Area stratigraphy, stratigraphic and
 43 geographic distribution of paleontological resources, field and laboratory methods and
 44 procedures, fossil recovery, and paleontological significance. The report will also include
 45 geological cross sections and stratigraphic sections depicting fossil discovery localities and

- 1 excavated rock units; maps showing the activity location and vicinity, as well as geology and
 2 location of discovered fossil localities; appropriate illustrations depicting monitoring
 3 conditions, field context of collecting localities, quarry maps, and laboratory activities; and
 4 appendices including an itemized listing of catalogued fossil specimens, complete
 5 descriptions of all fossil collecting localities, an explanation of report acronyms and terms,
 6 and a signed curation agreement with an approved paleontological repository.
- 7 • Procedures for preparing, identifying, and analyzing fossil specimens and data recovered
 8 will be established, consistent with the SVP Conditions of Receivership (Society of
 9 Vertebrate Paleontology 1996 and 2010) and any specific requirements of the designated
 10 repository institution.

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

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

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

- 33 • One onsite paleontological monitor will likely be sufficient to handle observation of most
 34 ground-disturbing activities. However, if additional paleontological monitors are needed,
 35 the PRS will coordinate with the Resident Engineer. This communication is imperative and
 36 fundamental to the success of this PRMMP and to compliance with CEQA and NEPA.
- 37 • Whenever possible, sedimentary rocks exposed during trenching and other deep excavation
 38 work will be inspected. Ideally, this monitoring will involve inspection of fresh bedrock
 39 exposures. However, observation of some work may not be possible for safety reasons and
 40 inspection from these operations will be restricted to spoils. In this case, the monitor will
 41 inspect spoils as they are stockpiled and remove any matrix blocks containing
 42 paleontological resources. Construction personnel, namely the Resident Engineer/Lead,
 43 must communicate depths of excavated materials and their approximate location to the field
 44 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 CM2–CM21**

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 CM21) 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.

1 **NEPA Effects:** Although excavation associated with these conservation measures under Alternative
 2 4 would be shallow, CM2, CM4–CM6, and CM10 require deeper or more extensive excavation. 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 4 would be fairly shallow, CM2, CM4–CM6, and
 16 CM10 require deeper or more extensive excavation. Units sensitive for paleontological resources,
 17 such as the Riverbank and Modesto Formations, occur at the surface in several conservation zones
 18 and occur at shallow depth in other zones. If fossils are present in the Plan Area, they could be
 19 damaged during excavation associated with these conservation measures. The greater the extent of
 20 excavation, the greater the potential impact, although even localized excavation could damage or
 21 destroy paleontological resources. Direct or indirect destruction of significant paleontological
 22 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 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 4.

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 4.

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 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 CM2–CM21**

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–CM21) 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 2C, 3 and 4. The type of effects would be the same, but the magnitude of potential effects associated
 37 with 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 CM2–CM21**

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–CM21) 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 CM2–CM21**

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–CM21) 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 CM2–CM21**

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–CM21) 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 CM2–CM21**

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–CM21) 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 CM2–CM21**

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–CM21) 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-1d are available to mitigate all shallow ground-
 8 disturbing conservation measures. Mitigation Measures PALEO-1a through PALEO-1d 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 Chapter
 10 3, *Description of Alternatives*.

11 **Table 27-15. Summary of BDCP Construction Activities and Geologic Units Sensitive for**
 12 **Paleontological 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 acres (3 permanent)	Pleistocene units
19- by 19-foot, 23- by 23-foot, and 26- by 26-foot 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

1 clearing and grubbing, rough grading, excavation, pile driving, constructing foundations, and final
2 grading. Construction of the intakes would involve an area of approximately 30 acres. Each intake
3 would be approximately 85 feet wide and 45 feet long.

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

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

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

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

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

41 Channel enlargement would take place in four locations along Middle River: between Mildred Island
42 and Railroad Cut (enlarged area 4,777 square feet), between Railroad Cut and Woodward Canal
43 (enlarged area 4,319 square feet), between Woodward Canal and Victoria Canal (enlarged area
44 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 BDCP
8 alternatives (Table 27-11). Impacts, however, would be mitigated with the same mitigation
9 measures described 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 CM2–CM21**

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–CM21) 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 Effects and Mitigation Approaches—Alternatives 4A,**
 19 **2D, and 5A**

20 **27.3.4.1 No Action Alternative Early Long-Term**

21 The effects of the No Action Alternative (ELT) considered for the purposes of Alternative 4A, 2D, and
 22 5A would be expected to be similar to the effects described for the No Action Alternative Late Long-
 23 Term (LLT) in Section 27.3.3.1. Activities within the Plan Area that under the No Action Alternative
 24 (ELT) could affect paleontological resources would be expected to be similar to those described
 25 under Existing Conditions and would include continued programs by federal, state, and local
 26 agencies and non-profit groups as well as projects that are permitted or assumed to be constructed
 27 in the ELT period. This includes expected restoration actions within the Yolo Bypass being driven by
 28 the 2008 and 2009 USFWS and NMFS BiOps and the restoration of 8,000 acres intertidal habitat in
 29 the Delta and Suisun Marsh.

30 Because of the shorter implementation period, the magnitude of ground disturbing activities that
 31 could adversely affect paleontological resources would be less than those expected under the No
 32 Action Alternative (LLT). However, there could be adverse impacts on paleontological resources in
 33 the ELT period as a result of ground disturbing activities occurring within the Plan Area, as a result
 34 of the planned restoration activities described above and other activities such as flood control and
 35 roadway improvements.

36 **CEQA Conclusion:** Under the No Action Alternative (ELT), activities will occur within the Plan Area
 37 that include disturbing land that could impact paleontological resources. Land use changes within
 38 the Plan Area, including habitat restoration projects, could result in loss of paleontological

resources, although to a lesser degree than under the No Action Alternative (LLT) because fewer acres would be disturbed. Because the region is sensitive for paleontological resources, these actions could collectively result in disturbance of paleontological resources and a potentially significant impact.

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

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

The construction of water conveyance facilities and the extent of destruction of unique or significant paleontological resources under Alternative 4A would be identical to those described under Alternative 4. Construction activities that could result in adverse effects on paleontological resources include excavation for new intakes, new pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an operable barrier at the head of Old River, 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 and are provided in the description of the extent of impacts on paleontological resources in Alternative 4 and summarized in Table 27-14.

As described under Alternative 4, depending on location, excavation would be in the Pleistocene age sensitive paleontological units of the Riverbank Formation and the Modesto Formation (Figures 27-2 and 27-3). Additionally, some offsite borrow excavation would be in the sensitive paleontological Modesto Formation and Montezuma Formation. Any new offsite borrow locations would undergo additional technical and environmental review, including that for Paleontological Resource impacts.

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

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 PALEO-1d.

Mitigation Measures PALEO-1a through PALEO-1d are available to mitigate the effects of the surface-related ground disturbance activities associated with Alternative 4A. 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, pumping plants, new/expanded forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for Alternative 4A would most likely destroy unique or significant paleontological resources and would constitute an adverse effect under NEPA.

1 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 4A could
 2 cause the destruction of unique paleontological resources. The ground-disturbing activities
 3 associated with Alternative 4A 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.

7 Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of
 8 surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels
 9 necessary for Alternative 4A would most likely destroy unique or significant paleontological
 10 resources in the Plan Area and would potentially cause a significant and unavoidable impact.

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

13 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 14 Alternative 4.

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

18 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 19 Alternative 4.

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

22 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 23 Alternative 4.

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

26 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 27 Alternative 4.

28 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**
 29 **with the Implementation of Environmental Commitments 3, 4, 6-12, 15, and 16**

30 Ground-disturbing activities associated with restoration actions under Alternative 4A would result
 31 in impacts that would be similar in nature to those described under Alternative 4. However, the
 32 extent of these impacts would be much less under Alternative 4A because less ground-disturbing
 33 activity would occur. The Environmental Commitments are described in Chapter 3, *Description of*
 34 *Alternatives*, and include natural communities protection and restoration, tidal natural communities
 35 restoration, channel margin enhancement, riparian natural community restoration, vernal pool and
 36 alkali seasonal wetland complex restoration, and nontidal marsh restoration. Land-disturbing
 37 activities would be required to implement each of the conservation and stressor reduction
 38 measures.

1 **NEPA Effects:** If fossils are present in the Plan Area, they could be damaged during excavation
 2 required to implement the conservation and stressor reduction Environmental Commitments. The
 3 greater the extent of excavation, the greater the potential effect, although even localized excavation
 4 could 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-1d are available to mitigate all shallow ground-
 8 disturbing Environmental Commitments. Mitigation Measures PALEO-1a through PALEO-1d would
 9 address all deeper ground-disturbing Environmental Commitments.

10 **CEQA Conclusion:** Ground-disturbing activities associated with implementing the conservation and
 11 stressor reduction components under Alternative 4A could affect paleontological resources. If fossils
 12 are present in the Plan Area, they could be damaged during excavation associated with these
 13 Environmental Commitments. The greater the extent of excavation, the greater the potential impact,
 14 although even localized excavation could damage or destroy paleontological resources. Direct or
 15 indirect destruction of significant paleontological resources as defined by the SVP (2010) would
 16 constitute a significant impact.

17 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing
 18 Environmental Commitments and Mitigation Measures PALEO-1a through PALEO-1d for all deeper
 19 ground-disturbing Environmental Commitments 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
 26 Alternative 4.

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 4.

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 4.

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 4.

27.3.4.3 Alternative 2D—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 1, 2, 3, 4, and 5 (15,000 cfs; Operational Scenario B)

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

Alternative 2D would include the same physical/structural components as Alternative 4, but would include two additional intakes. The potential for Alternative 2D to affect unique or significant paleontological resources would be similar to the impacts described for Alternative 4, but could include additional impacts associated with constructing Intakes 1 and 4. Construction activities that could result in adverse effects on paleontological resources include excavation for new intakes, new pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants, an operable barrier at the head of Old River, other water facility components, roads, and borrow sites. The depth, extent, and location of excavation and other ground-disturbing activities vary greatly across the project area would be similar to the description of the extent of impacts on paleontological resources in Alternative 4 and summarized in Table 27-14, with the exception of two additional intakes.

Excavation for the intakes and intermediate forebay would be conducted in geologic units both sensitive and nonsensitive for paleontological resources (Figure 27-2). As described under Alternative 4, depending on location, excavation would be in the Pleistocene age sensitive paleontological units of the Riverbank Formation and the Modesto Formation (Figures 27-2 and 27-3). Intake 1 would be on the north side of Clarksburg in sensitive paleontological Riverbank Formation deposits. Intake 4 would be south of Hood in sensitive paleontological Riverbank Formation deposits. Additionally, some offsite borrow excavation would be in the sensitive paleontological Modesto Formation and Montezuma Formation. Any new offsite borrow locations would undergo additional technical and environmental review, including that for Paleontological Resource impacts.

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

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 2D. 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 pumping plants, new/expanded forebays, pipelines and tunnels, canals to Jones and Banks pumping plants, and other water facility components necessary for

1 Alternative 2D would most likely destroy unique or significant paleontological resources and would
2 constitute an adverse effect under NEPA.

3 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 2D could
4 cause the destruction of unique paleontological resources. The ground-disturbing activities
5 associated with Alternative 2D would occur in geologic units sensitive for paleontological resources
6 and could therefore have the potential to damage or destroy those resources. Direct or indirect
7 destruction of significant paleontological resources as defined by the SVP (2010) would constitute a
8 significant impact because construction of conveyance facilities could substantially affect geologic
9 formations that have potential to contain unique paleontological resources.

10 Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of
11 surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels
12 necessary for Alternative 2D would most likely destroy unique or significant paleontological
13 resources in the project area and would potentially cause a significant and unavoidable impact.

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 4.

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 4.

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 4.

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 4.

31 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**
32 **with the Implementation of Environmental Commitments 3, 4, 6-12, 15, and 16**

33 Ground-disturbing activities associated with restoration actions under Alternative 2D would result
34 in impacts that would be similar in nature to those described under Alternative 4. However, the
35 extent of these impacts would be much less than under Alternative 4 because less ground disturbing
36 activity would occur. The Environmental Commitments are described in detail in Chapter 3,
37 *Description of Alternatives*, and include natural communities protection and restoration, tidal natural
38 communities restoration, channel margin enhancement, riparian natural community restoration,
39 vernal pool and alkali seasonal wetland complex restoration, and nontidal marsh restoration. Land

1 disturbing activities would be required to implement each of the conservation and stressor
2 reduction measures.

3 **NEPA Effects:** If fossils are present in the project area, they could be damaged during excavation
4 required to implement the conservation and stressor reduction Environmental Commitments. The
5 greater the extent of excavation, the greater the potential effect, although even localized excavation
6 could damage or destroy paleontological resources. Direct or indirect destruction of vertebrate or
7 otherwise scientifically significant paleontological resources as defined by the SVP (2010) would be
8 an adverse effect.

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

12 **CEQA Conclusion:** Ground-disturbing activities associated with implementing the conservation and
13 stressor reduction Environmental Commitments under Alternative 2D could affect paleontological
14 resources. If fossils are present in the project area, they could be damaged during excavation
15 associated with these Environmental Commitments. The greater the extent of excavation, the
16 greater the potential impact, although even localized excavation could damage or destroy
17 paleontological resources. Direct or indirect destruction of significant paleontological resources as
18 defined by the SVP (2010) would constitute a significant impact because construction activities
19 could substantially affect geologic formations that have potential to contain unique paleontological
20 resources.

21 Implementation of Mitigation Measures PALEO-1b and PALEO-1d for all shallow ground-disturbing
22 Environmental Commitments and Mitigation Measures PALEO-1a through PALEO-1d for all deeper
23 ground-disturbing Environmental Commitments 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-1a 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-1a 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-1a under Impact Paleo-1 in the discussion of
 4 Alternative 4.

5 **27.3.4.4 Alternative 5A—Dual Conveyance with Modified**
 6 **Pipeline/Tunnel and Intake 2 (3,000 cfs; Operational Scenario C)**

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

9 Alternative 5A would include the same physical/structural components as Alternative 4, but would
 10 include two fewer intakes than Alternative 4. The potential for Alternative 5A to affect unique or
 11 significant paleontological resources would be similar to the impacts described for Alternative 4 but
 12 would include fewer impacts associated with constructing only Intake 2. Construction activities that
 13 could result in adverse effects on paleontological resources include excavation for a new intake, new
 14 pumping plants, new forebays, pipelines and tunnels, canals to the Jones and Banks pumping plants,
 15 an operable barrier at the head of Old River, other water facility components, roads, and borrow
 16 sites. The depth, extent, and location of excavation and other ground-disturbing activities vary
 17 greatly across the project area would be similar to the description of the extent of impacts on
 18 paleontological resources in Alternative 4 and summarized in Table 27-14, with the exception of two
 19 fewer intakes. Additionally, some offsite borrow excavation would be in the sensitive
 20 paleontological Modesto Formation and Montezuma Formation. Any new offsite borrow locations
 21 would undergo additional technical and environmental review, including that for Paleontological
 22 Resource impacts.

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

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

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

38 Excavation for a new intake, new pumping plants, new/expanded forebays, pipelines and tunnels,
 39 canals to Jones and Banks pumping plants, and other water facility components necessary for
 40 Alternative 5A would most likely destroy unique or significant paleontological resources and would
 41 constitute an adverse effect under NEPA.

1 **CEQA Conclusion:** Construction of water conveyance facilities proposed under Alternative 5A could
 2 cause the destruction of unique paleontological resources. The ground-disturbing activities
 3 associated with Alternative 5A 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 because construction of conveyance facilities could substantially affect geologic
 7 formations that have potential to contain unique paleontological resources.

8 Implementation of Mitigation Measures PALEO-1a through PALEO-1d would reduce the effects of
 9 surface-related ground disturbance to a less-than-significant level, but excavation for the tunnels
 10 necessary for Alternative 5A would most likely destroy unique or significant paleontological
 11 resources in the project area and would potentially cause 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 4.

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 4.

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 4.

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 4.

29 **Impact PALEO-2: Destruction of Unique or Significant Paleontological Resources Associated**
 30 **with the Implementation of Environmental Commitments 3, 4, 6, 7, 8–12, 15, and 16**

31 Ground-disturbing activities associated with restoration actions under Alternative 5A would result
 32 in impacts that would be similar in nature to those described under Alternative 4. However, the
 33 extent of these impacts would be much less than under Alternative 4 because less ground disturbing
 34 activity would occur. The conservation and stressor reduction Environmental Commitments are
 35 described in detail in Chapter 3, *Description of Alternatives*, and include natural communities
 36 protection and restoration, tidal natural communities restoration, channel margin enhancement,
 37 riparian natural community restoration, vernal pool and alkali seasonal wetland complex
 38 restoration, and nontidal marsh restoration. Land disturbing activities would be required to
 39 implement each of the conservation and stressor reduction measures.

1 **NEPA Effects:** If fossils are present in the project area, they could be damaged during excavation
 2 required to implement the conservation and stressor reduction Environmental Commitments. The
 3 greater the extent of excavation, the greater the potential effect, although even localized excavation
 4 could 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-1d are available to mitigate all shallow ground-
 8 disturbing Environmental Commitments. Mitigation Measures PALEO-1a through PALEO-1d would
 9 address all deeper ground-disturbing Environmental Commitments.

10 **CEQA Conclusion:** Ground-disturbing activities associated with implementing the conservation and
 11 stressor reduction Environmental Commitments under Alternative 5A could affect paleontological
 12 resources. If fossils are present in the project area, they could be damaged during excavation
 13 associated with these Environmental Commitments. The greater the extent of excavation, the
 14 greater the potential impact, although even localized excavation could damage or destroy
 15 paleontological resources. Direct or indirect destruction of significant paleontological resources as
 16 defined by the SVP (2010) would constitute a significant impact because construction activities
 17 could substantially affect geologic formations that have potential to contain unique paleontological
 18 resources.

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

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

27 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 28 Alternative 4.

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

32 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 33 Alternative 4.

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

36 Please see Mitigation Measure PALEO-1a under Impact Paleo-1 in the discussion of
 37 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-1a under Impact Paleo-1 in the discussion of
 4 Alternative 4.

5 **27.3.5 Cumulative Analysis**

6 The cumulative analysis for paleontological resources considers the effects of project
 7 implementation in combination with the potential effects of other past, present, and reasonably
 8 foreseeable projects and programs. The analysis focuses on projects and programs within the Plan
 9 Area and the broader Delta region that involve substantial ground-disturbing activities in geologic
 10 units with a high potential for containing significant paleontological resources (the Modesto, Tulare,
 11 Tehama, Montezuma, Riverbank, Neroly, and Markley Formations). The principal programs and
 12 projects considered in the analysis are listed in Table 27-16. This list has been drawn from a more
 13 substantial compilation of past, present, and reasonably foreseeable programs and projects included
 14 in Appendix 3D, *Defining Existing Conditions, No Action Alternative, No Project Alternative, and*
 15 *Cumulative Impact Conditions.*

16 **Table 27-16. Effects on Paleontological Resources from Plans, Policies, and Programs Considered**
 17 **for 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, Fresno to Merced Section	FEIR/FEIS completed on May 3, 2012. Record of Decision issued on September 18, 2012.	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

Agency	Program/Project	Status	Description of Program/Project	Effect on Paleontological Resources
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.
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	Yolo County 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
Department of Water Resources and Bureau of Reclamation	In-Delta Storage Project	Currently under study	Water storage project that would inundate Webb Tract and Bacon Island and restore Holland Tract and Bouldin Island	The project could disturb or destroy paleontological resources.
Delta Conservancy	California EcoRestore	Initiated in 2015	This program will accelerate and implement a suite of Delta restoration actions for up to 30,000 acres of fish and wildlife habitat by 2020.	Potential for effects on paleontological resources from construction of restoration actions.
Department of Water Resources	Dutch Slough Tidal Marsh Restoration Project	Currently under study	Restoration 1,178-acre site located in the South Delta to tidal marsh habitat.	The project could disturb or destroy paleontological resources.
Department of Water Resources and Suisun Marsh Preservation Agreement agencies	Miens Landing Restoration	Currently under study	Restoration of duck clubs to tidal marsh.	The project could disturb or destroy paleontological resources.
Department of Water Resources	Cache Slough Area Restoration	Currently under study	Restoration of lands within the Cache Slough Complex located in the Delta	The project could disturb or destroy paleontological resources. This project is examined as part of the BDCP alternatives and effects further described in the BDCP.

1

2 27.3.5.1 Cumulative Effects of the 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
14 ongoing projects and programs in the Delta could both singly and collectively result in adverse
15 effects on paleontological resources.

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

13 **27.3.5.2 Concurrent Project Effects**

14 Construction and operation of the water conveyance facility under the BDCP alternatives
 15 (Alternatives 1A–2C, 3, 4, 5, and 6A–9) would have an adverse impact on paleontological resources
 16 by destroying unique or significant examples of these resources during earthmoving activities.
 17 Because of the large land area that would be disturbed, the impact on paleontological resources was
 18 found to be significant under the action alternatives. Mitigation Measures PALEO-1a through 1d
 19 would reduce the impact occurring under Alternative 1A–9 but not to a less-than-significant level
 20 because disturbance cannot be avoided to complete construction of the water conveyance facilities.
 21 Operation and maintenance of the water conveyance facilities would not adversely impact
 22 paleontological resources because extensive ground disturbing activities would not be required.

23 Implementing CM2–CM4 and CM6–CM11 would adversely impact paleontological resources as a
 24 result of construction activities required to implement the restoration actions. Implementing
 25 Mitigation Measures PALEO-1a through 1d would reduce these impacts to a less than significant
 26 because construction of restoration features would primarily occur on the land surface and the
 27 proposed measures would help avoid destruction of these resources.

28 Although there would not be any new impacts other than those previously disclosed, the combined
 29 impact of constructing the water conveyance facility with implementing CM2–CM4 and CM6–CM11
 30 could increase the overall magnitude of the significant impact on paleontological resources because
 31 ground disturbing activities would occur simultaneously. Implementing Mitigation Measures MIN-6
 32 and MIN-11 would reduce these combined impacts, but not to a less-than-significant level.

33 Concurrent effects of Alternatives 4A, 2D, and 5A on paleontological resources would likely be much
 34 less than under the BDCP alternatives because restoration actions under these non-HCP alternatives
 35 (Environmental Commitments 3, 4, 6--2, 15, and 16) would be reduced compared to the BDCP
 36 alternatives.

37 **27.3.5.3 Cumulative Effects of the Action Alternatives**

38 **Impact PALEO-3: Cumulative Effect on Paleontological Resources from Construction** 39 **Activities in the Plan Area and Delta Region**

40 **NEPA Effects:** Implementation of the proposed project and other local and regional projects as
 41 presented in Table 27-16, could contribute to regional impacts on paleontological resources.
 42 Construction of the action alternatives would take place in geologic units sensitive for

1 paleontological resources, such as the Riverbank and Modesto Formations. The greater the extent of
2 excavation, the greater the potential effect, although even localized excavation could damage or
3 destroy important paleontological resources. Other past, present, and probable future projects and
4 programs in the region that are identified in Table 27-16 and Appendix 3D, *Defining Existing*
5 *Conditions, No Action Alternative, No Project Alternative, and Cumulative Impact Conditions*, have the
6 potential to destroy unique or significant paleontological resources.

7 The action alternatives involve surface excavation for both water conveyance construction and
8 restoration implementation. Additionally, Alternatives 1A-8, including Alternatives 4A, 2D and 5A,
9 would entail subsurface tunneling in geologic units sensitive for paleontological resources. Although
10 Alternatives 4A, 2D, and 5A would result in fewer acres converted for habitat restoration purposes,
11 they would still include extensive subsurface excavation and when combined with other projects
12 would also be considered adverse. Excavation into sensitive geologic units—extensive grading,
13 trenching, structure foundation excavation, levee construction, and dredging—in combination with
14 other projects listed in Table 27-16 that require similar surface excavation in sensitive geologic
15 units, in addition to tunneling, which would disturb a large volume of sensitive Pleistocene deposits
16 that may contain sensitive resources would create an adverse cumulative effect on paleontological
17 resources.

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

23 The subsurface effect caused by Alternatives 1A-8 cannot be mitigated because the technology used
24 to bore the tunnels does not allow access for monitoring or recovery, even if fossils are present in
25 the boring cuttings. Mitigation Measures PALEO-1a through PALEO-1d, which include monitoring,
26 identification, and recovery of paleontological resources during ground-disturbing activities, are
27 available to address the effect resulting from surface excavation.

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

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

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

39 Alternatives 1A-8 involve both surface excavation and tunneling. While surface excavation has been
40 shown to have a less-than-significant impact with implementation of Mitigation Measures PALEO-1a
41 through PALEO-1d, tunneling has been shown to have a significant and unavoidable impact on
42 sensitive paleontological resources. Alternatives 1A-8 would entail subsurface tunneling in geologic
43 units sensitive for paleontological resources. Combined with other past, present and probable future

1 projects and programs in the Plan Area, the impacts of Alternatives 1A-8 would be cumulatively
 2 significant. Since none of the projects identified in Table 27-16 involves tunneling, the incremental
 3 impact from Alternatives 1A-8 is cumulatively considerable and cannot be mitigated.

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

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

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

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

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

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

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

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

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

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