

4.3.6 Soils

Impact SOILS-1: Accelerated Erosion Caused by Vegetation Removal and Other Soil Disturbances as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 4A would include the same physical/structural components as Alternative 4. These locations would be where soils have similar erosion hazards and would not substantially change the project effects on water soil erosion. The effects of Alternative 4A would, therefore, be the same as under Alternative 4. See the discussion of Impact SOILS-1 under Alternative 4.

NEPA Effects: Construction of the proposed water conveyance facility under Alternative 4A could cause substantial accelerated erosion. However, as described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, DWR would be required to obtain coverage under the General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper implementation of the requisite SWPPP and compliance with the General Permit (as discussed in Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS) would ensure that there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs as a result of construction of the proposed water conveyance facility, and therefore, there would not be an adverse effect.

Additionally, implementation of the environmental commitment Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material would help reduce wind blowing of excavated soils, particularly peat soils, during transport and placement at spoils storage, disposal, and reuse areas.

CEQA Conclusion: Vegetation removal and other soil disturbances associated with construction of water conveyance facilities could cause accelerated water and wind erosion of soil. However, DWR would seek coverage under the state General Permit for Construction and Land Disturbance Activities, necessitating the preparation of a SWPPP and an erosion control plan. As a result of implementation of the requisite SWPPP, and compliance with the General Permit, there would not be substantial soil erosion resulting in daily site runoff turbidity in excess of 250 NTUs the effect would be less than significant. No mitigation is required.

Impact SOILS-2: Loss of Topsoil from Excavation, Overcovering and Inundation as a Result of Constructing the Proposed Water Conveyance Facilities

Alternative 4A would include the same physical/structural components as Alternative 4 and construction would be the same as under Alternative 4. Therefore, the effects on topsoil under Alternative 4A would be the same as Alternative 4. See the discussion of Impact SOILS-2 under Alternative 4.

NEPA Effects: Topsoil effectively would be lost as a resource as a result of its excavation (e.g., forebays, borrow areas, tunnel shafts, levee foundations, intake facilities, pumping plants); overcovering (e.g., levees and embankments, spoil storage, pumping plants); and water inundation (e.g., forebays, sedimentation basins, and solids lagoons). DWR has made an Environmental Commitment for Disposal Site Preparation which would require that a portion of the temporary sites selected for storage of spoils, RTM and dredged material will be set aside for topsoil storage and the topsoil would be saved for reapplication to disturbed areas, thereby lessening the effect.

1 However, this effect would be adverse because it would result in a substantial loss of topsoil.
2 Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of this effect.

3 **CEQA Conclusion:** Construction of the water conveyance facilities would involve excavation,
4 overcovering, and inundation of topsoil over extensive areas, thereby resulting in a substantial loss
5 of topsoil despite a commitment for Disposal Site Preparation. The impact on soils in the Plan Area
6 would be significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate
7 for these impacts, but not to a less-than-significant level because topsoil would be permanently lost
8 over extensive areas. Therefore, this impact is considered significant and unavoidable.

9 **Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance**

10 Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4.

11 **Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a**
12 **Topsoil Storage and Handling Plan**

13 Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4.

14 **Impact SOILS-3: Property Loss, Personal Injury, or Death from Instability, Failure, and**
15 **Damage from Construction on or in Soils Subject to Subsidence as a Result of Constructing the**
16 **Proposed Water Conveyance Facilities**

17 Alternative 4A would include the same physical/structural components as Alternative 4 and
18 therefore the effects from potential soil subsidence under Alternative 4A would be the same as
19 Alternative 4. See the discussion of Impact SOILS-3 under Alternative 4.

20 **NEPA Effects:** This potential effect could be substantial because the facilities could be located on
21 unstable soils that are subject to subsidence. However, as described in Section 10.3.1, *Methods for*
22 *Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments*, in Appendix A of this
23 RDEIR/SDEIS, geotechnical studies (as described in the Geotechnical Exploration Plan—Phase 2
24 [California Department of Water Resources 2014]) would be conducted at all facilities to identify the
25 types of soil avoidance or soil stabilization measures that should be implemented to ensure that the
26 facilities are constructed to withstand subsidence and settlement and to conform to applicable state
27 and federal standards. These investigations would build upon the geotechnical data reports
28 (California Department of Water Resources 2001a, 2010b, 2011) and the CERs (California
29 Department of Water Resources 2010a, 2010b). As discussed under Alternative 4, conforming to
30 state and federal design standards, including conduct of site-specific geotechnical evaluations,
31 would ensure that appropriate design measures are incorporated into the project and any
32 subsidence that takes place under the project facilities would not jeopardize their integrity.
33 Therefore, there would not be an adverse effect.

34 **CEQA Conclusion:** Some of the conveyance facilities would be constructed on soils that are subject
35 to subsidence. Subsidence occurring after the facility is constructed could result in damage to or
36 failure of the facility. However, DWR would be required to design and construct the facilities
37 according to state and federal design standards and guidelines (e.g., California Building Code,
38 American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures,
39 ASCE-7-10, 2010) (see Appendix 3B, *Environmental Commitments*, in Appendix A of this
40 RDEIR/SDEIS). Conforming to these codes would reduce the potential hazard of subsidence or
41 settlement to acceptable levels by avoiding construction directly on or otherwise stabilizing the soil

1 material that is prone to subsidence. Because these measures would reduce the potential hazard of
2 subsidence or settlement to meet design standards, the impact would be less than significant. No
3 mitigation is required.

4 **Impact SOILS-4: Risk to Life and Property as a Result of Constructing the Proposed Water**
5 **Conveyance Facilities in Areas of Expansive, Corrosive, and Compressible Soils**

6 Alternative 4A would include the same physical/structural components as Alternative 4 and
7 therefore the effects related to expansive, corrosive, and compressible soils under Alternative 4A
8 would be the same as Alternative 4. See the discussion of Impact SOILS-4 under Alternative 4.

9 **NEPA Effects:** The integrity of the water conveyance facilities, including tunnels, pipelines, intake
10 facilities, pumping plants, access roads and utilities, and other features could be adversely affected
11 because they would be located on expansive, corrosive, and compressible soils. However, all facility
12 design and construction would be executed in conformance with the CBC which specifies measures
13 to mitigate effects of expansive soils, corrosive soils, and soils subject to compression and
14 subsidence. By conforming to the CBC and other applicable design standards, potential effects
15 associated with expansive and corrosive soils and soils subject to compression and subsidence
16 would be offset (see Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS).
17 There would be no adverse effect.

18 **CEQA Conclusion:** Some of the project facilities would be constructed on soils that are subject to
19 expansion, corrosion to concrete and uncoated steel, and compression under load. Expansive soils
20 could cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils
21 could damage in-ground facilities or shorten their service life. Compression/settlement of soils after
22 a facility is constructed could result in damage to or failure of the facility. However, because DWR
23 would be required to design and construct the facilities in conformance with state and federal
24 design standards, guidelines, and building codes (e.g., CBC and USACE design standards).
25 Conforming to these codes and standards is an environmental commitment by DWR to ensure that
26 potential adverse effects associated with expansive and corrosive soils and soils subject to
27 compression and subsidence would be offset (see Appendix 3B, *Environmental Commitments*, in
28 Appendix A of this RDEIR/SDEIS). Therefore, this impact would be less than significant. No
29 mitigation is required.

30 **Impact SOILS-5: Accelerated Bank Erosion from Increased Channel Flow Rates as a Result of**
31 **Operations**

32 Alternative 4A have operations similar to those under Alternative 4 and therefore the potential
33 effects on accelerated bank erosion because the flow from the north Delta under Alternative 4A
34 would be the same as Alternative 4. See the discussion of Impact SOILS-5 under Alternative 4.

35 **NEPA Effects:** The effect of increased channel flow rates on channel bank scour would not be
36 adverse because, as described in Section 3.6.2, *Conservation Components*, of Appendix A of this
37 RDEIR/SDEIS, as part of the Environmental Commitment 4, major channels could be dredged to
38 create a larger cross-section that would offset increased tidal velocities. The effect would not be
39 adverse because there would be no net increase in river flow rates and therefore no net increase in
40 channel bank scour.

41 **CEQA Conclusion:** Changes in operational flow regimes could cause increases in flow rates in
42 channels and sloughs, potentially leading to increases in channel bank scour. However, where such

1 changes are expected to occur (i.e., at the mouths of tidal marsh channels), the project would also
2 entail expansion of the channel cross-section to increase the tidal prism at these locations as
3 described in Section 3.6.2, *Conservation Components*, of Appendix A of this RDEIR/SDEIS. The net
4 effect would be to reduce the channel flow rates by 10–20% compared to Existing
5 Conditions. Consequently, no appreciable increase in scour is anticipated. The impact would be less
6 than significant. No mitigation is required.

7 **Impact SOILS-6: Accelerated Erosion Caused by Clearing, Grubbing, Grading, and Other**
8 **Disturbances Associated with Implementation of Proposed Environmental Commitments 3, 4,**
9 **6-11**

10 Effects under Alternative 4A on accelerated erosion would be similar in mechanism to those
11 described for Alternative 4, but to a substantially lesser magnitude based on the Environmental
12 Commitments proposed under Alternative 4A (and as described in Section 4.1.2, *Description of*
13 *Alternative 4A*, in this RDEIR/SDEIS). See the discussion of Impact SOILS-6 under Alternative 4.

14 Implementation of some of the Environmental Commitments would involve ground disturbance and
15 construction activities that could lead to accelerated soil erosion rates and consequent loss of
16 topsoil. Implementation of Environmental Commitments 3, 4, and 6–11 could involve breaching,
17 modification or removal of existing levees and construction of new levees and embankments. Levee
18 modifications, including levee breaching or lowering, may be performed to reintroduce tidal
19 exchange, reconnect remnant sloughs, restore natural remnant meandering tidal channels,
20 encourage development of dendritic channel networks, and improve floodwater conveyance. Some
21 of the environmental commitments would also require constructing setback levees and cross levees
22 or berms; raising the land elevation by excavating relatively high areas to provide fill for subsided
23 areas or by importing fill material; surface grading; deepening and/or widening tidal channels;
24 excavating new channels; modifying channel banks; and other activities. These activities could lead
25 to accelerated soil erosion rates and consequent loss of topsoil.

26 Construction of conservation hatcheries and implementation of urban stormwater treatment are not
27 part of Alternative 4A.

28 **NEPA Effects:** These effects could potentially cause substantial accelerated erosion. However, as
29 described in Section 10.3.1, *Methods for Analysis*, of the Draft EIR/EIS, and Appendix 3B,
30 *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, the project proponents would be
31 required to obtain coverage under the General Permit for Construction and Land Disturbance
32 Activities, necessitating the preparation of a SWPPP and an erosion control plan. Proper
33 implementation of the requisite SWPPP, site-specific BMPs, and compliance with the General Permit
34 would ensure that accelerated water and wind erosion as a result of implementing conservation
35 measures would not be an adverse effect.

36 **CEQA Conclusion:** Vegetation removal and other soil disturbances associated with construction of
37 restoration areas could cause accelerated water and wind erosion of soil. However, the project
38 proponents would seek coverage under the state General Permit for Construction and Land
39 Disturbance Activities (see Appendix 3B, *Environmental Commitments*, in Appendix A of this
40 RDEIR/SDEIS). Permit conditions would include erosion and sediment control BMPs (such as
41 revegetation, runoff control, and sediment barriers) and compliance with water quality standards.
42 As a result of implementation of permit conditions, the impact would be less than significant. No
43 mitigation is required.

1 **Impact SOILS-7: Loss of Topsoil from Excavation, Overcovering and Inundation Associated**
2 **with Restoration Activities as a Result of Implementing the Proposed Environmental**
3 **Commitments 3–4, 6–11**

4 Effects from implementation of Environmental Commitments under Alternative 4A on loss of topsoil
5 would be similar in mechanism to those described for Alternative 4, but to a substantially lesser
6 magnitude based on the smaller acreages of restoration proposed by the Environmental
7 Commitments under Alternative 4A (and as described in Section 4.1.2, *Description of Alternative 4A*,
8 of this RDEIR/SDEIS). See the discussion of Impact SOILS-7 under Alternative 4.

9 **NEPA Effects:** Topsoil effectively would be lost as a resource as a result of its excavation (e.g., levee
10 foundations, water control structures); overcovering (e.g., levees, embankments, application of fill
11 material in subsided areas); and water inundation (e.g., aquatic habitat areas) over areas of the Plan
12 Area. Based on ICF’s calculations using a geographic information system, implementation of habitat
13 restoration activities at the ROAs would result in excavation, overcovering, or inundation of a
14 minimum of 1,176 acres of topsoil. This effect would be adverse because it would result in a
15 substantial loss of topsoil. Mitigation Measures SOILS-2a and SOILS-2b would reduce the severity of
16 this effect.

17 **CEQA Conclusion:** Significant impacts could occur if there is loss of topsoil from excavation,
18 overcovering, and inundation associated with restoration activities as a result of implementing the
19 proposed Environmental Commitments. Implementation of the Environmental Commitments would
20 involve excavation, overcovering, and inundation (to create aquatic habitat areas) of topsoil over
21 extensive areas, thereby resulting in a substantial loss of topsoil. Therefore, the impact would be
22 significant. Mitigation Measures SOILS-2a and SOILS-2b would minimize and compensate for these
23 impacts to a degree by minimizing topsoil loss, but not to a less-than-significant level because
24 topsoil would still be permanently lost over extensive areas. Therefore, this impact is considered
25 significant and unavoidable.

26 **Mitigation Measure SOILS-2a: Minimize Extent of Excavation and Soil Disturbance**

27 Please see Mitigation Measure SOILS-2a under Impact SOILS-2 in the discussion of Alternative 4

28 **Mitigation Measure SOILS-2b: Salvage, Stockpile, and Replace Topsoil and Prepare a**
29 **Topsoil Storage and Handling Plan**

30 Please see Mitigation Measure SOILS-2b under Impact SOILS-2 in the discussion of Alternative 4

31 **Impact SOILS-8: Property Loss, Personal Injury, or Death from Instability, Failure, and**
32 **Damage from Construction on Soils Subject to Subsidence as a Result of Implementing the**
33 **Proposed Environmental Commitments 3, 4, 6–11**

34 Effects from implementation of Environmental Commitments under Alternative 4A related to
35 subsidence would be similar in mechanism to those described for Alternative 4, but to a
36 substantially lesser magnitude based on the Environmental Commitments proposed under
37 Alternative 4A (and as described in Section 4.1.2, *Description of Alternative 4A*, in RDEIR/SDEIS).
38 Damage to or failure of the habitat levees could occur where these are constructed in soils and
39 sediments that are subject to subsidence and differential settlement. These soil conditions have the
40 potential to exist in the Suisun Marsh ROA Levee damage or failure could cause surface flooding in
41 the vicinity. See the discussion of Impact SOILS-8 under Alternative 4.

1 **NEPA Effects:** This potential effect could be substantial because the facilities could be located on
2 unstable soils that are subject to subsidence. However, as described in Section 10.3.1, *Methods for*
3 *Analysis*, of the Draft EIR/EIS, and Appendix 3B, *Environmental Commitments*, in Appendix A of this
4 RDEIR/SDEIS, geotechnical studies would be conducted at all the ROAs to identify the types of soil
5 stabilization that should be implemented to ensure that levees, berms, and other features are
6 constructed to withstand subsidence and settlement and to conform to applicable state and federal
7 standards.

8 With construction of all levees, berms, and other conservation features designed and constructed to
9 withstand subsidence and settlement and through conformance with applicable state and federal
10 design standards, this effect would not be adverse.

11 **CEQA Conclusion:** Some of the restoration area facilities would be constructed on soils that are
12 subject to subsidence. Subsidence occurring after the facility is constructed could result in damage
13 to or failure of the facility. However, because the project proponents would be required to design
14 and construct the facilities according to state and federal design standards and guidelines (which
15 may involve, for example, replacement of the organic soil), the impact would be less than significant.
16 No mitigation is required.

17 **Impact SOILS-9: Risk to Life and Property from Construction in Areas of Expansive, Corrosive,**
18 **and Compressible Soils as a Result of Implementing the Proposed Environmental**
19 **Commitments 3, 4, 6-11**

20 Effects from implementation of Environmental Commitments under Alternative 4A in areas of
21 expansive, corrosive, or compressible soils would be similar in mechanism to those described for
22 Alternative 4, but to a substantially lesser magnitude based on the environmental commitments
23 proposed under Alternative 4A (and as described in Section 4.1, *Introduction*, of this RDEIR/SDEIS).
24 See the discussion of Impact SOILS-9 under Alternative 1A.

25 Seasonal shrinking and swelling of moderately or highly expansive soils could damage water control
26 structures or cause them to fail, resulting in a release of water from the structure and consequent
27 flooding, which would cause unplanned inundation of aquatic habitat areas. Soils in all the ROAs
28 possess high potential for corrosion of uncoated steel, and the Suisun ROA and portions of the West
29 Delta ROA possess soils with high corrosivity to concrete.

30 Highly compressible soils are in the Cache Slough, Yolo Bypass Cosumnes/Mokelumne, and South
31 Delta ROAs.

32 **NEPA Effects:** The Environmental Commitments could be located on expansive, corrosive, and
33 compressible soils. However, ROA-specific geotechnical studies and testing would be completed
34 prior to construction within the ROAs. The site-specific studies and testing would identify specific
35 areas where engineering soil properties, including soil compressibility, may require special
36 consideration during construction of specific features within ROAs (see Appendix 3B, *Environmental*
37 *Commitments*, in Appendix A of this RDEIR/SDEIS). Conformity with USACE, CBC, and other design
38 standards for construction on expansive, corrosive and/or compressible soils described in detail in
39 Chapter 10, *Soils*, in the Draft EIR/EIS, would prevent adverse effects of such soils.

40 **CEQA Conclusion:** Some of the restoration facilities would be constructed on soils that are subject to
41 expansion, corrosive to concrete and uncoated steel, and compress under load. Expansive soils could
42 cause foundations, underground utilities, and pavements to crack and fail. Corrosive soils could

1 damage in-ground facilities or shorten their service life. Compression or settlement of soils after a
2 facility is constructed could result in damage to or failure of the facility. However, as outlined in
3 Appendix 3B, *Environmental Commitments*, in Appendix A of this RDEIR/SDEIS, because the project
4 proponents would be required to design and construct the facilities according to state and federal
5 design standards, guidelines, and building codes (which may involve, for example, soil lime
6 stabilization, cathodic protection of steel, and soil replacement), this impact would be considered
7 less than significant. No mitigation is required.

