Chapter 25

Public Health

25.1 Environmental Setting/Affected Environment

25.1.1 Potential Environmental Effects Area

25.1.1.1 Drinking Water

Constituents of Concern

Trace Metals

Trace metals occur naturally in the environment, and can be toxic to human and aquatic life in high concentrations. Trace metals include aluminum, arsenic, cadmium, copper, iron, lead, nickel, silver, and zinc. The beneficial uses of Delta waters most affected by trace metal concentrations include aquatic life uses (cold freshwater habitat, warm freshwater habitat, and estuarine habitat), harvesting activities that depend on aquatic life (shellfish harvesting, commercial and sport fishing), and drinking water supplies (municipal and domestic supply) (See Table 8-1 in Chapter 8, *Water Quality*).

25.1.1.3 Pathogens

The Delta is commonly used for various recreational activities such as boating, swimming, and fishing. Because the waterways within the Delta have the potential to contain common pathogens (disease-causing micro-organisms), direct contact or ingestion can affect human health. Pathogens of concern include bacteria, such as *Escherichia coli* (*E. coli*) and *Campylobacter*; viruses, such as hepatitis and rotavirus; and protozoa, such as *Giardia* and *Cryptosporidium*. Sampling for bacterial and viral pathogens involves collection of data for fecal indicators, such as total coliform or fecal coliform.

Overview

Sources of pathogens include wild and domestic animals, aquatic species, urban stormwater runoff, discharge from wastewater treatment plants, and agricultural point and nonpoint sources such as confined feeding lots. Pathogens that have animal hosts can be transported from the watershed to source waters from grazed lands and cattle operations; aquatic species such as waterfowl also contribute pathogens directly to water bodies. Stormwater runoff from urban or rural areas can contain pathogens carried in waste from domestic pets, birds, or rodents, as well as sewage spills. Although some pathogens have the ability to colonize within sediments, current research has not addressed this behavior in the Central Valley (Tetra Tech 2007), so information regarding effects of colonization within sediments is limited. Furthermore, sediment disturbance would be limited to localized areas under the alternatives since, based on the pathogen conceptual model (discussed in Section 25.3.1.2, *Pathogens and Water Quality*), pathogen concentrations experience a rapid die-off the farther they travel from their source; thus, this issue is not discussed further.

Pathogen transport into Delta waterways can be expected to be higher during initial wet weather events, since they are carried by stormwater and agricultural runoff into the study area (as was observed with fecal coliform indicators by Tetra Tech (2007). ~~Although transport rates are initially increased during wet weather events, the increased availability of water to the Delta helps to reduce pathogen viability during these instances.~~ Other sources of pathogens include wetland and inundated restoration areas due to increased biological activity associated with these habitats (e.g., birds and fish species).

~~In most instances, pathogens in drinking water sources are removed by filtration or bio-membranes, or are destroyed by disinfection. Infections in humans may arise from pathogens that break through standard treatment processes implemented at drinking water sources.~~ Humans can be exposed to and infected by certain pathogens (e.g., *E. coli*) in contaminated rivers, lakes, and coastal waters while participating in recreational activities including swimming, water skiing, surfing, and boating. Waterborne pathogenic microbes are capable of causing illness in people in a dose-dependent way and depending on the physical condition of the individual(s) exposed. Exposure to waterborne pathogens does not always result in infection, and infection with a pathogen does not always result in clinical illness (Pond 2005).~~Infection in humans may also result from food ingestion or the ingestion of untreated water during recreation.~~

Although there are many potential pathogens that enter Delta waterways, the presence of pathogens identified in Table 25-~~3~~3 is tested by wastewater treatment service districts, public drinking water service districts, and other public agencies as needed (e.g., Department of Public Health).

Table 25-3. Pathogens

Pathogen	Description and Source	Method of Transmittal	Public Health Concern
Escherichia coli	Anaerobic bacterium that lives in the gastrointestinal tract of warm-blooded animals	Fecal contamination by human waste, wastewater, or animal wastes	Generates toxicants that can result in diarrhea, inflammation, fever, and bacillary dysentery. Certain strains of *E. coli* can be severely toxic to some patients, particularly children, causing destruction of red blood cells and occasional kidney failure (Tetra Tech 2007)
Campylobacter	Present in the gastrointestinal tract of cattle, pigs, and poultry	Natural waters	Causes bacterial gastroenteritis. In rare cases, Campylobacter infection may be followed by Guillain-Barre Syndrome, a form of neuromuscular paralysis
Hepatitis	Viruses such as Hepatitis A and E	Fecal-oral route and via contaminated food and water	Causes liver inflammation
Rotavirus	Virus	Fecal-oral route and via contaminated food and water	Causes diarrhea
Giardia	Parasite found in the intestinal linings of a wide range of animals and their feces, and in contaminated water	Wastewater	Causes diarrhea and abdominal pain
Cryptosporidium	Single-celled, intestinal parasites that infect humans and a variety of animals	Wastewater	Diarrhea, stomach cramps, upset stomach, and slight fever; more serious symptoms can result in weakened immune systems (U.S. Environmental Protection Agency 1999). Major cause of gastrointestinal illness

Water Treatment

EPA's Surface Water Treatment Rules (SWTR [discussed in detail in Section 25.2.2.5]) require that public water systems using surface water or groundwater under the direct influence of surface water (1) disinfect water to destroy pathogens, and (2) either meet criteria for avoiding filtration or filter water to remove pathogens so that the contaminants are controlled at the following levels (U.S. Environmental Protection Agency 2013).

- Total Coliform: No more than 5.0% of samples for total coliform are positive in a month (for water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month). Every sample that is positive for total coliform must be analyzed for either fecal coliform or *E. coli*. If two consecutive total coliform-positive samples occur, and one is also positive for *E. coli*/fecal coliform, the system is deemed as having an acute maximum contaminant level (MCL) violation.

- Viruses: 99.99% removal/inactivation.
- *Giardia lamblia*: 99.9% removal/inactivation.
- *Cryptosporidium*: 99% removal.

Water treatment processes that are focused on the removal of particulates, such as filtration and bio-membranes, are generally effective at removing pathogens. Disinfection of bacteria pathogens can be achieved effectively through either chemical oxidation using chlorine or ozone, or through exposure to ultraviolet light. Viruses can also be removed effectively through chlorine or ozone oxidation. The treatment of protozoa is more challenging, as cysts and oocysts of protozoa cannot be fully removed by sand filtration and are resistant to chemical disinfection; however, disinfection using ultraviolet light and ozonation has been found to be effective (Tetra Tech 2007).

Study Area

There are numerous potential sources of pathogens in the study area, including urban runoff, wastewater treatment discharges, agricultural discharges, and wetlands (Tetra Tech 2007). Specifically, tidal wetlands are known to be sources of coliforms originating from aquatic, terrestrial, and avian wildlife that inhabit these areas (Desmarais et al. 2001; Grant et al. 2001; Evanson and Ambrose 2006; Tetra Tech 2007).

Although this chapter represents an effort to fully disclose existing conditions of pathogens in the study area, the variable nature of pathogen and indicator concentrations in surface waters, and the rapid die-off of many of these organisms in the ambient environment, makes it very difficult to quantify the importance of different sources on a scale as large as the Central Valley, especially for coliforms that are widely present in water under a variety of conditions. A single source in proximity to the sampling location can dominate the coliform concentrations observed at a location downstream of several thousand square miles of watershed.

Of the known sources that deposit coliforms into the waters of the Central Valley, it was found that wastewater total coliform concentrations for most plants were low (less than 1,000 most probable number [MPN]/100 milliliters [ml]), whereas the highest total coliform concentrations in water (greater than 10,000 MPN/100 ml) were observed near samples influenced by urban areas (Tetra Tech 2007). In the San Joaquin Valley, comparably high concentrations of *E. coli* were observed for waters affected by urban areas and intensive agriculture (Tetra Tech 2007). Fecal indicator data showed minimal relationships with flow rates, although most of the high concentrations were observed during the wet months of the years, possibly indicating the contribution of stormwater runoff (Tetra Tech 2007).

Data for *Cryptosporidium* and *Giardia* along the Sacramento River showed that these parameters were often not detected, and when detected the concentrations were generally low, typically less than one organism per liter (Tetra Tech 2007). The incidence of these pathogens could be caused by the presence of natural or artificial barriers that limit transport to water and by the significant die-off of oocysts that do reach the water, as well as by limitations in the analytical detection of *Cryptosporidium* oocysts in natural waters (Tetra Tech 2007).

There was limited pathogen data at the locations examined, as indicated by Tetra Tech (2007). Where data were collected, these parameters were often not detected. However, when they were detected, the concentrations were typically less than one organism per liter. Pathogen concentrations are highly variable in time and space; monitoring programs that adequately address these constraints are very limited.

Pathogens are listed on the Section 303(d) list for the Stockton Deep Water Ship Channel (SDWSC), with sources including recreational and tourism activities (non-boating) and urban runoff/storm sewers. The Basin Plan addresses this on the basis of water contact recreation such that fecal coliform (minimum 5 samples in any 30-day period) shall not exceed a geometric mean of 200 organisms/100 ml, nor shall more than 10% of the total number of samples taken during any 30-day period exceed 400 organisms/100 ml. These criteria have been exceeded at several of the water quality sampling locations in the Delta (Tetra Tech 2007). The Basin Plan water quality objectives for pathogens are detailed in Appendix 8A of Chapter 8, *Water Quality*.~~It was determined in the report by Tetra Tech (2007) that the data are inadequate to assess if the sites examined exceeded these standards. California drinking water MCLs do not exist for pathogens.~~

25.1.1.4 *Microcystis*

Microcystis aeruginosa (*Microcystis*) is a species of cyanobacteria or blue-green algae that produces the cyanotoxin microcystin. Microcystin is a liver toxin and is the most widespread of the cyanotoxins. *Microcystis* is a photosynthetic bacterium which is naturally occurring in lakes, streams, ponds, and other surface waters. Because *Microcystis* is commonly found in surface water, microcystin is of relevance to drinking water supplies and recreational waters, and therefore to public health. In addition to producing surface scums that interfere with recreation and cause aesthetic problems, microcystin also produces taste and odor compounds.

Overview

There are at least 80 known microcystins, including microcystin-LR, which is generally considered one of the most toxic (U.S. Environmental Protection Agency 2012c). Microcystin-LR is the most widely studied congener of the known microcystins, and it has been associated with most incidents of toxicity involving microcystins. *Microcystis* blooms can cause toxicity to phytoplankton, zooplankton, and fish, and also can affect feeding success or food quality for zooplankton and fish. Although cyanotoxins break down slowly over time in full sunlight, they are very stable and can withstand boiling, indicating that cooking is not sufficient to destroy the toxins (California Environmental Protection Agency 2009). There are many reports of a variety of health effects in addition to liver damage(e.g., diarrhea, vomiting, blistering at the mouth, headache) following human exposure to blue-green algae toxins (cyanobacteria) in drinking water or from swimming in water in which are present. Such effects can occur within minutes to days following exposure to cyanotoxins (World Health Organization 2003). However, there are no reported cases of human deaths occurring from microcystin ingestion (California Environmental Protection Agency 2009).

Water treatment can effectively remove cyanotoxins in drinking water supplies. However, some treatment options are effective for some cyanotoxins, but not for others (U.S. Environmental Protection Agency 2012~~d~~c). Thus, operators of drinking water treatment systems must remain informed about the growth patterns and species of blue-green algae blooming in their surface water supplies to determine appropriate treatment or actions, and monitor treated water for cyanotoxins.

Blooms of *Microcystis* require high levels of nutrients and low turbidity, but also require sufficiently high water temperature (i.e., above 19°C) and long hydraulic residence time (low flow), since the species is fairly slow growing (Lehman et al. 2008; Lehman et al. 2013). In addition, low vertical mixing associated with long hydraulic residence time allows *Microcystis* colonies to float to the surface of the water column, where they out compete other species for light.

The World Health Organization released a provisional drinking water guideline for microcystin-LR in 1998. The guideline value for drinking water for microcystin-LR is 1.0 micrograms per liter (µg/L), which is an advisory value developed to protect against adverse liver effects associated with human consumption of this toxin. For recreational waters, the World Health Organization has issued multiple guidance values for the relative probability of acute health effects due to recreational exposure to cyanobacteria and microcystins because of the variety of possible exposures routes via recreational activities (e.g., direct contact, ingestion, and inhalation) (Table 25-4). No federal regulatory guidelines for cyanobacteria or their toxins in drinking water or recreational waters exist at this time in the United States. Guidance values for microcystin and other cyanotoxins in drinking water have been adopted by three states (Minnesota, Ohio, and Oregon) and guidance values for recreational water have been adopted by 20 states, including California (U.S. Environmental Protection Agency 2014). The advisory value for microcystin for recreational waters in California is 0.8 µg/L.

Table 25-4. World Health Organization Guidance Values for the Relative Probability of Acute Health Effects During Recreational Exposure to Cyanobacteria and Microcystins

Relative Probability of Acute Health Effects	Cyanobacteria (cells/ml)	Microcystin-LR (µg/L)
Low	< 20,000	< 10
Moderate	20,000 – 100,000	10 – 20
High	100,000 – 10,000,000	20 – 2,000
Very High	> 10,000,000	> 2,000

Source: U.S. Environmental Protection Agency 2014
Notes: cells/ml = cells per milliliter; µg/L = micrograms per liter.

Study Area

Like other types of algae, under favorable conditions *Microcystis* can multiply rapidly in surface water and cause algal "blooms" (U.S. Environmental Protection Agency 2012c). As described in Chapter 8, *Water* Quality, water temperatures greater than 19°C, low water velocities, and high water clarity are conditions necessary for *Microcystis* levels to reach bloom-forming scale (Paerl 1988; Lehman et al. 2008; Lehman et al. 2013). Water temperature is considered the primary factor that restricts bloom development to the months of June through September (Lehman et al. 2013).

Sufficiently high water temperature (i.e., 19°C), low flow and thus sufficiently long hydraulic residence time, and increased clarity enable bloom formation, which occurs in the San Joaquin River, Old River, and Middle River earlier than other areas of the Delta. Blooms of *Microcystis* have been observed from June to November throughout the freshwater Delta since 1999 (Lehman et al. 2005, 2008), with peaks in abundance in September (Acuña et al. 2012). Lehman and coauthors (2010) found abundance greatest in the western and central Delta, with the highest densities near Old River at Rancho Del Rio and the San Joaquin River at Antioch. The Delta's shallow, submerged islands sustain high levels of *Microcystis* during the growing season because the physical drivers of bloom formation are amplified in these areas due to low flushing rates (Lehman et al. 2008). Although elevated pH is tolerated by *Microcystis*, pH is not currently thought to be a primary driver of seasonal and interannual variation in bloom formation (Lehman et al. 2013). Similarly, nutrient concentrations/ratios for constituents such as nitrogen and phosphorus do not appear to control seasonal or interannual variation in bloom formation.

As discussed in Chapter 8, *Water* Quality, issues related to *Microcystis* blooms upstream of the Delta have only occurred in highly eutrophic lakes, such as Clear Lake, because most upstream reservoirs have relatively low nutrient levels. Hydrodynamic conditions of upstream rivers and watersheds are not conducive to *Microcystis* bloom formation. Problematic *Microcystis* blooms have not occurred in the Export Service Areas, but microcystins produced in waters of the Delta have been exported from Banks and Jones pumping plants to the SWP and CVP (Sanitary Survey Update 2011).

~~25.1.1.4~~25.1.1.5 Vectors

The vector of most concern in the study area is the mosquito because it is considered a nuisance to the public through irritating bites and can transmit various diseases, including the West Nile virus (WNV), to birds and humans. Recently, two invasive species of mosquitoes that can potentially transmit dengue[1] and chikungunya[2] viruses have been detected in Madera, Fresno, San Diego, San Mateo, Kern, and Tulare counties (*Aedes aegypti*), and in Los Angeles County (*Aedes albopictus* and *Aedes aegypti*) (California Department of Public Health 2014c). *Aedes albopictus* (Asian tiger mosquito) and *Aedes aegypti* (yellow fever mosquito). Currently, the risk of local dengue or chikungunya transmission is low, and there have been no reported cases of either of these diseases that have been acquired in California. Therefore, these mosquito species and diseases are not discussed further.

The focus of this section is on public nuisances associated with mosquito-borne diseases transmitted to humans. This section provides a description of the habitat and life history of mosquito species that exist in the study area.

Overview

Different cropping and land use patterns create differing amounts of suitable mosquito breeding habitat, which affect mosquito prevalence in the study area. Currently, the Delta consists primarily of agricultural lands and tidal, riparian and other water-related habitat that can provide suitable habitat for mosquitoes to breed and multiply. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over water bodies disrupts the ability of larvae to penetrate the water surface, and because vegetation necessary for egg laying and larvae survival is lacking (U.S. Fish and Wildlife Service 1992). Tidally influenced marshes that lack sufficient tidal flow can provide suitable breeding habitat for mosquitoes (Kramer et al. 1992, 1995). The optimal conditions for mosquitoes to carry out their complete growth and reproduction cycles can be found in areas of standing water with non-stagnant pond surface water, such as ponds subject to daily tide

[1] Dengue is a mosquito-borne infection transmitted principally by the yellow fever mosquito and secondarily by the Asian tiger mosquito. With the exception of parts of Mexico, Puerto Rico, and small areas in southern Texas and southern Florida, dengue transmission does not occur in North America. Dengue virus cannot be transmitted from person to person (California Department of Public Health 2014a).
[2] Chikungunya is a viral disease transmitted by the yellow fever mosquito and the Asian tiger mosquito. In California, chikungunya infections have been documented only in people who acquired the virus while travelling outside the United States; Chikungunya is not a contagious disease (California Department of Public Health 2014b).

flushes or wind-driven wave action. The majority of mosquitoes lay eggs on the surface of fresh or stagnant water. The water may be in various stagnant water locations, such as tin cans, barrels, horse troughs, ornamental ponds, swimming pools, puddles, creeks, ditches, catch basins, or marshy areas. The breeding habitat varies depending on the species of mosquito. The majority of mosquito species prefer water sheltered from the wind by grass and weeds.

The availability of preferable mosquito breeding habitat varies by season, and is reduced during dry periods of the year. Available open water habitat can be expected to increase during the wet season; however, changes in flow volume in the Delta would result in increased flow velocities, limiting preferable mosquito breeding habitat.

Suitable mosquito breeding habitat is in close proximity to urban areas along the Sacramento River and the south Delta; therefore, the current urban population is already exposed to vector-borne diseases (See *Potential Mosquito-Borne Diseases in Delta* below for additional information).

The islands and tracts within the Delta presently have mosquitoes and require varying degrees of mosquito control by existing mosquito and vector control districts (MVCDs). Mosquito control techniques employed by different MVCDs generally emphasize minimization and disruption of suitable habitat and control of larvae through chemical and biological means (Kwansy et al. 2004). Control techniques most often include source reduction and source prevention (e.g., drainage of water bodies that produce mosquitoes), application of larvicides, use of chemical larvicides, use of biological agents such as mosquitofish as larval predators, and monitoring of mosquito populations and vector-borne diseases (Kwansy et al. 2004). Furthermore, to address public health concerns about mosquito production in existing managed wetlands and tidal areas, MVCDs have developed guides and habitat management strategies to reduce mosquito production. MVCDs encourage Integrated Pest Management (IPM), which incorporates multiple strategies to achieve effective control of mosquitoes and includes the following.

- Source reduction – designing wetlands and agricultural operations to be inhospitable to mosquitoes.
- Monitoring – implementing monitoring and sampling programs to detect early signs of mosquito population problems.
- Biological control – use of biological agents such as mosquitofish (*Gambusia affinis*) to limit larval mosquito populations.
- Chemical control – use of larvicides and adulticides.
- Cultural control – changing the behavior of people so their actions prevent the development of mosquitoes or the transmission of vector-borne disease.

Specifically, the following guidelines are incorporated for habitat management plans in different MVCDs in the study area.

- *Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands,* 2004.
- *Best Management Practices for Mosquito Control on California State Properties, California Department of Public Health*, June 2008.
- *Mosquito Reduction Best Management Practices, Sacramento-Yolo County Mosquito and Vector Control District*, 2008.

Study Area

The islands and tracts within the Delta presently have mosquitoes and require varying degrees of mosquito control by MVCDs. The change in mosquito prevalence in the study area is attributable to changes in cropping and land use patterns. Different cropping and land use patterns create differing amounts of suitable mosquito breeding habitat. Currently, the Delta consists primarily of agricultural lands and tidal, riparian and other water-related habitat that can provide suitable habitat for mosquitoes to breed and multiply.

Tidally influenced marshes that lack sufficient tidal flow can provide suitable breeding habitat for mosquitoes (Kramer et al. 1992 and 1995). However, functional tidal marshes do not provide high-quality habitat for many mosquito species, such as *Aedes dorsalis* (Meigen) and *Aedes squamiger* (Coquillett), and maintenance and restoration of natural tidal flushing in marshes is effective at limiting mosquito populations (Kramer et al. 1995; Williams and Faber 2004). Problems can occur in seasonally ponded wetlands, in densely vegetated tidal areas that pond water between tides, or where tidal drainage has been interrupted (Williams and Faber 2004). Therefore, tidal wetland restoration can reduce mosquito populations as tidal fluctuations keep water moving so that mosquitoes do not have standing water in which to breed (Williams and Faber 2004; Kramer et al. 1995). Semi-permanent and permanent non-tidal wetlands can produce *An. freeborni* and *Cx. tarsalis*; however, because of their limited acreage, stable water levels, and abundance of mosquito predators (fish, dragonflies, and other predatory invertebrates) such wetlands are not typically considered mosquito production areas (Kwansy et al. 2004).

Existing land uses in the Delta are currently located in relatively close proximity to urban areas along the Sacramento River and the south Delta; therefore, the current urban population is already exposed to mosquitoes and the vector-borne diseases that mosquitoes carry.

~~The number of documented human cases of West Nile Virus (WNV) in Delta counties is relatively low compared with the population of the counties, and the number of documented WNV-positive dead birds in Delta counties is less than 200 per year in Delta counties (Table 25-7). Therefore, while WNV is a concern and a potential threat to the study area and California, the documented human occurrences have been relatively limited.~~

Common Mosquito Species

There are multiple species of mosquito known to occur in the study area. Factors that affect the productivity and breeding of mosquitoes include water circulation, organic content, vegetation, temperature, humidity, and irrigation and flooding practices.

The habitat for the breeding of mosquitoes varies depending on the combination of habitat conditions. The following discussion presents an overview of mosquito species located in the study area that are known to transmit diseases and their habitat. Table 25-~~4~~5 identifies the seasonal presence of mosquitoes.

Table 25-45. Seasonal Presence of Mosquito

General Water Source/Preferred Habitat	Most Active Season			
	Winter	Spring	Summer	Fall
Standing Water (e.g., permanent wetlands or foul standing water sources; brackish or freshwater)	• Cool weather mosquito (*Culiseta incidens*)[2] • California salt marsh mosquito (*Ochlerotatus squamiger*)[3] • Winter salt marsh mosquito (*Aedes squamiger*)	• California salt marsh mosquito (*Ochlerotatus squamiger*)[3]	• Encephalitis mosquito (*Culex tarsalis*) • Northern house mosquito (*Culex pipiens*) • Western malaria mosquito (*Anopheles freeborni*)	• Encephalitis mosquito (*Culex tarsalis*) • Northern house mosquito (*Culex pipiens*) • Western malaria mosquito (*Anopheles freeborni*) • Cool Weather Mosquito (*Culiseta incidens)*[2]
Flood waters (e.g., seasonal/semi-permanent wetlands, including pastures and rice fields)		• Wetlands mosquito (*Aedes melanimon*) • Inland floodwater mosquito (*Aedes vexans*) • Pale marsh mosquito (*Ochlerotatus doralis*)[1]	• Inland floodwater mosquito (*Aedes vexans*) • Western malaria mosquito (*Anopheles freeborni*)[5]	• Wetlands mosquito (*Aedes melanimon*) • Inland floodwater mosquito (*Aedes vexans*)
Tule and Grasses		Tule mosquito (*Culex erythrothorax*)[4]	Tule mosquito (*Culex erythrothorax*)[4]	
Containers (e.g., holes in oak woodlands, containers of standing water, sumps)	Western treehole mosquito (*Aedes sierrensis*)	Western treehole mosquito (*Aedes sierrensis*)	Northern house mosquito (*Culex pipiens*)	Northern house mosquito (*Culex pipiens*)
Wooded areas, seasonal creeks and year-round rivers	Woodland malaria mosquito (*A. punctipennis*) *			

Unless otherwise noted, sources in this table are from http://www.fightthebite.net/download/ecomanagement/SYMVCD_BMP_Manual.pdf.

[1] Solano County Mosquito Abatement District 2005a; Napa County Mosquito Abatement District 2006

[2] Alameda County Mosquito Abatement District 2011

[3] Solano County Mosquito Abatement District 2005b

[4] Santa Cruz County Government Environmental Health Services 2011. Available: <http://sccounty01.co.santa-cruz.ca.us/eh/Medical_Waste/mosquito_species.htm>. Accessed: December 23, 2011

[5] Marin/Sonoma Mosquito and Vector Control District 2009; Solano County Mosquito Abatement District 2005

* Unknown what season the woodland malaria mosquito is most active.

Potential Mosquito-Borne Diseases in the Delta

Mosquitoes in the study area are known to carry six major diseases: malaria, cerebral encephalitis (CE), ~~West Nile virus (~~WNV~~)~~, St. Louis Encephalitis (SLE), dog heartworms, and Western Equine Encephalitis (WEE). Table 25-~~5~~6 summarizes the types of mosquitoes known to occur in the study area and the types of diseases they commonly carry. Brief descriptions of these diseases are provided below the table.

Table 25-~~5~~6. Mosquitoes Known to Occur in the Delta and the Diseases They Commonly Carry

Mosquito	Distance Travels from Breeding Ground	Diseases
Pale marsh mosquito[a]	20 miles	Cerebral Encephalitis (CE) virus; Dog heartworms
Cool weather mosquito[b]	5 miles	Western Equine Encephalitis (WEE) virus*
Western encephalitis mosquito[c, d]	~~Unavailable~~Up to 16 miles	WEE virus; St. Louis Encephalitis (SLE) West Nile Virus (WNV)
California salt marsh mosquito[d]	~~Unavailable~~Up to 20 miles or more	CE virus WNV in a limited number of this species in 2004
Western treehole mosquito[e]	Limited	Dog heartworms
Wetlands mosquito[~~f~~d]	10 or more miles	Secondary vector of the WEE virus Primary carrier of the CE virus Recently linked as a potential vector of the WNV
House mosquito[d, ~~g~~f]	~~Unavailable~~3 – 5 miles	Major vector of the SLE virus and the WNV**
Inland floodwater mosquito[e]	10 or more miles	WEE virus; CE virus; and secondary vector for dog heartworms
Tule mosquito[~~h~~g]	Unavailable	SLE virus WEE virus
Salt marsh mosquito[~~i~~h]	30 miles	Secondary vector of SLE virus Secondary vector of WEE virus
Winter salt marsh mosquito[~~j~~i]	20 miles	Seasonal nuisance not considered a disease or virus vector
Western malaria mosquito[~~k~~j]	5 miles	Malaria
Woodland malaria mosquito[~~l~~k]	Less than 1 mile	Malaria

[a] Marin/Sonoma Mosquito and Vector Control District 2009; Solano County Mosquito Abatement District 2005.

[b] Napa County Mosquito Abatement District 2006; Solano County Mosquito Abatement District 2005

[c] Marin/Sonoma Mosquito and Vector Control District 2009; Napa County Mosquito Abatement District 2006; Alameda County Mosquito Abatement District 2011; Reisen 1993

[d] Solano County Mosquito Abatement District 2005c

[e] Sacramento-Yolo Mosquito and Vector Control District 2009

~~[f] Solano County Mosquito Abatement District 2005~~

[~~g~~f] Marin/Sonoma Mosquito and Vector Control District 2009

[~~h~~g] Marin/Sonoma Mosquito and Vector Control District 2009

[h~~i~~] Solano County Mosquito Abatement District 2005 and Napa County Mosquito Abatement District 2006

[i~~j~~] Napa County Mosquito Abatement District 2006

[j~~k~~] Marin/Sonoma Mosquito and Vector Control District 2009, Solano County Mosquito Abatement District 2005 and Marin/Sonoma Mosquito and Vector Control District 2009, Solano County Mosquito Abatement District 2005

[~~l~~k] Napa County Mosquito Abatement District 2006

[*] Recently identified under laboratory conditions as a vector for WEE, but has not yet been found in wild populations.

[**] Not considered a strong virus vector for humans in northern California but identified in southern California and the Gulf Coast as human virus vector.

Malaria

Malaria is a mosquito-borne disease caused by a single-celled parasite, *Plasmodium* (Reiter 2001). This parasite infects and destroys the red blood cells of its host. The disease is usually transmitted through the bite of an infected mosquito; a mosquito becomes infected from feeding on people carrying malaria in the blood (Zucker 1996). Malaria occurs in tropical and subtropical areas with high humidity and temperatures, including Africa and Central and South America. Although no longer considered an endemic disease in California, malaria cases continue to be reported in the United States (CalSurv 2012). In the United States there are approximately 1,200 diagnosed cases each year (Marin/Sonoma Mosquito and Vector Control District 2009). In California, the primary vectors of this disease are female western malaria mosquitoes.

Encephalitis

Encephalitis is a virus with symptoms characterized by swelling or inflammation of the brain and spinal cord. Mosquito-borne encephalitis is directly transmitted to humans by mosquitoes and maintained through the contact between virus-carrying birds and mosquitoes. It is most commonly found in California as a consequence of the WNV, SLE virus, and WEE virus. Horses and birds are usually the most important carriers and also the most vulnerable and susceptible to these viruses (California Department of Public Health 2010a, 2010b).

West Nile Virus

WNV is a mosquito-borne virus introduced to North America in 1999 (San Joaquin County Mosquito and Vector Control District 2009). The *Culex* mosquito genus has been identified as the primary transmitting vector of the virus (Goodard et al. 2002). The majority of victims of this virus develop very few or no symptoms. Some of the common symptoms identified are fever, nausea, body aches, headache, and mild skin rash. A very small proportion (less than 1%) of victims may also develop brain inflammation (encephalitis), which could lead to partial paralysis and death (Marin/Sonoma Mosquito and Vector Control District 2009).

St. Louis Encephalitis

SLE is distributed throughout California and generally affects non-human mammals, principally horses. The western encephalitis and house mosquitoes are the main transmitting vectors (CalSurv 2012). The main sources of infection for mosquitoes are birds; once infected, the mosquito can transmit the virus to other animals and, on few occasions, humans. Symptoms tend to be very mild and usually include fever, headache, and dizziness. However, the disease may also lead to convulsions and death, and carries a fatality rate that ranges from 3–30% (Contra Costa Mosquito and Vector Control District 2011; CalSurv 2012). From 1964 through 2009, an average of 102 cases were reported annually in the United States. From 1964 through 2010, 123 cases of SLE were reported in California (Centers for Disease Control and Prevention 2011)

Western Equine Encephalitis

Seasonal viral activity is at its highest for WEE from late spring to early summer, especially in areas with highly irrigated agriculture and stream drainages. The disease has a fatality rate of 33% and affects young children most severely (Marin/Sonoma Mosquito and Vector Control District 2009). The western encephalitis mosquitoes are generally identified as primary transmitters. In California, the pale marsh mosquito is also a major vector. Symptoms range from mild flu-like illness to encephalitis, which could lead victims into a coma and death (Napa County Mosquito Abatement District 2006). Between 1964 and 2005, 639 cases of WEE were reported in the United States (Centers for Disease Control 2005).

Mosquito-Borne Disease Incidence

Each county, following public health and safety code regulations, designs its individual Mosquito and Vector Control District Programs to control mosquito-borne disease incidence in its individual district. The most common mosquito-borne diseases each district is expected to control include WNV, WEE virus, SLE virus, heartworm disease, and malaria. Based on mosquito-borne disease surveillance and activity data, yearly reports show that WNV has the highest incidence reported within the Delta counties. This virus is commonly identified in small animals, such as squirrels and birds, and can also affect large mammals, including horses and humans. The ratio of dead birds infected with WNV to reported human cases within the statutory Delta counties is approximately 10:1 (Table 25-~~6~~7 and Table 25-~~7~~8). The number of documented human cases of WNV in Delta counties is relatively low compared with the population of the counties, and the number of documented WNV-positive dead birds in Delta counties is less than 200 per year (Table 25-~~7~~8). Therefore, while WNV is a concern and a potential threat to the study area and California, the documented human occurrences have been relatively limited.

Table 25-~~6~~7. Confirmed West Nile Virus Cases in California 2008–2010

Cases	2008	2009	2010
Number of Counties	49	42	35
Human Cases	445	112	105
Horses	32	18	19
Dead Birds	2,569	515	412
Mosquito Samples	2,003	1,063	1,305
Sentinel Chickens	585	443	281
Squirrels	32	10	24

Source: The California Department of Public Health West Nile Virus Website 2009, 2010.

Table 25-~~7~~8. West Nile Virus Activity by County in Study Area, 2008–2010

	2008				2009				2010			
County	Human Case	Horses	Dead Birds	Mosquito Samples	Human Case	Horses	Dead Birds	Mosquito Samples	Human Cases	Horses	Dead Birds	Mosquito Samples
Alameda	1	N/A	12	1	-	-	10	1	1	-	1	-
Contra Costa	4	3	88	31	5	1	45	17	4	-	8	4
Sacramento	18	N/A	N/A	N/A	-	2	28	36	12	2	115	205
San Joaquin	12	N/A	69	207	10	3	24	83	6	1	26	57
Solano	1	N/A	7	1	-	1	3	2	-	1	1	1
Sutter			22	1212				25			1	26
Yolo	1	1	9	19	2	-	7	16	-	-	14	11

Source: The California Department of Public Health West Nile Virus Website 2009, 2010.
N/A = not available.
- = No record.

~~25.1.1.5~~25.1.1.6 Electromagnetic Fields

An EMF is an invisible line of force that is produced by an electrically charged object. It affects the behavior of other charged objects in the vicinity of the field. The EMF extends indefinitely throughout space and can be viewed as the combination of an electric field and a magnetic field. Electric fields are produced by voltage and increase in strength as the voltage increases. The electric field strength is measured in units of volts per meter. Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measured in units of gauss or tesla. Most electrical equipment has to be turned on (i.e., current must be flowing) for a magnetic field to be produced. If current does flow, the strength of the magnetic field will vary with power consumption. Electric fields, on the other hand, are present and constant even when the equipment is switched off, as long as the equipment remains connected to the source of electric power (World Health Organization 2012.)

Electric fields are shielded or weakened by materials that conduct electricity (including trees, buildings, and human skin). Magnetic fields, on the other hand, pass through most materials and are therefore more difficult to shield. Both electric and magnetic fields decrease as the distance from the source increases (California Public Utility Commission 2007).

Electromagnetic fields are present everywhere in our environment but are invisible to the human eye. Besides natural sources, such as thunderstorms, the electromagnetic spectrum includes fields generated by human-made sources, such as X-rays. The electricity that comes out of every power socket has associated low-frequency electromagnetic fields, and various kinds of higher frequency radio waves are used to transmit information (World Health Organization 2012).

Electric fields and magnetic fields can be characterized by their wavelength, frequency, and amplitude or strength. The frequency of the field, measured in hertz (Hz), describes the number of cycles that occur in one second. Electricity in North America alternates through 60 cycles per second, or 60 Hz. The time-varying electromagnetic fields produced by electrical appliances are an example of extremely low-frequency (ELF) fields. ELF fields generally have frequencies up to 300 Hz. Other technologies produce intermediate-frequency (IF) fields with frequencies from 300 Hz to 10 megahertz (MHz) and radiofrequency (RF) fields with frequencies of 10 MHz to 300 gigahertz (GHz). The effects of electromagnetic fields on the human body depend not only on their field level but on their frequency and energy. Our electricity power supply and all appliances using electricity are the main sources of ELF fields; computer screens, anti-theft devices, and security systems are the main sources of IF fields; radio, television, radar, cellular telephone antennas, and microwave ovens are the main sources of RF fields (World Health Organization 2012). Electromagnetic fields are commonly measured in units of gauss; a milligauss (mG) is 1,000 times smaller than a gauss. High voltage transmission line EMF levels range from 30–90 mG underneath the wires, based on the voltage, height, and placement of the lines. Most household appliances' EMF levels range from 3 mG–1,600 mG.

Potential Health Concerns

There has been extensive research done over the past 20 years on the relationship of EMF exposure and human health risks. To date, the potential health risk caused by EMF exposure remains unknown and inconclusive. Two national research organizations (the National Research Council and the National Institute of Health) have concluded that there is no strong evidence showing that EMF exposures pose a health risk. However, some studies have shown an association between household EMF exposure and a small increased risk of childhood leukemia at average exposures greater than 3 mG (Greenland et al. 2000). For cancers other than childhood leukemia, there is less evidence for an effect. For example, workers that repair power lines and railway workers can be exposed to much higher EMF levels than the general public. The results of cancer studies in these workers are mixed. Some studies have suggested a link between EMF exposure in electrical workers and leukemia and brain cancer while. O other similar studies have not found such associations (Ahlbom et al. 2001). There is also some evidence that utility workers exposed to high levels of EMF may be at increased risk of developing amyotrophic lateral sclerosis (ALS, or Lou Gehrig's disease). The current scientific evidence provides no definitive answers as to whether EMF exposure can increase health risks (California Public Utilities Commission 2007).

Proximity to Power Lines

Residences and other sensitive receptors located 300 feet or more from power lines with kilovolts (kV) of 230 kV or less are not considered to be at risk of high EMF exposure (National Institute of Environmental Health Sciences and National Institutes of Health 2002). At this distance, EMF exposure from power lines is no different than from typical levels around the home. Furthermore, recognizing that transmission lines carry different voltages, the California Department of Education created regulations that require schools to be set back from transmission line right-of-ways based on the voltage of the lines. Schools must be placed 100 feet or greater from 50–133 kV lines; 150 feet or greater from 220–230 kV lines; and 350 feet or greater from 500–550 kV lines. Similar to the National Institute of Health's 300-foot setback for sensitive receptors, these distances were based on the fact that the electrical fields from the transmission lines decrease to background levels at the corresponding distances (California Department of Public Health 1999).

There are currently approximately 621 miles of transmission lines in the study area. Sensitive receptors to EMFs include schools, hospitals, parks and fire stations. Parks and schools provide a location for people to congregate, and fire stations and hospitals could have sensitive communications and health equipment that could be affected by EMF interference. The following list summarizes the types of existing transmission lines and sensitive receptors within the study area or immediately adjacent to the study area.

- No hospitals are located within 300 feet of existing 230 kV or 69 kV lines.
- No schools are located within 300 feet of existing 230 kV or 69 kV lines.
- One fire station (Station 52 of Sacramento Metro District at 9780 Elder Creek Road, Sacramento) is within 300 feet of existing 230 kV lines located just outside the study area.
- Three sections of Cosumnes River Ecological Reserve and the Woods (Jones) park (part of Cosumnes River Admin Area) are within 300 feet of existing 230 kV lines (lines run through parks).

25.2 Regulatory Setting

25.2.2 Federal Plans, Policies, and Regulations

25.2.2.4 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was established to protect the public health and quality of drinking water in the United States, whether from aboveground or underground sources. The SDWA directed EPA to set national standards for drinking water quality. It required EPA to set MCLs for a wide variety of potential drinking water pollutants (see Appendix 8A of Chapter 8, *Water Quality*). The owners or operators of public water systems are required to comply with federal primary (health-related) MCLs and encouraged to comply with federal secondary (nuisance- or aesthetics-related) MCLs. SDWA drinking water standards apply to treated water as it is served to consumers. See Section 25.2.3.2, *California Safe Drinking Water Act*, for applicable state drinking water regulations.

25.2.3 State Plans, Policies, and Regulations

25.2.3.2 California Safe Drinking Water Act

EPA has designated CDPH as the prima~~r~~cy agency to administer and enforce the requirements of the federal SDWA in California. A state or a tribe with primacy has direct oversight of the regulated public water systems and is responsible for ensuring that the systems meet all of the requirements of the drinking water regulations. Public water systems are required to be monitored for regulated contaminants in their drinking water supply. California's drinking water standards (e.g., MCLs) are the same as or more stringent than the federal standards, and include additional contaminants not regulated by EPA. Like the federal enforceable MCLs, California's primary MCLs address health concerns, while secondary MCLs address aesthetics, such as taste and odor. Although federal secondary drinking water standards are established only as guidelines, California secondary MCLs, like primary MCLs, are legally enforceable. The California SDWA is administered by CDPH, primarily through a permit system.

25.2.3.4 The California Department of Public Health's *Best Management Practices for Mosquito Control in California*

The *Best Management Practices for Mosquito Control in California* was prepared by the California Department of Public Health in collaboration with the Mosquito and Vector Control Association of California to promote mosquito control on California properties and enhance early detection of WNV. This plan describes mosquito control Best Management Practices (BMPs) to be implemented by property owners and managers to reduce mosquito populations through a variety of ways including: 1) reducing or eliminating breeding sites; 2) increasing the efficacy of biological control, and 3) decrease the amount of pesticides applied while increasing the efficacy of chemical control measures (California Department of Public Health 2012). In addition to these recommended practices, the plan stresses coordination between property owners and local vector control agencies regarding control practices on lands located within or near a local agency's jurisdiction and appropriate integrated pest management strategies that are most suitable for specific land-use types.

25.2.4 Regional Agencies and Programs Responsible for Regulating Drinking Water

25.2.4.5 California Drinking Water Standards Incorporated by Reference in Basin Plans

CDPH establishes state drinking water standards, enforces both federal and state standards, administers water quality testing programs, and issues permits for public water system operations. The drinking water regulations are found in Title 22 of the California Code of Regulations. The state drinking water standards for public water systems consist of enforceable primary and secondary maximum MCLs. Primary MCLs are established for the protection of environmental health and secondary MCLs are established for constituents that affect the aesthetic qualities of drinking water, such as taste and odor. Both the Central Valley and San Francisco Bay Basin Plans incorporate by reference the CDPH numerical drinking water MCLs. The incorporation into the Basin Plans of the MCLs~~, which are normally applicable to treated drinking water systems regulated by CDPH,~~ makes these ~~MCLs~~ standards also applicable to ambient receiving waters regulated by the Regional Water Boards. The state primary and secondary MCLs applicable to the Central Valley and San Francisco Bay Basin Plans are provided in Appendix 8A of Chapter 8, *Water Quality*.

25.2.5 Regional Agencies and Programs Responsible for Vector Control

California's Health and Safety Code (Sections 2001–2007; 2060–2067 and 2001 b[2]) provide the legal procedures that each district in the State of California must follow to achieve effective vector control programs. The Health and Safety Code outlines the physical, biological, and chemical controls by which each district must achieve effective mosquito abatement.

Under the Health and Safety Code, local mosquito and vector control agencies have the authority to conduct surveillance for vectors, prevent the occurrence of vectors, and legally abate production of vectors, any water that is a breeding place for vectors, and "any activity that supports the development, attraction, or harborage of vectors, or that facilitates the introduction or spread of vectors (Section 2002[j] and 2040). Further, vector control agencies are authorized to participate in review, comment, and make recommendations regarding local, state, or federal land use planning and environmental quality processes, permits, licenses, entitlements, and documents for projects with potential effects with respect to vector production (Section 2041).

25.3 Environmental Consequences

25.3.1 Methods for Analysis

The proposed BDCP action alternatives may affect public health in the study area through the following mechanisms.

- Construction of the water conveyance facilities and water supply operations under all action alternatives would result in an increase in sedimentation basins and solids lagoons. These new features could result in an increase in standing water, thereby potentially increasing vector breeding locations and vector-borne diseases in the study area.

- Water conveyance facilities operation activities could mobilize or increase the amount of trace metals or pesticides in surface waters.
- Water conveyance facilities operation activities under all action alternatives could change hydraulic residence times and increase water temperatures under the action alternatives, which could cause an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms. This could result in negative effects on drinking water quality and recreational waters, which would represent a potential public health concern.
- Habitat restoration and enhancement activities under all action alternatives could change hydraulic residence times and increase water temperatures under the action alternatives, which could cause an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms. This could result in negative effects on drinking water quality and recreational waters, which would represent a potential public health concern.
- Water conveyance facilities operation activities under all action alternatives would generally result in a change in source water inflow to the study area, thereby potentially influencing parameters that bioaccumulate (e.g., methylmercury).
- Water conveyance facilities operation activities under all action alternatives would require new transmission lines (with lines at 69 kV and 230 kV), thereby potentially increasing exposure of people to EMFs.
- Habitat restoration and enhancement activities under all action alternatives would increase the amount of tidal and wetland areas in the study area (including Suisun Marsh and the Yolo Bypass), which are known to generate pathogens that represent a potential public health concern to recreational activities.
- Habitat restoration activities under all action alternatives could increase standing water in the Delta throughout the year, thereby potentially resulting in an increase in vector breeding locations and in vector-borne diseases in the study area.
- Habitat restoration activities under all action alternatives could change the water quality such that there is an increase DOC in the study area, thereby potentially increasing the amount of DBPs in the water, which represents a potential drinking water public health concern.
- Restoration and certain habitat enhancement activities (e.g., channel margin enhancement) under all action alternatives could disturb and re-suspend existing sediment that is contaminated with parameters which bioaccumulate (e.g., methylmercury) or result in mobilization of toxic constituents into the food chain (e.g., methylation of mercury).
- The methodologies to evaluate these different mechanisms are described below.

25.3.1.3 *Microcystis*

The conceptual model for evaluating effects of the action alternatives on *Microcystis* in the Plan Area is described in Chapter 8, *Water Quality* (Section 8.3.1.7), and includes consideration of abiotic factors considered to be the primary drivers of seasonal and interannual variation in abundance of *Microcystis* in the Delta. These factors include water temperature, hydraulic residence time, nutrients, and water clarity. Nutrient (i.e., ammonia, nitrate, and phosphorus) and water clarity effects on *Microcystis* abundance under the action alternatives relative to Existing Conditions and the No Action Alternative were determined to not be substantial (See Chapter 8, *Water Quality*).

In Chapter 8, *Water Quality*, a qualitative evaluation was done to determine if the action alternatives would result in an increase in frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta based on the following two additional abiotic factors that may affect *Microcystis*: 1) changes to water operations and creation of tidal and floodplain restoration areas that change hydraulic residence times within Delta channels, and 2) increases in Delta water temperatures. The findings from Chapter 8, *Water Quality*, are summarized for each action alternative and a qualitative determination is made as to whether recreationists would experience a substantial increase in exposure to *Microcystis* and whether there would be adverse effects on drinking due to increases in *Microcystis*.

~~25.3.1.3~~25.3.1.4 Constituents of Concern and Water Quality

As discussed in Chapter 8, *Water Quality* (Section 8.1.1.6), numerical water quality objectives and standards have been established to protect beneficial uses, and therefore represent concentrations or values that should not be exceeded. The beneficial uses provide standards that indirectly maintain public health, such as contact recreation to protect individuals against illness. Chapter 8, *Water Quality,* discusses the different water quality standards evaluated through modeling and determines whether these standards would be exceeded as a result of implementation of the action alternatives. Therefore, this analysis summarizes the qualitative and quantitative results presented in Chapter 8 to identify whether the construction and operation of the facilities associated with the alternatives would exceed water quality standards for pesticides that do not bioaccumulate (for this assessment, only present use pesticides for which substantial information is available, namely diazinon, chlorpyrifos, pyrethroids, and diuron, are addressed); trace metals of human health and drinking water concern (i.e., arsenic, iron, and manganese); and DBP precursors, DOC and bromide[3]~~s, including HAA5, bromated, chlorite, and THMs via the THM formation potential[4] (THMFP)~~. ~~It should be noted that the water quality analysis did not assess HAA5 or THMFP directly, but rather assessed changes in organic carbon. As indicated in Section 25.1.1.1, because organic carbon, such as DOC, can react with disinfectants during the water treatment disinfection process to form DBPs, such as THMs and HAAs, DOC concentrations can be an indicator of DBPs (discussed in detail in Chapter 8, *Water Quality*, Section 8.1.3.11).~~

Qualitative assessments were conducted to determine whether operation of the action alternatives would result in adverse effects on drinking water quality as represented by an exceedance in water quality standards for these constituents of concern. Drinking water is generally treated for various standard constituents prior to distribution and use in the drinking water supply.

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[3] Because organic carbon, such as DOC, and bromide can react with disinfectants during the water treatment disinfection process to form DBPs, such as THMs and HAAs, as described in Section 25.1.1.1, DOC and bromide concentrations can be an indicator of DBPs (discussed in detail in Chapter 8, Water Quality, Section 8.1.3.11).

~~[4] This evaluates the potential for trihalomethanes to form as a result of the level of dissolved organic carbon, bromide, and chloride in a water source.~~

25.3.2 Determination of Effects

Implementation of an alternative could result in an adverse effect under NEPA and a significant impact under CEQA if it would result in any of the following.

- Substantial increase in the public's risk of exposure to vector-borne diseases. For purposes of this analysis, "substantial increase" is evaluated qualitatively, depending on the location of the alternative, in accordance with Section 15064(b) of the State CEQA Guidelines (see footnote 4, Section 25.3.1.1, *Vectors*).
- Exceedance(s) of water quality criteria for constituents of concern such that an adverse effect would occur to public health from drinking water sources. This analysis is based on the qualitative and quantitative results presented in Chapter 8, *Water Quality*, to identify whether the construction and operation of the alternatives would exceed water quality standards for pesticides that do not bioaccumulate (present use pesticides for which substantial information is available, namely diazinon, chlorpyrifos, pyrethroids, and diuron); trace metals of human health and drinking water concern (i.e., arsenic, iron, and manganese); and DBP precursors, DOC and bromide~~DBPs, including HAA5, bromated, chlorite; and THMs via the THMFP~~.
- Substantial mobilization or substantial increase of constituents known to bioaccumulate. For purposes of this analysis, an expected increase in bioaccumulation above existing conditions (levels and locations) in fish in the study area as a result of implementing an alternative would be considered a potential effect and is discussed qualitatively in terms of the populations affected and potential public health concerns. (See also Section 25.3.1.4, *Bioaccumulation*.)
- Exposing substantially more people to transmission lines that provide new sources of EMFs. Exposure to EMFs from new transmission lines is dependent on the location of the transmission lines in relation to sensitive receptors. For purposes of this analysis, schools, hospitals, parks, and fire stations are considered to be sensitive receptors. Residences and other sensitive receptors located 300 feet or more from power lines are not considered to be at risk of high EMF exposure (National Institute of Environmental Health Sciences and National Institutes of Health 2002). (See the discussion in Section 25.3.1.5, *Electromagnetic Fields*.) Temporary transmission lines are those that would be removed once construction was completed.
- Substantial increase in recreationists' exposure to pathogens. For purposes of this analysis, a "substantial increase in recreationists' exposure" is based on the amount of tidal habitat restored under CM 4 (the most of all the habitat restoration components), because pathogens in drinking water are effectively removed prior to distribution and have little effect on drinking water; and findings in Chapter 8, *Water Quality* (See also Section 25.3.1.2, *Pathogens and Water Quality*.)

Increase in *Microcystis* in water bodies in the study area such that municipal and domestic supply and water contact recreation beneficial uses are negatively affected. This analysis is based on the results of the qualitative analysis presented in Chapter 8, *Water Quality*. As described in Chapter 8, Water Quality, assumptions regarding how certain habitat restoration activities (CM2, *Yolo Bypass Fisheries Enhancement*, and CM4, *Tidal Natural Communities Restoration*) would affect Delta hydrodynamics were included in the modeling scenario assumptions. To the extent that BDCP restoration actions would alter hydrodynamics within the Delta, which would affect mixing of source waters, these effects are included in the assessment of operations-related changes of hydraulic residence times and its effects on *Microcystis* production (Impact PH-8). Other effects of CM2 - CM21 not attributable to hydrodynamics are discussed under Impact PH-9.

Table 25-~~8~~9. Potential Range of New Permanent and Temporary Transmission Lines (miles)

	Permanent Transmission Lines (69 kV)		Temporary Transmission Lines (69 kV)		Permanent Transmission Lines (230 kV)		Temporary Transmission Lines (230 kV)		Temporary Transmission Lines (34.5 kV)	
Alternative	Miles	New Sensitive Receptor	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors
1A (Dual Conveyance with Pipeline/Tunnel)	8.94	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A[a]	N/A	N/A	N/A
1B (Dual Conveyance with East Alignment)	36.79	Stone Lakes National Wildlife Refuge (Elk Grove)	13.49	None	16.35	None	N/A	N/A	N/A	N/A
1C (Dual Conveyance with West Alignment)	17.61	None	13.73	Fire Station 63 (9699 Highway 220, Walnut Grove)	18.45	None	N/A	N/A	N/A	N/A
2A (Dual Conveyance with Pipeline/Tunnel)	14.46	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
2B (Dual Conveyance with East Alignment)	40.5	Stone Lakes National Wildlife Refuge (Elk Grove)	13.49	None	16.35	None	N/A	N/A	N/A	N/A
2C (Dual Conveyance with West Alignment)	17.61	None	13.73	Fire Station 63 (9699 Highway 220, Walnut Grove)	18.45	None	N/A	N/A	N/A	N/A
3 (Dual Conveyance with Pipeline/Tunnel)	8.68	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
4 (Dual Conveyance with Modified Pipeline/Tunnel)	~~5.87~~None	None	~~N/A~~6.08	~~N/A~~None	~~14.17~~ ~~13.79~~ 15.96	None	~~34.73~~ ~~30.44~~ 30.00	None	~~3.259.63~~N/A	~~None~~N/A

	Permanent Transmission Lines (69 kV)		Temporary Transmission Lines (69 kV)		Permanent Transmission Lines (230 kV)		Temporary Transmission Lines (230 kV)		Temporary Transmission Lines (34.5 kV)	
Alternative	Miles	New Sensitive Receptor	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors	Miles	New Sensitive Receptors
5 (Dual Conveyance with Pipeline/Tunnel)	8.68	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
6A (Isolated Conveyance with Pipeline/Tunnel)	8.94	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
6B (Isolated Conveyance with East Alignment)	36.79	Stone Lakes National Wildlife Refuge (Elk Grove)	13.49	None	16.35	None	N/A	N/A	N/A	N/A
6C (Isolated Conveyance with West Alignment)	17.61	None	13.73	Fire Station 63 (9699 Highway 220, Walnut Grove)	18.45	None	N/A	N/A	N/A	N/A
7 (Dual Conveyance with Pipeline/Tunnel)	7.03	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
8 (Dual Conveyance with Pipeline/Tunnel)	7.03	None	24.71	Stone Lakes National Wildlife Refuge (Elk Grove)	42.68	None	N/A	N/A	N/A	N/A
9 (Through Delta/Separate Corridors)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[a] N/A: not applicable.

- Substantial increase in recreationists' exposure to pathogens. For purposes of this analysis, a "substantial increase in recreationists' exposure" is based on the amount of tidal habitat restored under CM 4 (the most of all the habitat restoration components), because pathogens in drinking water are effectively removed prior to distribution and have little effect on drinking water; and findings in Chapter 8, *Water Quality* (See also Section 25.3.1.2, *Pathogens and Water Quality*.)

Compatibility with Plans and Policies

Constructing the proposed water conveyance facilities (CM1) and implementing CM2–CM22CM21 could potentially result in incompatibilities with plans and policies related to the effects of water quality constituents and vector-borne diseases on public health. Section 25.2, *Regulatory Setting*, provides an overview of federal, state, regional, and agency-specific plans and policies applicable to the public health effects of water quality and vector-borne diseases. This section summarizes ways in which BDCP is compatible or incompatible with those plans and policies. Potential incompatibilities with local plans or policies do not necessarily translate into adverse environmental effects under NEPA or CEQA. Even where an incompatibility "on paper" exists, it does not by itself constitute an adverse physical effect on the environment, but rather may indicate the potential for a proposed activity to have a physical effect on the environment. The relationship among plans, policies, and regulations, and impacts on the physical environment is discussed in Chapter 13, *Land Use*, Section 13.2.3.

Consistent with requirements of California's Health and Safety Code (Sections 2001–2007; 2060–2067 and 2001 b[2]), the Alameda County Vector Control Services District, Contra Costa Mosquito and Vector Control District, Sacramento-Yolo Mosquito and Vector Control District, San Joaquin County Mosquito and Vector Control District, Solano County Mosquito Abatement District, and the Sutter-Yuba County Mosquito Abatement District (MVCDs), with jurisdictions in the study area, all have policies related to maintaining and protecting public health and quality of life by preventing the spread of mosquito-borne diseases and relieving pest nuisance. Implementing a selected BDCP alternative could potentially create temporary, additional breeding habitat for mosquitoes during construction of the water conveyance facilities; and permanently increase mosquito breeding habitat as a result of restoration activities under conservation measures, as described under Impact PH-1: *Increase in vector-borne diseases as a result of construction and operation of the intakes, solids lagoons, and/or sedimentation basins associated with the water conveyance facilities*; and Impact PH-5: *Increase in vector-borne diseases as a result of implementing* CM2–CM7, CM10, and CM11. The BDCP proponents would implement an environmental commitment to conduct pre-construction consultation and coordinate with local MVCDs, and to prepare MMPs (Appendix 3B, *Environmental Commitments*). As part of that environmental commitment, BDCP proponents would also follow guidelines provided in the Central Valley Joint Venture's Technical Guide to *Best Management Practices for Mosquito Control in Managed Wetlands* and the California Department of Public Health's *Best Management Practices for Mosquito Control in California* to develop and implement BMPs to manage and control the risk of mosquito-borne disease. This environmental commitment would ensure that the BDCP is compatible with the mission and goals of the applicable MVCDs.

California Water Code Section 13240 requires preparation and adoption of water quality control plans (WQCPs). WQCPs are regulatory references for meeting the state and federal requirements for water quality control, and are primarily implemented through the National Pollutant Discharge Elimination System (NPDES) permitting system. Basin plans provide the technical basis for determining waste discharge requirements and authorize the Regional Water Boards to take regulatory enforcement actions if deemed necessary. Accordingly, the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, Water Quality Control Plan for the San Francisco Bay Basin,* and the *Central Valley Regional Water Quality Control Board Drinking Water Policy* deal with beneficial uses, water quality objectives, implementation programs, and surveillance and monitoring programs for waters in their respective jurisdictions. California Drinking Water Standards for primary and secondary maximum MCLs, found in Title 22 of the California Code of Regulations, are incorporated by reference in Central Valley and San Francisco Bay Basin Plans. DWR and/or BDCP proponents would be required to apply for and comply with NPDES permits, and thereby would be compatible with these plans and policies.

The potential effects of implementing the BDCP alternatives on constituents of concern and *Microcystis* and microcystin related to drinking water and recreationists' exposure to pathogens and *Microcystis* and microcystin are discussed under Impact PH-2: *Exceedances of water quality criteria for constituents of concern such that there is an adverse effect on public health as a result of operation of the water conveyance facilities* (for constituents that do not bioaccumulate); Impact PH-3: *Substantial mobilization of or increase in constituents known to bioaccumulate as a result of construction, operation or maintenance of the water conveyance facilities* (which assesses risk in terms of bioaccumulation in fish that people might eat); and Impact PH-6: *Substantial increase in recreationists' exposure to pathogens as a result of implementing the restoration conservation measures*, (which examines the extent of potential for recreationists to come in contact with pathogens in water while using restored tidal habitat); Impact PH-8: *Increase in Microcystis bloom formation as a result of operation of the water conveyance facilities* (which examines the potential for public health impacts due to *Microcystis* and microcystin in drinking water and recreational waters due to operation of CM1 and hydrodynamic effects of CM2 and CM4); and Impact PH-9: *Increase in Microcystis bloom formation as a result of implementing CM2 and CM4* (which examines the potential for public health impacts implementation of restoration activities of CM2 CM4). Under most of the proposed alternatives, BDCP would not create an adverse effect under NEPA or a significant impact under CEQA for Impacts PH-2, PH-3, and PH-6, and therefore is compatible with the plans and policies related to water quality. However, implementing the proposed BDCP action alternatives has the potential to be incompatible with the Basin Plan because projected increases in Microcystis and microcystin would affect beneficial uses of waters in the Delta and would result in an adverse effect under NEPA and a significant and unavoidable impact under CEQA. While Mitigation Measure WQ-32a, *Design Restoration Sites to Reduce Potential for Increased Microcystis Blooms* and Mitigation Measure WQ-32b, *Investigate and Implement Operational Measures to Manage Water Residence Time* would reduce the severity of the impact, the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain.

However, implementing the proposed BDCP action alternatives has the potential to be incompatible with the Basin Plan, because long-term average concentrations of DOC (Alternatives 6A – 6C, and 7 – 9) and bromide (Alternatives 1A – 9) and, by extension, DBPs are estimated to substantially increase various Delta locations in the study area as described under these alternatives in Impact PH-2: *Exceedances of water quality criteria for constituents of concern such that there is an adverse effect on public health as a result of operation of the water conveyance facilities*. Such increases could trigger the need for substantial and costly changes in drinking water treatment plant design or operations in order to achieve EPA Stage 1 Disinfectants and Disinfection Byproduct Rule action thresholds. If upgrades were not undertaken, the increase in DOC and/or bromide concentrations could create an increased risk of adverse effects on public health from increases in DBPs in drinking water. While Mitigation Measure WQ-5, *Avoid, minimize, or offset, as feasible, adverse water quality conditions; site and design restoration sites to reduce bromide increases in Barker Slough* and implementing the North Bay Aqueduct Alternative Intake Project (AIP) could reduce the effects of bromide, and Mitigation Measure WQ-17, *Consult with Delta water purveyors to identify means to avoid, minimize, or offset increases in long-term average DOC concentrations*, is available to reduce the effects of DOC, the feasibility and effectiveness of these measures are uncertain, and it is not known if implementation would reduce the severity such that it would not be an adverse effect.

The CPUC regulates electric utilities in the state and has established design guidelines for regulating EMFs. Recognizing that there is scientific uncertainty as to the health effects of EMFs on receptors in proximity to power lines, the CPUC affirmed that setting numeric exposure limits is not appropriate but established precautionary no-cost and low-cost policies that utilities would follow for proposed electrical facilities. The various electrical utilities in the Delta region that might be selected to provide power to the BDCP generally follow CPUC guidelines. The CPUC ranked land use categories for mitigation priority. In descending order these are: schools and licensed day care; residential; commercial/industrial; recreational; agricultural; and undeveloped land. The California Department of Education established minimum set-back distances for schools in relation to power lines of different voltages. These are similar to the National Institute of Health's 300- foot setback for sensitive receptors. BDCP would be generally compatible with the policies established by CPUC and adopted by the selected utility because most new permanent and temporary power lines would be in sparsely populated areas, would be at least 300 feet from sensitive receptors, and would not expose new receptors or increase the exposure of current receptors. However, BDCP could be considered incompatible with the guidelines because one or both of two new sensitive receptors, one fire station and one park, would be affected by alternatives. BDCP would become compatible because the proponents would implement an environmental commitment that the location and design of the proposed new transmission lines would be conducted in accordance with CPUC's EMF Design Guidelines for Electrical Facilities, and would include one or more of three measures to reduce EMF exposure.

- Shielding by placing trees or other physical barriers along the transmission line right-of-way.
- Cancelation by configuring the conductors and other equipment on the transmission towers.
- Increasing the distance between the source of the EMF and the receptor either by increasing the height of the tower or increasing the width of the right-of-way.

The *Sacramento County General Plan of 2005–2030* and Alameda County East Area General Plan have policies related to safety concerns about electromagnetic fields. These policies reference power line setbacks for sensitive receptors such as schools. By implementing the environmental commitment to comply with CPUC's EMF Design Guidelines for Electrical Facilities, the BDCP would be compatible with these policies.

25.3.3 Effects and Mitigation Approaches

25.3.3.1 No Action Alternative

Water Supply Facilities

New water supply facilities would be constructed under the No Action Alternative as listed in Table 25-~~9~~10; therefore, there could be a disruption to existing sources of methylmercury associated with this type of construction. Water supply operations under the No Action Alternative likely would not involve the operation of solids lagoons or sedimentation basins; therefore, there would be no increase in the public's risk of exposure to vector-borne diseases. Under the No Action Alternative, there would be a change in various source waters throughout the Delta (i.e., upstream water, Bay water, agricultural return flow), due to potential changes in inflows, particularly from the Sacramento River watershed because of increased water demands or changes to climate and precipitation levels. Water supply operations under the No Action Alternative would continue to use the existing source(s) of drinking water from the study area. These sources generally meet regulatory standards for most constituents or experience some exceedances for constituents such as arsenic (see Chapter 8, *Water Quality*, Section 8.3.3.1). However, under the No Action Alternative, existing exceedances would not increase above baseline conditions (see Chapter 8) to levels that adversely affect any beneficial uses or substantially degrade water quality. Furthermore, drinking water from the study area would continue to be treated prior to distribution into the drinking water system. ~~Therefore, there would be no adverse effect on drinking water due to new water conveyance facilities.~~

Any modified reservoir operations under the No Action Alternative are not expected to promote *Microcystis* production upstream of the Delta since large reservoirs upstream of the Delta are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*. As indicated in Chapter 8, *Water Quality*, modeled hydraulic residence times in the Delta during *Microcystis* bloom season (June through September) would increase somewhat in most Delta areas, with hydraulic residence times in the East Delta having the greatest increase. The changes in hydraulic residence times are driven by several factors accounted for in the modeling, including climate change, sea level rise, and changes in operations and maintenance that affect net Delta outflows. Because the change is relatively small, it is unknown whether the increase in modeled hydraulic residence times expected under the No Action Alternative relative to Existing Conditions would result in measurable increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms throughout the Delta. Projected future water temperature changes in the Delta under the No Action Alternative indicate that water temperatures would increase due to climate change. This increase in temperature could lead to earlier attainment of the water temperature threshold of 19°C required to initiate *Microcystis* bloom formation, and thus earlier occurrences of *Microcystis* blooms in the Delta. As explained in Chapter 8, *Water Quality*, ambient meteorological conditions are anticipated to be the primary driver of the projected increase of water temperatures in the Delta, and not CM1 water operations. However, because it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to increased water temperatures from climate change under the No Action Alternative, long-term water quality degradation may occur in the Delta and water exported from the Delta to the SWP and CVP Export Service Areas. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and, as such, public health could be affected. Accordingly, this would be considered an adverse effect.

Catastrophic Seismic Risks

The Delta and vicinity are within a highly active seismic area, with a generally high potential for major future earthquake events along nearby and/or regional faults, and with the probability for such events increasing over time. Based on the location, extent and non-engineered nature of many existing levee structures in the Delta area, the potential for significant damage to, or failure of, these structures during a major local seismic event is generally moderate to high. In the instance of a large seismic event, levees constructed on liquefiable foundations are expected to experience large deformations (in excess of 10 feet) under a moderate to large earthquake in the region. A major earthquake event could result in breaching/failure of existing levees within the Delta area, with a substantial number of these structures exhibiting moderate to high failure probabilities. The most immediate and significant effect to water quality under such a scenario would be the influx of large volumes of seawater and/or brackish water into the Delta, which would alter the "normal" balance of freshwater/seawater flows and result in flooding of the associated islands. The corresponding shift in Delta water quality conditions would be characterized by an increase in salinity levels, including specific associated constituents such as bromide (which affects total dissolved solids concentrations and can contribute to the formation of undesirable chemical byproducts in treated drinking water). (See Appendix 3E, *Potential Seismic and Climate Change Risks to SWP/CVP Water Supplies* for more detailed discussion). Flooding caused by levee failure could result in a substantial increase in the public's risk of exposure to vector-borne diseases due to large bodies of standing water prior to flood waters being pumped off inundated Delta islands. Additionally, flood events could cause exceedance(s) of water quality criteria for constituents of concern such that an adverse effect would occur to public health from drinking water sources.

CEQA Conclusion: It is expected that implementation of existing plans, or existing and reasonably foreseeable habitat restoration projects, would not result in a substantial increase in the public's risk of exposure to vector-borne diseases because of the location of existing vector habitat, restoration design, and consultation with MVCDs. This is because habitat restoration would be located in areas that are already potential sources of vectors, such as existing channels or agricultural areas. Furthermore, activities would be designed to maximize water exchange and flow, thereby minimizing stagnant water and the production of mosquitoes. Finally, all of the restoration activities would occur in consultation with existing MVCDs. Therefore, it is not expected that habitat restoration under the No Action Alternative would result in a substantial increase in the public's risk of exposure to vector-borne diseases.

Construction impacts associated with No Action Alternative habitat restoration projects would not be adverse because the mobilization of existing sediment-bound contaminants (e.g., methylmercury) would occur during a limited time and would be localized around the area of construction. Once operational, other habitat restoration projects could result in an increase of methylmercury as a result of biogeochemical processes and sediment conditions established in tidal wetlands. However, it is expected these projects either have, or would evaluate the potential for, methylmercury production and would implement measures to monitor and adaptively manage methylmercury production.

Water supply operations under the No Action Alternative would continue to use the existing source(s) of drinking water from the study area. These sources generally meet regulatory standards for most constituents or experience some exceedances for constituents such as arsenic (see Chapter 8, *Water Quality*, Section 8.3.1.16). Under the No Action Alternative, existing exceedances would not increase above baseline conditions (see Chapter 8, Section 8.3.3.1).

It is unknown where new transmission lines would be and if they would be located in close proximity to sensitive receptors (e.g., hospitals, schools, parks); however, it is likely some of them would be within close proximity to sensitive receptors and present new sources of EMFs. Utilities must implement the CPUC design criteria and guidelines regarding EMFs, and CPUC reviews all proposals for transmission lines.

Because it is possible that increases in the frequency, magnitude, and geographic extent of Microcystis blooms in the Delta would occur due to increased water temperatures associated with climate change under the No Action Alternative, long-term water quality degradation may occur in the Delta and in water exported from the Delta to the SWP and CVP Export Service Areas. Thus, impacts on beneficial uses, including drinking water and recreational waters, could occur and could affect public health. As such, this would be considered significant impact.~~It is unknown where new transmission lines would be and if they would be located in close proximity to sensitive receptors (e.g., hospitals, schools, parks); however, it is likely some of them would be within close proximity to sensitive receptors and present new sources of EMFs. Utilities must implement the CPUC design criteria and guidelines regarding EMFs, and CPUC reviews all proposals for transmission lines.~~

~~Therefore, under the No Action Alternative, impacts related to public health would be less than significant.~~

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: Five intakes, up to 15 solids lagoons, ~~and~~ five sedimentation basins, two forebays and a forebay inundation area would be constructed and operated under Alternative 1A. The sedimentation basins would be approximately 120 feet long by 40 feet wide by 55 feet deep, and the solids lagoons would be approximately 165 feet long by 86 feet wide by 10 feet deep. Construction of ~~the~~ intake cofferdams would take place from June through October, and it is expected that dewatering of the cofferdams (i.e., removing water from behind the cofferdams) would occur after the construction of the cofferdams, when generally there are fewer mosquitoes breeding, as mosquitoes in northern California typically breed April–October (Sacramento–Yolo Mosquito and Vector Control District 2008). Under DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement Mosquito Management Plans (MMPs) (Appendix 3B, *Environmental Commitments*). BMPs to be implemented as part of the MMPs would help control mosquitoes and would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). BMP activities will include, but not necessarily be limited to, the following.

- Maintain stable water levels.
- Circulate water to avoid stagnation.
- Implement monitoring and sampling programs to detect early signs of mosquito population problems.
- Use biological agents such as mosquito fish to limit larval mosquito populations.

- Use larvicides and adulticides, as necessary.
- Test for mosquito larvae during the high mosquito season (June through September).
- Reduce or eliminate emergent vegetation in and along the edges of water.
- Manage the spread and density of floating and submerged vegetation that encourages mosquito production.
- ~~Introduce biological controls such as mosquitofish to areas of standing water if mosquitoes are present.~~
- Introduce physical controls to areas of standing water (e.g., discharging water more frequently or increasing circulation) if mosquitoes are present.

Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs.

The sedimentation basins and solids lagoons of Intakes 1 and 2 would be located within 1 mile of Clarksburg, and the sedimentation basins and solids lagoons of Intakes 3 and 4 would be located within 1 mile of Hood. The sedimentation basin and solids lagoons of Intake 5 would be located within 2.5 miles of Hood. The sedimentation basins would have a mat slab foundation and interior concrete walls to create separate sedimentation channels. The solids lagoons would be concrete-lined and approximately 10 feet deep. Up to three solids lagoons would be used in a rotating cycle for each intake, with one basin filling, one settling, and the third being emptied of settled and dewatered solids. The rate of filling and settling would depend on the volume of water pumped by the intakes; however, water would continuously move through the basins at a relatively slow but regulated rate so that the solids and sediments can be removed from the water prior to discharge into the conveyance facilities (~~e.g~~i.e., fall out of the water via gravity) (Figure 25-1). The flow rates would be high enough to prevent water from stagnating, as stagnant water would not facilitate conveying the water to the conveyance system or removing the sediment from the water. As discussed in Section 25.1.1.4, mosquitoes typically prefer shallow stagnant water with little movement. The sedimentation basins and solids lagoons would be considered too deep and have too much regulated water movement to provide suitable mosquito habitat. Furthermore, during sediment drying and basin cleaning operations, flow would be stopped completely and the moisture in the sediment would be reduced to a point at which the sediment would not support insect/mosquito larvae production. Therefore, these basins would not substantially increase suitable vector habitat and would not substantially increase the public's exposure to vector-borne diseases. Accordingly, adverse effects on public health with respect to vector-borne diseases are not expected.

There would be an approximately 350-acre inundation area adjacent to the proposed intermediate forebay to accommodate emergency overflow from the forebay. Water would enter this area only during forebay emergency overflow situations; however, these situations could result in standing water approximately 2 feet deep. While water of this depth would be suitable habitat for mosquitoes, such events would be more likely to occur during high flow events in winter, when fewer mosquitoes are breeding (Sacramento–Yolo Mosquito and Vector Control District 2008). Water in the emergency overflow area would be pumped out and back to the intermediate forebay. The pumping would create circulation that would minimize the amount of suitable habitat for mosquitoes. Because the area would be used only during emergencies and the water would be pumped from the area, the potential for creating suitable mosquito habitat would be low and adverse effects on public health with respect to vector-borne diseases are not expected.

Although the proposed intermediate forebay and Byron Tract Forebay would increase surface water within the study area, it is unlikely that these water bodies would provide suitable breeding habitat for mosquitoes given that the water in these forebays would not be stagnant and would be too deep. However, the shallow edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of these forebay areas, floating vegetation such pond weed would be harvested to maintain flow and forebay capacity. Further, BMPs to control mosquitoes would be implemented as part of this alternative. As such, operation of these forebays is not expected to result in an increase in mosquitoes or vector-borne diseases in the Plan Area.

In summary, although construction and operation of the water conveyance facilities would increase surface water area in the Plan Area and therefore potentially provide habitat for vectors that transmit diseases (e.g., mosquitoes), consultation and coordination with San Joaquin County and Sacramento-Yolo County MVCDs and preparation and implementation of MMPs would ensure that there would be no~~Therefore,~~ adverse effects on public health with respect to mosquito-borne diseases~~ are not expected~~.

CEQA Conclusion: Sedimentation basins, solids lagoons, the Byron Tract Forebay, an intermediate forebay, and the intermediate forebay inundation area have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes reducing the need for local MVCDs to increase abatement activities in response to BDCP operations.~~ During operations, the depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat. Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Furthermore, the 350-acre inundation area adjacent to the intermediate forebay would be limited to forebay emergency overflow situations and water would be physically pumped back to the intermediate forebay, creating circulation such that the area would have a low potential for creating suitable vector habitat. Similarly, water in the intermediate forebay and Byron Tract Forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provided suitable mosquito breeding habitat. However, the shallow edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. As part of the regular maintenance of these forebays, floating vegetation such pond weed would be harvested to maintain flow and forebay capacity.

To minimize the potential for any impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes, thereby reducing the need for local MVCDs to increase abatement activities in response to BDCP operations. These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Therefore, construction and operation of Alternative 1A would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

It remains to be determined whether, or to what degree, the available and existing salinity response and countermeasure actions of SWP and CVP facilities or municipal water purveyors would be capable of offsetting the actual level of changes in bromide that may occur from implementation of Alternative 1A. Therefore, to determine the feasibility of reducing the effects of increased bromide levels, and potential adverse effects on beneficial uses associated with CM1 operations (and hydrodynamic effects of tidal restoration under CM4), the proposed mitigation requires a series of phased actions to identify and evaluate existing and possible feasible actions, followed by development and implementation of the actions, if determined to be necessary. The development and implementation of any mitigation actions shall be focused on those incremental effects attributable to implementation of Alternative 1A operations only. Development of mitigation actions for the incremental bromide effects attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 1A. The goal of specific actions would be to reduce/avoid additional degradation of Barker Slough water quality conditions with respect to the CALFED bromide goal.

Following commencement of initial operations of CM1, the BDCP proponents will conduct additional evaluations described herein, and develop additional modeling (as necessary), to define the extent to which modified operations could reduce or eliminate the increased bromide concentrations currently modeled to occur under Alternative 1A. The additional evaluations should also consider specifically the changes in Delta hydrodynamic conditions associated with tidal habitat restoration under CM4 (in particular the potential for increased bromide concentrations that could result from increased tidal exchange) once the specific restoration locations are identified and designed. If sufficient operational flexibility to offset bromide increases is not practicable/feasible under Alternative 1A operations, achieving bromide reduction pursuant to this mitigation measure would not be feasible under this alternative.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

Any modified reservoir operations under Alternative 1A are not expected to promote *Microcystis* production upstream of the Delta since large reservoirs upstream of the Delta are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*. Further, in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, bloom development would be limited by high water velocity and low hydraulic residence times.

As described in Chapter 8, *Water* Quality, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis*, but the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase *Microcystis* blooms. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 1A would dilute *Microcystis* and microcystins in water diverted from the south Delta. Because the degree to which *Microcystis* blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 1A will result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions are the primary driver of Delta water temperatures, and therefore climate warming, and not water operations, would determine future water temperatures in the Delta. Increasing water temperatures due to climate change could lead to earlier attainment of the water temperature threshold of 19°C required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes under Alternative 1A would not be different from what would occur under the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of hydraulic residence time increases under Alternative 1A. The modeled increase in residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms, and thus microcystin levels, throughout the Delta. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and, as such, public health could be affected. Accordingly, this would be considered an adverse effect.Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 1A, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta because large reservoirs upstream are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*, and high water velocity and low hydraulic residence times in the upstream area limit the development of *Microcystis* blooms. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 1A would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which would result in an increase in the frequency, magnitude and geographic extent of *Microcystis*, and therefore microcystin levels. However, the potential water quality effects due to temperature increases would be due to climate change, not effects resulting from operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would potentially be impacted and therefore, so would public health. Therefore this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** As described in Chapter 8, *Water Quality*, implementation of CM3 and CM6–CM21 is unlikely to affect *Microcystis* abundance in the rivers and reservoirs upstream of the Delta, in the Delta region, or the waters exported to the CVP and SWP service areas. Implementation of CM5, Seasonally Inundated Floodplain Restoration, could result in increased local water temperatures in areas near restored seasonally inundated floodplains. However, floodplain inundation typically occurs during spring and winter months when *Microcystis* growth is limited in general by low water temperatures and by insufficient surface water irradiance. Water temperatures would not increase sufficiently due to floodplain inundation such that effects on *Microcystis* growth would occur. Therefore, implementation of CM5 is unlikely to affect *Microcystis* blooms in the study area. Implementation of CM13, Invasive Aquatic Vegetation Control, may increase turbidity and flow velocity, particularly in restored aquatic habitats, which could discourage *Microcystis* growth in these areas. To the extent that invasive aquatic vegetation (IAV) removal would affect turbidity and water velocity, it is possible that IAV removal could, to some degree, help offset the increase in *Microcystis* production expected under Alternative 1A, relative to the No Action Alternative.

As discussed under Impact PH-8, development of restoration areas under CM2 and CM4 could potentially increase the frequency, magnitude, and geographic extent of *Microcystis* blooms due to the hydrodynamic impacts that are expected to increase hydraulic residence times throughout the Delta. Additionally, restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season, which could result in further degradation of water quality to the extent that beneficial uses are affected. Were *Microcystis* blooms to increase with implementation of CM2 and CM4, there would be an increase in the potential for impacts on public health as a result of potential effects on drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. However this would be an adverse effect.

CEQA Conclusion: Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and hydraulic residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased Microcystis Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: As with Alternative 1A, implementation of CM1 under Alternative 1B would involve construction and operation of five north Delta intakes, up to 15 solids lagoons, ~~and~~ five sedimentation basins, and Byron Tract Forebay. ~~Sedimentation basins and solids lagoons~~These facilities have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, DWR would~~

~~consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction. See Impact PH-1 under Alternative 1A.~~

Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. ~~During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. ~~As described under Alternative 1A, implementation of CM1 under Alternative 1B would not substantially increase suitable vector habitat and would not substantially increase vector-borne diseases. Accordingly, no adverse effects on public health would result.~~

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in this forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity.

Although construction and operation of the water conveyance facilities would increase surface water area in the Plan Area and therefore potentially provide habitat for vectors that transmit diseases (e.g., mosquitoes), DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the water conveyance facilities. These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, construction and operation of the water conveyance facilities under Alternative 1B would not result in a substantial increase in vector-borne diseases and the impact would be less than significant. No mitigation is required.

CEQA Conclusion: As with Alternative 1A, implementation of CM1 under Alternative 1B would involve construction and operation of solids lagoons,~~ and~~ sedimentation basins, and the Byron Tract Forebay. Public exposure to vector-borne diseases would not substantially increase because water depth and ~~movement~~ circulation in sedimentation basins and the Byron Tract Forebay would prevent development of suitable mosquito habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, ~~Furthermore,~~ DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 for Alternative 1A. These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 1B would not result in a substantial increase in vector-borne diseases and the impact would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Water operations under Alternative 1B would be the same as under Alternative 1A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same. Any modified reservoir operations under Alternative 1B are not expected to promote *Microcystis* production upstream of the Delta or in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta.

As described in Chapter 8, Water Quality, Microcystis blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to Microcystis bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by Microcystis. However, the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase Microcystis blooms, as discussed below. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 1B would dilute Microcystis and microcystins in water diverted from the south Delta. Because the degree to which Microcystis blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 1B would result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta. Increasing water temperatures due to climate change could lead to earlier attainment of the water temperature threshold required to initiate Microcystis bloom formation, and therefore earlier occurrences of Microcystis blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Modeled hydraulic residence times in the Delta are projected to increase in the summer and fall periods in the north and west Delta and in the summer in Cache Slough, the east Delta, and south Delta relative to the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of residence time increases under

Alternative 1B. The modeled increase in hydraulic residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of Microcystis blooms, and thus microcystin levels. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to Microcystis. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 1B, operation of the water conveyance facilities is not expected to promote Microcystis bloom formation in the reservoirs and watersheds upstream of the Delta. Microcystis blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to Microcystis bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of Microcystis-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 1B would result in increased or decreased levels of Microcystis and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in Microcystis blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of Microcystis blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to Microcystis. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for Microcystis abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if Microcystis abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce hydraulic residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

NEPA Effects: The amount and location of habitat restoration and enhancement that would occur under Alternative 1B would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage Microcystis growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on Microcystis blooms identified in Impact PH-8. An increase in Microcystis blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on Microcystis from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to Microcystis growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in Microcystis blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on Microcystis from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: As with Alternative 1A, implementation of CM1 under Alternative 1C would involve construction and operation of five north Delta intakes, up to 15 solids lagoons, ~~and~~ five sedimentation basins, and Byron Tract Forebay. Sedimentation basins and solids lagoons near the intakes have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~Activities will include, but not be limited to: testing for mosquito larvae during the high mosquito season (June through September), introducing biological controls such as mosquitofish if mosquitoes are present, and introducing physical controls (e.g., discharging water more frequently or increasing circulation) if mosquitoes are present. During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep.

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in these forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such pond weed would be harvested to maintain flow and forebay capacity.

Although construction and operation of the water conveyance facilities would increase surface water area in the Plan Area and therefore potentially provide habitat for vectors that transmit diseases (e.g., mosquitoes), DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes.These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Activities will include, but not be limited to: testing for mosquito larvae during the high mosquito season (June through September), introducing biological controls such as mosquitofish if mosquitoes are present, and introducing physical controls (e.g., discharging water more frequently or increasing circulation) if mosquitoes are present. Accordingly, as described under Alternative 1A, construction and operation of the intakes, solids lagoons, and/or sedimentation basins under Alternative 1C would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Therefore, no adverse effects would result.

CEQA Conclusion: As with Alternative 1A, implementation of CM1 under Alternative 1C would involve construction and operation of solids lagoons~~, and~~ sedimentation basins and Byron Tract Forebay. These areas could provide suitable habitat for vectors (i.e., mosquitoes). ~~However,~~ During operations, water depth and circulation would prevent the solids lagoons and sedimentation basins from substantially increasing suitable vector habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012).Accordingly, construction and operation of the water conveyance facilities under Alternative 1C would not result in a substantial increase in vector-borne diseases and the impact would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

***NEPA Effects*:** Water operations under Alternative 1C would be the same as under Alternative 1A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same. Any modified reservoir operations under Alternative 1C are not expected to promote *Microcystis* production upstream of the Delta or in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta.

As described in Chapter 8, *Water* Quality, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis*. However, the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase *Microcystis* blooms, as discussed below. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 1C would dilute *Microcystis* and microcystins in water diverted from the south Delta. Because the degree to which *Microcystis* blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 1C would result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta.

Increasing water temperatures due to climate change could lead to earlier attainment of the water temperature threshold required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Modeled hydraulic residence times in the Delta are projected to increase in the summer and fall periods in the north and west Delta and in the summer in Cache Slough, the east Delta, and south Delta relative to the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of residence time increases under Alternative 1C. The modeled increase in residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms, and thus microcystin levels. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and public health could be affected. Accordingly, this would be considered an adverse effect.

Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 1C, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 1C would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

NEPA Effects: The amount and location of habitat restoration and enhancement that would occur under Alternative 1C would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage Microcystis growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on Microcystis blooms identified in Impact PH-8. An increase in Microcystis blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on Microcystis from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to Microcystis growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in Microcystis blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on Microcystis from increased local water temperatures and hydraulic residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: As with Alternative 1A, implementation of CM1 under Alternative 2A would involve construction and operation of up to 15 solids lagoons, five sedimentation basins, Byron Tract Forebay, an intermediate forebay, and a 350-acre inundation area adjacent to the intermediate forebay. Sedimentation basins, solids lagoons, ~~and a 350-acre~~the intermediate forebay inundation area, and the periphery of the intermediate forebay and Byron Tract Forebay ~~adjacent to the intermediate forebay~~ have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, .~~ ~~Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be approximately 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be approximately 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the 350-acre inundation area would be limited to forebay emergency overflow situations and water would be ~~physically~~ pumped, creating circulation such that the area would have a low potential for creating suitable vector habitat. Similarly, water in the intermediate forebay and the Byron Tract Forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012).Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Therefore, as described under Alternative 1A, construction and operation of the intakes, solids lagoons, ~~and/or~~ sedimentation basins, the forebays, and the intermediate forebay inundation area under Alternative 2A would not substantially increase suitable vector habitat and would not substantially increase vector-borne diseases. Accordingly, no adverse effects on public health would result.

CEQA Conclusion: As with Alternative 1A, implementation of CM1 under Alternative 2A would involve construction and operation of solids lagoons, sedimentation basins, an intermediate forebay and associated 350-acre inundation area, and Byron Tract Forebay ~~adjacent to the intermediate forebay~~. While these ~~areas~~ facilities could provide suitable habitat for vectors (e.g., mosquitoes), water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. ~~In addition,~~ The inundation area would only be used during emergency overflow situations and water would be pumped back into the intermediate forebay, creating circulation that would discourage mosquito breeding. The shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Accordingly, construction and operation of the water conveyance facilities ~~in~~under Alternative 2A would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

***NEPA Effects*:** Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 2A, *Microcystis* abundance, and thus microcystins concentrations, in water bodies of the affected environment under Alternative 2A would be very similar (i.e., nearly the same) to those discussed for Alternative 1A.

As described in Chapter 8, Water Quality, although Microcystis blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 2A may become more conducive to Microcystis bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 2A, which could lead to earlier occurrences of Microcystis blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, Water Quality, the increase in Delta water temperatures, and consequent potential increase in Microcystis blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of hydraulic residence time changes during the Microcystis bloom period due to operation of the water conveyance facilities under Alternative 2A compared to Alternative 1A, relative to the No Action Alternative. As a result, Microcystis blooms, and therefore microcystin, could increase in surface waters throughout the Delta. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality in the Delta. Although there is uncertainty regarding this impact, the effects on Microcystis from implementing CM1 is determined to be adverse.

CEQA Conclusion: Under Alternative 2A, operation of the water conveyance facilities is not expected to promote Microcystis bloom formation in the reservoirs and watersheds upstream of the Delta. Microcystis blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to Microcystis bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of Microcystis-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 2A would result in increased or decreased levels of Microcystis and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in Microcystis blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of Microcystis blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to Microcystis. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for Microcystis abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if Microcystis abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 2A would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 2A are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: As with Alternative 1A, implementation of CM1 under Alternative 2B would involve construction and operation of up to 15 solids lagoons~~, and~~ 5 sedimentation basins and Bryon Tract Forebay. ~~Sedimentation basins and solids lagoons~~These facilities have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, During operation, the depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying.~~ Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying.

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in this forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity.

To minimize the potential for causing impacts related to increasing suitable mosquito habitat in the Plan Area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, as described for Alternative 1A, construction and operation of the ~~intakes, solids lagoons, and/or sedimentation basins~~water conveyance facilities under Alternative 2B would not substantially increase suitable vector habitat and would not substantially increase vector-borne diseases. No adverse effects would result.

CEQA Conclusion: As with Alternative 1A, implementation of CM1 under Alternative 2B would involve construction and operation of solids lagoons, ~~lagoons, and~~ sedimentation basins, and the Byron Tract Forebay. These areas could provide suitable habitat for vectors (e.g., mosquitoes).

~~However, ~~During operations, water depth and circulation would prevent these areas from substantially increasing suitable vector habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 2B would not result in a substantial increase in vector-borne diseases and the impact would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Water operations under Alternative 2B would be the same as under Alternative 2A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same.

Any modified reservoir operations under Alternative 2B are not expected to promote *Microcystis* production in waters upstream of the Delta. As described in Chapter 8, *Water Quality*, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis*. However, the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase *Microcystis* blooms, as discussed below. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 2B would dilute *Microcystis* and microcystins in water diverted from the south Delta. Because the degree to which *Microcystis* blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 2B would result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta. Increasing water temperatures could lead to earlier attainment of the water temperature threshold required to initiate Microcystis bloom formation, and therefore earlier occurrences of Microcystis blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of hydraulic residence time increases under Alternative 2B. The modeled increase in residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of Microcystis blooms, and thus microcystin levels. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and public health could be affected. Accordingly, this would be considered an adverse effect.

Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to Microcystis. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 2B, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 2B would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, there could be potential impacts on public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 2B would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 2B are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

25.3.3.7 Alternative 2C—Dual Conveyance with West Alignment and Intakes W1–W5 (15,000 cfs; Operational Scenario B)

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: As with Alternative 1A, implementation of CM1 under Alternative 2C would involve construction and operation of five north Delta intakes; up to 15 solids lagoons; ~~and~~ five sedimentation basins; and Byron Tract Forebay. ~~Sedimentation basins and solids lagoons~~These facilities have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, During operation t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep.

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in this forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity.

To minimize the potential for impacts related to increasing suitable mosquito habitat in the Plan Area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, as described for Alternative 1A, construction and operation of the intakes, solids lagoons, and/or sedimentation basins under Alternative 2C would not substantially increase suitable vector habitat and would not substantially increase vector-borne diseases. Accordingly, there would be no adverse effects on public health.

CEQA Conclusion: As with Alternative 1A, implementation of CM1 under Alternative 2C would involve construction and operation of solids lagoons,~~ and~~ sedimentation basins, and Byron Tract Forebay. These areas could provide suitable habitat for vectors (e.g., mosquitoes). ~~DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 under Alternative 1A.~~ During operations, water depth and circulation would prevent these areas from substantially increasing suitable vector habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 under Alternative 1A. These BMPs would be consistent practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 2C would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Water operations under Alternative 2C would be the same as under Alternative 2A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same.

Any modified reservoir operations under Alternative 2C are not expected to promote *Microcystis* production in waters upstream of the Delta. As described in Chapter 8, *Water* Quality, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis*. However, the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase *Microcystis* blooms, as discussed below. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 2C would dilute *Microcystis* and microcystins in water diverted from the south Delta. Because the degree to which *Microcystis* blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 2C would result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta. Increasing water temperatures could lead to earlier attainment of the water temperature threshold required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of hydraulic residence time increases under Alternative 2C. The modeled increase in residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms, and thus microcystin levels. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 2C, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 2C would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, there could be potential impacts on public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 2C would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters.   Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 2C are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with the Water Conveyance Facilities

NEPA Effects: Alternative 3 would be similar to Alternative 1A, but the water conveyance facilities would involve construction and operation of up to six solids lagoons, two sedimentation basins, Byron Tract Forebay, an intermediate forebay, and a 350-acre inundation area adjacent to the intermediate forebay. The mechanisms for potential public health effects from construction and operation of the water conveyance facilities are similar to those described for Alternative 1A. Specifically, sedimentation basins, solids lagoons, the intermediate forebay and associated the inundation area, and Byron Tract Forebay have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas.

However, During operation, tThe depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the 350-acre inundation area would be limited to forebay emergency overflow situations and water would be physically pumped back to the intermediate forebay, creating circulation such that the area would have a low potential for creating suitable vector habitat. Similarly, water in the Byron Tract Forebay and intermediate forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012).Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Therefore, Alternative 3 would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Accordingly, no adverse effects on public health would result.

CEQA Conclusion: Implementation of CM1 under Alternative 3 would involve construction and operation of an intermediate forebay and associated 350-acre inundation area~~adjacent to the intermediate forebay~~, and Bryon Tract Forebay, but fewer solids lagoons and sedimentation basins would be constructed under this alternative relative to Alternative 1A. These areas could provide suitable habitat for vectors (e.g., mosquitoes). ~~However,~~ During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. However, the shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 3 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 3, *Microcystis* abundance, and thus microcystin concentrations, in water bodies of the affected environment under Alternative 3 would be very similar (i.e., nearly the same) to those discussed for Alternative 1A.

As described in Chapter 8, Water Quality, although Microcystis blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 3 may become more conducive to Microcystis bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities. Under Alternative 3, relative to No Action Alternative, water exported to the SWP/CVP Export Service Area will be a mixture of Microcystis-affected source water from the south Delta intakes and unaffected source water from the Sacramento River, diverted at the north Delta intakes. It cannot be determined whether operations and maintenance under Alternative 3 will result in increased or decreased levels of Microcystis and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 3, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water*

Quality, the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 3 compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta. ***CEQA Conclusion:*** Under Alternative 3, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 3 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 3 would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 3 are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: Alternative 4 would involve construction and operation of three intakes (Intakes 2, 3, and 5);~~,~~ ~~up to nine solids lagoons, three~~ six sedimentation basins;~~,~~ 12 solids lagoons; a 24~~5~~3-acre intermediate forebay with a water surface area of 37~~4~~1~~0~~ acres, ~~and~~ a ~~125~~131-acre inundation (emergency overflow) area adjacent to the intermediate forebay on Glannvale Tract, and an expanded Clifton Court Forebay. The Clifton Court Forebay would be expanded by approximately 590 acres; the north cell of the expanded Clifton Court Forebay would have a surface area of approximately 806 acres at maximum operation level, and the south cell would have surface area of approximately 1,691 acres. A map and a schematic diagram depicting the conveyance facilities associated with Alternative 4 are provided in Figures 3-2 and 3-9. Figure 3-2 shows the major construction features (including work and borrow/spoil areas) associated with this proposed water conveyance facility alignment; a detailed depiction is provided in Figure M3-4 in the Mapbook Volume.

Each intake site would require a temporary cofferdam to create a dewatered construction area encompassing the entire intake site. Construction of the cofferdams would take place from June through October, and it is expected that dewatering of the cofferdams (i.e., removing water from behind the cofferdams) would occur after the construction of the cofferdams, when generally there are fewer mosquitoes breeding, as mosquitoes in northern California typically breed April–October (Sacramento–Yolo Mosquito and Vector Control District 2008).

S~~In addition, s~~edimentation basins, solids lagoons, ~~and~~ the intermediate forebay inundation area, the periphery of the intermediate forebay, and the expanded Clifton Court Forebay have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (see Chapter 3, Section 3.6.1 ~~Figure 25-1~~). Specifically, the basins would be too deep (25 feet) and the constant movement of water would prevent mosquitoes from breeding and multiplying. The ~~S~~sedimentation basins would be triangular in shape and would be approximately 250 to 677 feet wide (with the maximum width facing the intake channels), 660 feet long ~~would be divided into three sedimentation channels. Each channel would be 500 feet long by 200 feet wide by~~and 2~~3~~5 feet deep.~~,~~ ~~and~~ ~~s~~Solids lagoons would be approximately 160 feet wide at the bottom, and 350 feet long.~~be 400 feet long by 200 feet~~ The lagoons would be ~~wide by~~ 15 feet deep. ~~Furthermore, u~~Use of the inundation area adjacent to the intermediate forebay would be limited to forebay emergency overflow situations and water would be physically pumped back to the intermediate forebay, creating circulation such that the area would have a low potential for creating suitable vector habitat. Similarly, water in the intermediate forebay and the expanded Clifton Court Forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito breeding habitat.

The sedimentation basins and solids lagoons ~~of~~ at Intake 2 would be located within 1 mile of and across the Sacramento River from Clarksburg, and the sedimentation basins and solids lagoons ~~of~~ at Intake 3 would be located within 1 mile of Hood. The sedimentation basins and solids lagoons ~~of~~ at

Intake 5 would be located within 1.5 miles (south) of Hood and 2 miles (north) of Courtland. The sedimentation basins would have a mat slab foundation and interior concrete walls to create separate sedimentation channels. The solids lagoons would be concrete-lined and approximately 10 feet deep. Up to three solids lagoons would be used in a rotating cycle for each intake, with one basin filling, one settling, and the third being emptied of settled and dewatered solids. The rate of filling and settling would depend on the volume of water pumped by the intakes; however, water would continuously move through the basins at a relatively slow but regulated rate so that the solids and sediments can be removed from the water, via settling, prior to discharge into the conveyance facilities (Figure 25-1). The flow rates would be high enough to prevent water from stagnating, as stagnant water would not facilitate conveying the water to the conveyance system or removing the sediment from the water. As discussed in Section 25.1.1.4, mosquitoes typically prefer shallow stagnant water with little movement. The sedimentation basins and solids lagoons would be considered too deep and have too much regulated water movement to provide suitable mosquito habitat. Furthermore, during sediment drying and basin cleaning operations, flow would be stopped completely and the moisture in the sediment would be reduced to a point at which the sediment would not support insect/mosquito larvae production. Therefore, it is anticipated that these basins would not substantially increase suitable vector habitat and would not substantially increase the public's exposure to vector-borne diseases. Accordingly, adverse effects are not expected.

There would be an approximately ~~125~~131-acre inundation area adjacent to the 24~~5~~3-acre intermediate forebay to accommodate emergency overflow from the forebay. Water would enter this inundation area only during forebay emergency overflow situations; however, these situations could result in standing water approximately 2 feet deep. While water of this depth would be suitable habitat for mosquitoes, such events would be more likely to occur during high flow events in winter, when fewer mosquitoes are breeding (Sacramento–Yolo Mosquito and Vector Control District 2008). Water in the emergency overflow area would be pumped out and back to the intermediate forebay once the danger of overflow has passed. This pumping would create circulation that would minimize the amount of suitable habitat for mosquitoes. Because the area would be used only during emergencies and the water would be pumped from the area, the potential for creating suitable mosquito habitat would be low. Therefore, adverse effects are not expected.

Although the proposed intermediate forebay and the expanded Clifton Court Forebay will increase surface water within the study area, it is unlikely that these water bodies would provide suitable breeding habitat for mosquitoes given that the water in these forebays would not be stagnant and would be too deep. However, the shallow edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of these forebay areas, floating vegetation such pond weed would be harvested to maintain flow and forebay capacity. Further, BMPs to control mosquitoes would be implemented as part of this alternative. As such, the intermediate forebay and the expanded Clifton Court Forebay would not likely increase mosquito breeding habitat in the Plan Area.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs, as necessary, to control mosquitoes and reduce the likelihood that construction and operation of the water conveyance facilities would require an increase in mosquito abatement activities by the local MVCDs (Appendix 3B, *Environmental Commitments*). BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the sedimentation basins, solids lagoons, ~~and~~ intermediate forebay, intermediate forebay inundation area, and the expanded Clifton Court Forebay. BMP activities would be consistent with the CDPH's *Best Management Practices for Mosquito Control* plan (described in Section 25.2.3.4) include, but not necessarily be limited to, the following.

- Maintain stable water levels.
- Circulate water.
- Implement monitoring and sampling programs to detect early signs of mosquito population problems.
- Use biological agents such as mosquito fish to limit larval mosquito populations, and introduce biological agents to areas of standing water if mosquitoes are present.
- Use larvicides and adulticides, as necessary.
- Test for mosquito larvae during the high mosquito season (June through September).
- Reduce or eliminate emergent vegetation in and along the edges of water
- ~~Introduce biological controls such as mosquitofish to areas of standing water if mosquitoes are present.~~
- Introduce physical controls to areas of standing water (e.g., discharging water more frequently or increasing circulation) if mosquitoes are present.

Accordingly, Alternative 4 would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. No adverse effects on public health would result.

CEQA Conclusion: Sedimentation basins, solids lagoons, and the intermediate forebay inundation area have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. However, during operations, the depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat. Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Furthermore, the 131~~25~~-acre inundation area adjacent to the intermediate forebay would be limited to forebay emergency overflow situations and water would be ~~physically~~ pumped back to the intermediate forebay, creating circulation such that the area would have a low potential for creating suitable vector habitat. In addition, although the proposed intermediate forebay and the expanded Clifton Court Forebay would increase surface water within the study area, it is unlikely that these water bodies would provide suitable breeding habitat for mosquitoes given that the water in these forebays would not be stagnant and would be too deep. However, the shallow edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

~~Further, D~~To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes during construction and operation of the sedimentation basins, solids lagoons, the expanded Clifton Court Forebay, the intermediate forebay, and the intermediate forebay inundation area. Therefore, construction and operation of Alternative 4 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Facilities under Alternative 4 would be operated to provide diversions up to a total of 9,000 cfs from the new north Delta intakes. Alternative 4 water conveyance operations would follow the guidelines described as Operational Scenario H and would include criteria for north Delta diversion bypass flows; south Delta OMR flows; south Delta E/I Ratio; flows over Fremont Weir into Yolo Bypass; Delta inflow; Delta outflow, as determined by the outcome of a decision tree process needed to account for uncertainties related to delta smelt and longfin smelt flow requirements; Delta Cross Channel gate operations; Rio Vista minimum in-stream flow; operations for Delta water quality and residence; and water quality for agricultural and municipal/industrial diversions. These criteria are discussed in detail in Chapter 3, *Description of Alternatives*, Section 3.6.4.2.

NEPA Effects:

Disinfection Byproducts

As described in Chapter 8, *Water Quality*, modeling scenarios included assumptions regarding how certain habitat restoration activities (CM2 and CM4) would affect Delta hydrodynamics. To the extent that restoration actions alter hydrodynamics within the Delta region, which affects mixing of source waters, these effects are included in this assessment of operations-related water quality changes (i.e., CM1).

Changes to DOC and bromide concentrations and, by extension, DBPs, under Alternative 4 operational scenarios (H1–H4) suggest that there would not be exceedances of DBP criteria due to operations, because long-term average DOC and bromide concentrations would be only slightly higher under this alternative relative to the No Action Alternative. For all of the operational scenarios relative to the No Action Alternative, the modeled DOC effects would be greatest at Franks Tract, Rock Slough, and Contra Costa Pumping Plant Number 1. Increased long-term average DOC concentrations at these locations would be greatest under Scenario H4 and would be least under Scenario H1, although differences would generally be small (i.e., ≤0.2 mg/L). Under Scenario H4, maximum increases of DOC would be ≤12% for these locations. In addition, relative to the No Action Alternative, the frequency which long-term average DOC concentrations would exceed 4 mg/L during the modeled drought period at Buckley Cove would increase by 8%. In general, substantial change in ambient DOC concentrations would need to occur before significant changes in drinking water treatment plant design or operations are triggered. The increases in long-term average DOC concentrations estimated to occur at various Delta locations under the four alternative operational scenarios of Alternative 4 are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment for DOC removal above levels currently employed.

Under operational Scenarios H1-H4, modeled long-term average bromide concentrations would increase at Buckley Cove, Staten Island, Emmaton, and Barker Slough, and would decrease at other assessment locations, relative to the No Action Alternative. Overall effects would be greatest under Scenario H2 at Barker Slough, source of the North Bay Aqueduct, where long-term average concentrations are predicted to increase by 44% (97% during the drought period). Although Scenario H2 would result in the greatest relative increase in long-term average bromide concentrations at Barker Slough, the difference between operational scenarios is very small (see Chapter 8, Water Quality, Section 8.3.3.9, for detail). Regardless of particular Alternative 4 operational scenario, the increase in long-term average bromide concentrations at Barker Slough could necessitate changes in water treatment plant operations or require treatment plant upgrades in order to maintain DBP compliance.

Important to the results presented above is the assumed habitat restoration footprint on both the temporal and spatial scales incorporated into the modeling. Modeling sensitivity analyses have indicated that habitat restoration (which is reflected in the modeling—see Section 8.3.1.3), not operations covered under CM1, are the driving factor in the modeled bromide increases. The timing, location, and specific design of habitat restoration will have effects on Delta hydrodynamics, and any deviations from modeled habitat restoration and implementation schedule will lead to different outcomes. Although habitat restoration near Barker Slough is an important factor contributing to modeled bromide concentrations at the North Bay Aqueduct, BDCP habitat restoration elsewhere in the Delta can also have large effects. Because of these uncertainties, and the possibility of adaptive management changes to BDCP restoration activities, including location, magnitude, and timing of restoration, the estimates are not predictive of the bromide levels that would actually occur in Barker Slough or elsewhere in the Delta.

The Stage 1 Disinfectants and Disinfection Byproduct Rule, adopted by EPA in 1998 as part of the SDWA, requires drinking water utilities to reduce TOC concentrations by specified percentages prior to disinfection. These requirements were adopted because organic carbon, such as DOC, can react with disinfectants during the water treatment disinfection process to form DBPs such as THMs and HAAs, which can pose potential lifetime carcinogenic risks to humans. Water treatment plants that utilize Delta water are designed and operated to meet EPA's 1998 requirements based on the ambient concentrations and seasonal variability that currently exists in the Delta. Ambient DOC and bromide concentrations would need to change substantially to trigger significant changes in plant design or operations. Although the increases in long-term average DOC and bromide concentrations estimated to occur at most modeled Delta locations under Alternative 4 operational scenarios are of sufficiently small magnitude that they would not require existing drinking water treatment plants to substantially upgrade treatment, the modeled average bromide concentration increase predicted for the North Bay Aqueduct at Barker Slough could necessitate upgrades or changes in operations at certain water treatment plants, and this would be considered an adverse effect.

While treatment technologies sufficient to achieve the necessary bromide removal exist, implementation of such technologies would likely require substantial investment in new or modified infrastructure. Should treatment plant upgrades not be undertaken, a change of such magnitude in long-term average bromide concentrations in drinking water sources would represent an increased risk for adverse effects on public health from DBPs in drinking water sources. Mitigation Measure WQ-5 is available to reduce these effects (implementation of this measure along with a separate, non-environmental commitment as set forth in EIR/EIS Appendix 3B, *Environmental Commitments*, relating to the potential increased treatment costs associated with bromide-related changes would reduce these effects). Further, DWR issued a Notice of Preparation on December 2, 2009 to construct and operate the AIP that would establish an alternative surface water intake on the Sacramento River upstream of the Sacramento Regional Wastewater Treatment Plant discharge. The AIP would connect to the existing North Bay Aqueduct system by a new segment of pipe. The proposed alternative intake would be operated in conjunction with the existing North Bay Aqueduct intake at Barker Slough. The proposed project would be designed to improve water quality and to provide reliable deliveries of SWP supplies to its contractors, the Solano County Water Agency and the Napa County Flood Control and Water Conservation District. The timing of DWR's implementation of the AIP is uncertain at this time. The adverse water quality effects on the North

Bay Aqueduct at Barker Slough due to increased bromide may be minimized by implementation of the AIP.

Trace Metals

Water quality modeling results indicate that water conveyance facilities operations would not substantially change concentrations of metals of primarily human health and drinking water concern (arsenic, iron, manganese) in Delta waters relative to the No Action Alternative. The arsenic criterion was established to protect human health from the effects of long-term chronic exposure, while secondary ~~maximum contaminant level~~MCLs for iron and manganese were established as reasonable federal regulatory goals for drinking water quality, and enforceable standards in California. Average concentrations for arsenic, iron, and manganese in the primary source water (Sacramento River, San Joaquin River, and the bay at Martinez) are below these criteria. No mixing of these three source waters could result in a metal concentration greater than the highest source water concentration, and, given that the modeled average water concentrations for arsenic, iron, and manganese do not exceed water quality criteria, more frequent exceedances of drinking water criteria in the Delta would not be an expected result under this alternative. Accordingly, no adverse effect on public health related to the trace metals arsenic, iron, or manganese from drinking water sources is anticipated.

Pesticides

Sources of pesticides to the study area include direct input of surface runoff from in-Delta agriculture and Delta urbanized areas as well as inputs from rivers upstream of the Delta. These sources would not be affected by implementing Alternative 4. However, under Alternative 4 Scenarios H1-H4, the distribution and mixing of Delta source waters would change. Changes in source water fractions at the modeled Delta assessment locations would vary depending on operational scenario, but relative differences between the operational scenarios would be small. As described in Chapter 8, *Water Quality* (Section 8.3.3.9), at most modeled Delta locations, these modeled changes in the source water fractions of Sacramento, San Joaquin and Delta agriculture water would not be of sufficient magnitude to substantially increase pesticide concentrations in Delta waters and would not adversely affect beneficial uses of the Delta relative to the No Action Alternative. However, depending on operational scenario, modeled San Joaquin River fractions at Buckley Cove would increase between 16–17% in July (31–34% for the modeled drought period) and 24–25% in August (47–49% for the modeled drought period). These increases would primarily balance through decreases in Sacramento River and eastside tributary waters. While the source water and potential pesticide related toxicity co-occurrence predictions do not mean adverse effects would occur, such considerable modeled increases in summer San Joaquin River source water fraction for all operational scenarios at Buckley Cove could substantially alter the long-term risk of pesticide-related toxicity to aquatic life, given the apparent greater incidence of pesticides in the San Joaquin River. A conclusion regarding the risk to human health at this location, based on the predicted adverse effects from pesticides on aquatic life, cannot be made. However, because the modeled increase would only occur at one location, and over a very short period during the year, it is expected that the potential for affecting public health would be relatively low. Additionally, the prediction of adverse effects of pesticides relative to the No Action Alternative fundamentally assumes that the present pattern of pesticide incidence in surface water would occur at similar levels into the future. In reality, the makeup and character of the pesticide use market during the late long-term would not be exactly as it is today. Use of chlorpyrifos and diazinon is on the decline with their replacement by pyrethroids on the rise (see Chapter 8, *Water Quality*, Section 8.1.3.13, for a detailed discussion on pesticide fate and transport in the Delta). Yet in this assessment it is the apparent greater incidence of diazinon and chlorpyrifos in the San Joaquin River that serves as the basis for concluding that substantially increased San Joaquin River source water fraction would correspond to an increased risk of pesticide-related toxicity to aquatic life. Furthermore, drinking water from the study area would continue to be treated prior to distribution into the drinking water system, and water treatment plants are required to meet drinking water requirements set forth in the California Safe Drinking Water Act (Health and Safety Code Section 116275 et seq.) and the regulations adopted by CDPH. Therefore, it is not anticipated that there would be adverse effects on public health related to pesticides from drinking water sources.

CEQA Conclusion: Under Alternative 4, water supply operations would increase contributions from the San Joaquin River relative to the Sacramento River, and decrease the dilution capacity of the Sacramento River for contaminants. This could result in changes in water quality. Water quality modeling results (Chapter 8, *Water Quality*, Section 8.3.3.9) indicate that changes in flows under Alternative 4 operational scenarios would not, for the most part, result in increased exceedances of water quality criteria for constituents of concern (DBPs, trace metals and pesticides) in the study area. Long-term average DOC concentrations for the modeled 16-year hydrologic period and the modeled drought period would be predicted to increase by ≤14%. Under Scenario H4, increases in long-term average DOC concentrations at Franks Tract, Rock Slough, and Contra Costa Pumping Plant would correspond to more frequent concentration threshold exceedances, with the greatest change occurring at Rock Slough and Contra Costa Pumping Plant (see Chapter 8, Water Quality, Section 8.3.3.9). However, this predicted change would not be expected to adversely affect MUN beneficial uses, or any other beneficial use.

Further, relative to Existing Conditions, Scenario H1-H4 long-term average bromide concentrations would increase at the North Bay Aqueduct at Barker Slough, Staten Island, and Emmaton on the Sacramento River under Alternative 4. Overall effects would be greatest at Barker Slough, with the smallest model predicted increases occurring under Scenario H3 (21%; 72% increase during the drought period), and the largest model predicted increases occurring under Scenario H2 (40%;98% increase during the drought period). The increase in long-term average bromide concentrations predicted for Barker Slough would result in a substantial change in source water quality to existing drinking water treatment plants drawing water from the North Bay Aqueduct. These modeled increases in bromide at Barker Slough could contribute to~~lead to adverse changes in~~ the formation of DBPs and could potentially result in an exceedance of the MCL for DBPs at drinking water treatment plants ultimately resulting in impacts on public health. Accordingly, this would be a significant impact.

The increase in bromide concentrations in drinking water sources could require considerable water treatment plant upgrades in order to achieve equivalent levels of drinking water health protection. While treatment technologies sufficient to achieve the necessary bromide removal exist, implementation of such technologies would likely require substantial investment in new or modified infrastructure. Should treatment plant upgrades not be undertaken, a change of such magnitude in long-term average bromide concentrations in drinking water sources would represent an increased risk for adverse effects on public health from DBPs in drinking water sources. Assuming the adverse water quality effects on the North Bay Aqueduct at Barker Slough may be avoided or minimized by implementation of the AIP, the potential adverse water quality effects on the municipal beneficial uses potentially provided in Barker Slough would remain significant.

~~such that considerable water treatment plant upgrades would be necessary in order to achieve equivalent levels of drinking water health protection. This would be a significant impact.~~

Implementation of Mitigation Measure WQ-5 would reduce the severity of this impact. The proposed mitigation requires a series of phased actions to identify and evaluate existing and possible feasible actions to avoid, minimize, or offset increased bromide concentrations, followed by development and implementation of the actions, if determined to be necessary. ~~While treatment technologies sufficient to achieve the necessary bromide removal exist, implementation of such technologies would likely require substantial investment in new or modified infrastructure. Should treatment plant upgrades not be undertaken, a change of such magnitude in long-term average bromide concentrations in drinking water sources would represent an increased risk for adverse effects on public health from DBPs in drinking water sources. Assuming the adverse water quality effects on the North Bay Aqueduct at Barker Slough may be avoided or minimized by implementation of the AIP, the potential adverse water quality effects on the municipal beneficial uses potentially provided in Barker Slough would remain significant. While Mitigation Measure WQ-5 may reduce this impact~~However, the feasibility and effectiveness of this mitigation measure are uncertain based on currently available information.

In addition to and to supplement Mitigation Measure WQ-5, the BDCP proponents have incorporated into the BDCP, as set forth in EIR/EIS Appendix 3B, *Environmental Commitments*, a separate, non-environmental commitment to address the potential increased water treatment costs that could result from bromide-related concentration effects on municipal water purveyor operations. Potential options for making use of this financial commitment include funding or providing other assistance towards implementation of the North Bay Aqueduct AIP, acquiring alternative water supplies, or other actions to indirectly reduce the effects of elevated bromide and DOC in existing water supply diversion facilities. Please refer to Appendix 3B, *Environmental Commitments*, for the full list of potential actions that could be taken pursuant to this commitment in order to reduce the water quality treatment costs associated with water quality effects relating to chloride, electrical conductivity, and bromide. Because the BDCP proponents cannot ensure that the results of coordinated actions with water treatment entities will be fully funded or implemented successfully prior to the project's contribution to the impact, the ability to fully mitigate this impact is uncertain. If a solution that is identified by the BDCP proponents and an affected water purveyor is not fully funded, constructed, or implemented before the project's contribution to the impact is made, a significant impact in the form of increased DBP in drinking water sources could occur. Accordingly, this impact would be significant and unavoidable. If, however, all financial contributions, technical contributions, or partnerships required to avoid significant impacts prove to be feasible and any necessary agreements are completed before the project's contribution to the effect is made, impacts would be less than significant.

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

It remains to be determined whether, or to what degree, the available and existing salinity response and countermeasure actions of SWP and CVP facilities or municipal water purveyors would be capable of offsetting the actual level of changes in bromide that may occur from implementation of Alternative 4. Therefore, in order to determine the feasibility of reducing the effects of increased bromide levels, and potential adverse effects on beneficial uses associated with CM1 operations (and hydrodynamic effects of tidal restoration under CM4), the proposed mitigation requires a series of phased actions to identify and evaluate existing and possible feasible actions, followed by development and implementation of the actions, if determined to be necessary. The development and implementation of any mitigation actions shall be focused on those incremental effects attributable to implementation of Alternative 4 operations only. Development of mitigation actions for the incremental bromide effects attributable to climate change/sea level rise are not required because these changed conditions would occur with or without implementation of Alternative 4. The goal of specific actions would be to reduce/avoid additional degradation of Barker Slough water quality conditions with respect to the CALFED bromide goal.

BDCP proponents shall also consider effects of site-specific restoration areas proposed under CM4 on bromide concentrations in Barker Slough. Design and siting of restoration areas shall attempt to reduce potential effects to the extent possible without compromising proposed benefits of the restoration areas. It is anticipated that these efforts will be able to reduce the level of projected increase, though it is unknown whether it would be able to completely eliminate any increases.

In addition, ~~Following~~following commencement of initial operations of CM1, the BDCP proponents will conduct additional evaluations described herein, and develop additional modeling (as necessary), to define the extent to which modified operations could reduce or eliminate the increased bromide concentrations currently modeled to occur under Alternative 4. The additional evaluations should also consider specifically the changes in Delta hydrodynamic conditions associated with tidal habitat restoration under CM4 (in particular the potential for increased bromide concentrations that could result from increased tidal exchange) once the specific restoration locations are identified and designed. The evaluations will also consider up-to-date estimates of climate change an sea level rise, if and when such information is available.

If sufficient operational flexibility to offset bromide increases is not practicable/feasible under Alternative 4 operations, and/or siting and design of restoration areas cannot feasibly reduce bromide increases to a less than significant level without compromising the benefits of the proposed areas ~~achieving~~, achieving bromide reduction pursuant to this mitigation measure would not be feasible under this alternative.

Impact PH-3: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Construction, Operation or Maintenance of the Water Conveyance Facilities

NEPA Effects: Three intakes would be constructed and operated under Alternative 4. ~~s~~Sediment-disturbing activities during construction and maintenance of these intakes and other water conveyance facilities proposed near or in surface waters under this alternative~~Alternative 4~~ could result in the disturbance of existing constituents in sediment, such as pesticides or methylmercury.~~, in.~~ In-channel construction activities, such as pile driving during the construction of cofferdams at the intakes and pier construction at the barge unloading facilities, which would occur ~~during a~~over a period of 5~~-~~ months~~ time window~~, would result in the localized disturbance of river sediment. In addition, maintenance of the ~~five~~ three proposed north Delta intakes and the intermediate forebay would entail periodic dredging for sediment removal at these locations. Sediment accumulation in both the northern and southern portion of the expanded Clifton Court Forebay is expected to be minimal over the 50-year permit period. However, it is anticipated that there may be some sediment accumulation at the inlet structure of the northern portion of Clifton Court Forebay. Therefore, while overall sediment accumulation in this forebay is not expected to be substantial, some dredging may be required at the inlet structure to maintain an even flow path. Under the various Alternative 4 operational scenarios (H1–H4), changes in dilution and mixing of sources of water could result in a change in constituents known to bioaccumulate. For example, the reduction of flows in the Sacramento River downstream of the proposed north Delta intakes may result in a decreased dilution of constituents known to bioaccumulate in the study area.

Pesticides

Legacy pesticides, such as organochlorines, have low water solubility; they do not readily volatilize and have a tendency to bond to particulates (e.g., soil and sediment), settle out into the sediment, and not be transported far from the source. If present in sediment within in-water construction areas, legacy pesticides would be disturbed locally and would not be expected to partition into the water column to any substantial degree. Therefore, no significant adverse effect on public health would result from construction.

Numerous pesticides are currently used throughout the affected environment. While some of these pesticides may be bioaccumulative, those present-use pesticides for which there is sufficient evidence of their presence in waters affected by SWP and CVP operations (i.e., organophosphate pesticides, such as diazinon, chlorpyrifos, diuron, and pyrethroids) are not considered bioaccumulative. Thus, changes in their concentrations would not directly cause bioaccumulative problems in aquatic life or humans. Furthermore, Alternative 4 would not result in increased tributary flows that would mobilize organochlorine pesticides in sediments. Thus, the change in source water in the Delta associated with the change in water supply operations is not expected to adversely affect public health with respect to bioaccumulation of pesticides.

Methylmercury

If mercury is sequestered in sediments at water facility construction sites, it could become suspended in the water column during construction activities, opening up a new pathway into the food chain. Disturbance of sediment associated with construction activities (e.g., pile driving and cofferdam installation) at intake sites or barge landing locations would result in a localized, short-term increase in turbidity during the construction activity, which may suspend sediment that contains methylmercury. Please see Chapter 8, Section 8.1.3.9, *Mercury*, for a discussion of methylmercury concentrations in sediments.

As environmental commitments DWR would develop and implement Erosion and Sediment Control Plans and SWPPPs (Appendix 3B, *Environmental Commitments*). BMPs implemented under the Erosion and Sediment Control Plans and the SWPPPs would help reduce turbidity and keep sediment that may contain legacy organochlorine pesticides and methylmercury within the area of disturbance. These BMPs would include, but not necessarily be limited to the following.

- Install physical erosion control stabilization features (hydroseeding, mulch, silt fencing, fiber rolls, sand bags, and erosion control blankets) to capture sediment and control both wind and water erosion.
- Retain trees and natural vegetation to the extent feasible to stabilize hillsides, retain moisture, and reduce erosion.
- Limit construction, clearing of vegetation, and disturbance of soils to areas of proven stability.
- Use sediment ponds, silt traps, wattles, straw bale barriers or similar measures to retain sediment transported by runoff water onsite.

- Collect and direct surface runoff at non-erosive velocities to the common drainage courses.
- Deposit or store excavated materials away from drainage courses.
- Prevent transport of sediment at the construction site perimeter, toe of erodible slopes, soil stockpiles, and into storm drains.
- Reduce runoff velocity on exposed slopes.
- Reduce offsite sediment tracking.

Implementation of these measures would help ensure that construction activities would not substantially increase or substantially mobilize methylmercury. Accordingly, there would be no adverse effect.

Water quality and fish tissue modeling results showed small, insignificant changes in total mercury and methylmercury levels in water and fish tissues resulting from Alternative 4 water operations (see Chapter 8, Section 8.3.3.9, *Alternative 4—Dual Conveyance with Modified Pipeline/Tunnel and Intakes 1–2, 3, and 5 [9,000 cfs; Operational Scenario H*]), for a detailed discussion). Upstream mercury contributions and methylmercury production in Delta waters would not be altered by the operation of Alternative 4, as it would not change existing mercury sources and would not substantially alter methylmercury concentrations in the Sacramento River or San Joaquin River. Water quality modeling results indicate that the percentage change in assimilative capacity of waterborne total mercury relative to the 25 ng/L Ecological Risk Benchmark was greatest for Scenario H4 relative to the No Action Alternative. These changes ranged, from 5.0% at the Jones Pumping Plant to -2.3% at Old River at Rock Slough. These same sites show the smallest range of effects on assimilative capacity for Alternative 4 H1, with 4.3% and -1.4% for these same two stations, respectively. Operational Scenarios H2 and H3 fall between these two extremes. The changes are not expected to result in adverse effects on beneficial uses. Similarly, changes in methylmercury concentration are expected to be very small as predicted by modeling.

Fish tissue estimates showed small or no increase in exceedance quotient based on long-term annual average mercury concentrations at the nine Delta locations modeled. The greatest increases in exceedance quotients relative to the No Action Alternative were estimated to be 12% for both Old River at Rock Slough, and for Franks Tract. The lowest percentage change in modeled bass mercury concentrations is predicted to occur under Operational Scenario H1 relative to the No Action Alternative for these locations.

Currently, mercury concentrations in fish tissues exceed Delta TMDL guidance targets, which are set for human health rather than effects on fish, and operation of Alternative 4 is not expected to substantially alter this condition. Large sport fish throughout the Delta are currently uniformly in exceedance of consumption guidelines for mercury, and Alternative 4 is not expected to substantially alter that condition. Although methylmercury currently exceeds the TMDL, little to no change in mercury or methylmercury concentrations in water is expected under Alternative 4 operational scenarios. Thus, the alternative would not result in increased exceedances of water quality criteria. Because water operations would not substantially increase methylmercury above what currently exists in the study area and would not expose people to an additional public health hazard, adverse effects on public health are not expected to result. In addition, because these increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I for a discussion of the uncertainty associated with the fish tissue estimates.

CEQA Conclusion: Intermittent and/or short-term construction-related activities (as would occur for in-river construction) would not be anticipated to result in contaminant discharges of sufficient magnitude or duration to contribute to long-term bioaccumulation processes, or cause measureable long-term degradation such that existing 303(d) impairments would be made discernibly worse or TMDL actions to reduce loading would be adversely affected. Legacy organochlorine pesticides typically bond to particulates, and do not mobilize easily. Construction and maintenance of Alternative 4 would not cause these legacy pesticides to be transported far from the source or to partition into the water column. Other pesticides which are currently present in waters affected by SWP and CVP operations are not considered bioaccumulative. Although methylmercury currently exceeds the TMDL, little to no change in methylmercury concentrations in water are expected under Alternative 4 water conveyance construction.

Alternative 4 would not result in increased flows in the tributaries that would mobilize legacy organochlorine pesticides in sediments. Other pesticides that are present in study area water channels are not considered bioaccumulative and any changes in concentrations due to Alternative 4 operations would not cause them to become bioaccumulative.

Water quality modeling results indicated small, insignificant changes in mercury and methylmercury levels in water at certain Delta locations and in mercury in fish tissues due to Alternative 4 operational scenarios (H1–H4). Specifically, modeling results indicate that the percentage change in assimilative capacity of waterborne total mercury relative to the 25 ng/L Ecological Risk Benchmark for this alternative relative to Existing Conditions would show the greatest decrease (2.4%) in the Old River at Rock Slough and at the Contra Costa Pumping Plant. These are bounded by Alternative 4 H1 estimates of -1.4% and -1.5% at these two locations, respectively. In contrast the greatest increase in assimilative capacity relative to Existing Conditions would be 4.4% for operational Scenario H4 at the Jones Pumping Plant. Scenarios H2 and H3 range in changes in assimilative capacity in relation to Existing Conditions from -2.1% (H3 at Contra Costa Pumping Plant to 4.1% (H2 at Banks). These small changes in assimilative capacity are not expected to result in significant impacts to beneficial uses. Fish tissue estimates show only small or no increases in exceedance quotients based on long-term annual average concentrations for mercury at the nine Delta locations modeled. The greatest increase over Existing Conditions was for Scenario H4 and was 15% at Old River at Rock Slough and 13% for Franks Tract as compared to Scenario H1 estimates for both of those locations of 9%. Because these increases are relatively small, and it is not evident that substantive increases are expected at numerous locations throughout the Delta, these changes are expected to be within the uncertainty inherent in the modeling approach, and would likely not be measurable in the environment. See Appendix 8I for a discussion of the uncertainty associated with the fish tissue estimates.

BMPs implemented as part of Erosion and Sediment Control Plans and SWPPPs would help ensure that construction activities would not substantially increase or substantially mobilize legacy organochlorine pesticides or methylmercury during construction and maintenance. Further, because mercury concentrations are not expected to increase substantially, no long-term water quality degradation is expected to occur and, thus, no adverse effects to beneficial uses would occur. Because any increases in mercury or methylmercury concentrations are not likely to be measurable, changes in mercury concentrations or fish tissue mercury concentrations would not make any existing mercury-related impairment measurably worse. In comparison to Existing Conditions, Alternative 4 would not increase levels of mercury by frequency, magnitude, and geographic extent such that the affected environment would be expected to have measurably higher body burdens of mercury in aquatic organisms or humans consuming those organisms.

Therefore, construction, operation and maintenance of Alternative 4 would not cause increased exposure of the public to these bioaccumulative sediment constituents. Since construction, maintenance, or operation of the water conveyance facilities ~~in~~under Alternative 4 would not cause substantial mobilization or a substantial increase of constituents known to bioaccumulate, impacts on public health would be less than significant. No mitigation is required.

Impact PH-4: Expose Substantially More People to Transmission Lines Generating New Sources of EMFs as a Result of the Construction and Operation of the Water Conveyance Facilities

***NEPA Effects*:** Approximately 621 miles of existing transmission lines are located within the study area. Under Alternative 4, the method of delivering power to construct and operate the water conveyance facilities is assumed to be a "split" system that would connect to the existing grid in two different locations—one in the northern section of the alignment, and one in the southern section of the alignment. As described in Table 25-~~8~~9, a total of ~~5.87~~6.08 miles of new ~~permanent~~ temporary 69 kV transmission lines; 30~~34~~30~~.73~~ ~~44~~ miles of new temporary 230 kV transmission lines; and ~~14.17~~~~13.79~~15.96 miles of new permanent 230 kV transmission lines~~; and 3.25~~~~9.63~~ ~~miles of new temporary 34.5 kV transmission lines~~ would be constructed and operated under Alternative 4. In addition, an existing 500 kV transmission line south/southeast of the Clifton Court Forebay will be relocated to an area less than half a mile southeast of the current location of the existing towers.

Any new temporary and permanent transmission lines constructed and operated under Alternative 4 would, for the most part, be located in areas that are not densely populated (Figure 25-2) and, therefore, would not expose substantially more people to EMF from transmission lines. None of the proposed temporary or permanent transmission lines for this alternative would be located within 300 feet of sensitive receptors.

As discussed in Section 25.1.1.5, the current scientific evidence does not show conclusively that EMF exposure can increase health risks. In 2006, CPUC updated its EMF policy and reaffirmed that health hazards from exposures to EMF have not been established. State and federal public health regulatory agencies have determined that setting numeric exposure limits is not appropriate. CPUC also reaffirmed that the existing no-cost and low-cost precautionary-based EMF policy should be continued. Based on this, utility companies are required to establish and maintain EMF Design Guidelines in order to reduce potential health risks associated with power lines. These guidelines would be implemented for any new temporary or new permanent transmission lines constructed and operated under Alternative 4, depending on which electric provider is selected by DWR. Furthermore, as described in Appendix 3B, *Environmental Commitments*, the location and design of the proposed new transmission lines would be conducted in accordance with CPUC's EMF Design Guidelines for Electrical Facilities, and would include one or more of three measures to reduce EMF exposure.

- Shielding by placing trees or other physical barriers along the transmission line right-of-way.
- Cancelation by configuring the conductors and other equipment on the transmission towers.
- Increasing the distance between the source of the EMF and the receptor either by increasing the height of the tower or increasing the width of the right-of-way.

Therefore, operation of the transmission line corridors would not expose substantially more people to transmission lines generating EMFs, and there would be no adverse effect on public health.

***CEQA Conclusion*:** Under Alternative 4, the majority of proposed temporary (~~34.~~69~~5~~ kV and 230 kV) and permanent (~~69 kV and~~ 230 kV) transmission lines would be located within the rights-of-way of existing transmission lines; any new temporary or permanent transmission lines not within the right-of-way of existing transmission lines would, for the most part, be located in sparsely populated areas generally away from existing sensitive receptors. None of the proposed temporary or permanent transmission lines would be within 300 feet of sensitive receptors. Further, the temporary transmission lines would be removed when construction of the water conveyance facility features is completed, so there would be no potential permanent effects. Therefore, these transmission lines would not substantially increase people's exposure to EMFs.

Additionally, design and implementation of new proposed temporary or permanent transmission lines not within the right-of-way of existing transmission lines would follow CPUC's EMF Design Guidelines for Electrical Facilities and would implement shielding, cancelation, or distance measures to reduce EMF exposure. Since construction and operation of Alternative 4 would not expose substantially more people to transmission lines that provide new sources of EMFs, impacts on public health would be less than significant. No mitigation is required.

Impact PH-5: Increase in Vector-Borne Diseases as a Result of Implementing CM2-CM7, CM10 and CM11

***NEPA* Effects:** Implementation of CM2-CM7, CM10 and CM11 under Alternative 4 would include fisheries enhancement (CM2); the restoration of up to 65,000 acres of tidal and freshwater habitat (CM3 and CM4), 10,000 acres of seasonally inundated floodplain (CM5), and 1,200 acres of nontidal marsh and 500 acres of managed wetlands (CM10); enhancement of channel margin and riparian habitat (CM6 and CM7); and protection of 150 acres of alkali seasonal wetland complex and 1,500 acres of managed wetlands (CM3 and CM11). These activities could potentially increase suitable mosquito habitat within the study area.

Under CM2, *Yolo Bypass Fisheries Enhancement*, the frequency, duration, and magnitude of inundation of the Yolo Bypass would increase. The increased floodplain inundation and water surface may result in an increase in mosquitoes in the Yolo Bypass.

Of the approximate 65,000-acre tidal and freshwater habitat restoration target, approximately 55,000 acres of this restoration will consist of tidal perennial aquatic, tidal mudflat, tidal freshwater emergent wetland, and tidal brackish emergent wetland natural communities, and the remaining up to 10,000 acres will consist of transitional uplands to accommodate sea level rise. Of the approximate 55,000 acres of tidally influenced natural community, approximately 20,600 acres must occur in particular ROAs as listed below.

- 7,000 acres of brackish tidal habitat, of which at least 4,800 acres would be tidal brackish emergent wetland and the remainder would be tidal perennial aquatic and tidal mudflat, in Suisun Marsh (ROA).
- 5,000 acres of freshwater tidal habitat in the Cache Slough ROA.
- 1,500 acres of freshwater tidal habitat in the Cosumnes/Mokelumne ROA.
- 2,100 acres of freshwater tidal habitat in the West Delta ROA.

- 5,000 acres of freshwater tidal habitat in the South Delta ROA.

The remaining 34,400 acres would be distributed among the ROAs or may occur outside the ROAs. The areas within the ROAs currently have potentially suitable habitat for mosquitoes and aquatic habitat restoration in these areas may increase mosquito populations.

Potentially suitable mosquito habitat resulting from the implementation of CM2~~-~~–CM7, CM10 and CM11 would generally not be located near densely populated areas (Figure 25-3). Table 25-~~5~~6 outlines the distances travelled from breeding grounds for the species listed. These distances range from less than 1 mile to up to 30 miles. The conservation measures would generally expand existing habitat or replace existing agricultural areas, both of which are currently sources for mosquitoes. Of the ROAs, the South Delta ROA and West Delta ROA currently have the fewest acres of habitat suitable for mosquitoes and are the closest to more densely populated areas (Figure 25-3). Similarly, although much of Yolo Bypass is not proximate to densely populated areas, there are areas of Yolo Bypass near populated areas including El Macero, Davis, and West Sacramento. Therefore, habitat restoration in these ROAs and in the Yolo Bypass may result in an increase in mosquitoes and exposure to vector-borne diseases when compared with restoration of aquatic habitat within the other ROAs.

The habitat restoration and enhancement under all of these CMs would be performed in accordance with Natural Communities Enhancement and Management (CM11), which would require preparation and implementation of management plans for the protected natural communities and covered species habitats. The preparation and implementation of the management plans would be performed in consultation with the appropriate MVCDs. This consultation would occur when specific restoration and enhancement projects and locations are identified within the ROAs and prior to implementation of CM2. It is standard practice to use IPM to control mosquitoes, and, as part of the consultation with the MVCDs, BDCP proponents would prepare and implement MMPs (Appendix 3B, *Environmental Commitments*). In addition, BMPs from the guidelines outlined in Section 25.2.5.7 and detailed in Appendix 3B would be incorporated into the proposed project and executed to maintain proper water circulation and flooding during appropriate times of the year (e.g., fall) to prevent stagnant water and habitat for mosquitoes. BMPs to be implemented as part of the MMPs would include, but not necessarily be limited to, the following.

- Delay or phase fall flooding—phased flooding involves flooding habitat throughout the fall and winter in proportion to wildlife need and takes into consideration other wetland habitat that may be available in surrounding areas.
- Use rapid fall flooding
- Use deep initial flooding
- Subsurface irrigate
- Utilize water sources with mosquito predators for flooding
- Drain irrigation water into ditches or other water bodies with abundant mosquito predators
- Employ vegetation management practices to reduce mosquito production in managed wetlands (e.g., mowing, burning, discing of vegetation that serves as mosquito breeding substrate)
- Design wetlands and operations to be inhospitable to mosquitoes
- Implement monitoring and sampling programs to detect early signs of mosquito population problems

- Use biological agents such as mosquito fish to limit larval mosquito populations.
- Use larvicides and adulticides, as necessary
- Test for mosquito larvae during the high mosquito season (June through September)

Finally, restoration of different types of habitat would potentially increase mosquito predators, such as birds and bats, using the habitat. Therefore, implementation of the habitat restoration and enhancement conservation measures would not significantly increase the public's risk of exposure to vector-borne diseases. Accordingly, there would be no adverse effect.

CEQA Conclusion: Although implementing Alternative 4 would increase restored and enhanced habitat in the study area that could result in a significant increase in vectors such as mosquitoes, implementation of environmental commitments, including consultation with the MVCDs and implementation of BMPs as part of MMPs as set forth in Appendix 3B, would reduce the potential for an increase in mosquito breeding habitat, and, as such, an associated substantial increase in vector-borne diseases would not result. Furthermore, habitat would be restored in areas where existing potentially suitable habitat for mosquitoes already exists. Finally, predators on mosquitoes would likely increase as a result of restoration and enhancement, which would keep mosquito populations in check. Accordingly, implementation of CM2-CM7, CM10 and CM11 under Alternative 4 would not substantially increase the public's risk of exposure to vector-borne diseases beyond what currently exists and would be less than significant. No mitigation is required.

Impact PH-6: Substantial Increase in Recreationists' Exposure to Pathogens as a Result of Implementing the Restoration Conservation Measures

NEPA Effects: The study area currently supports habitat types, such as tidal habitat, upland wetlands, and agricultural lands, that produce pathogens as a result of the biological productivity in these areas (e.g., migrating birds, application of fertilizers, waste products of animals). The study area does not currently have pathogen concentrations that rise to the level of adversely affecting beneficial uses of recreation. Restored habitat and protected agricultural lands under Alternative 4 could result in an increase in pathogen loading in the study area because these land uses are known to generate pathogens. However, as exemplified by the Pathogen Conceptual Model, any potential increase in pathogens associated with the proposed habitat restoration and enhancement (as part of implementation of restoration conservation measure) would be localized and within the vicinity of the actual restoration. The result would be similar for lands protected for agricultural uses. This localized increase is not expected to be of sufficient magnitude and duration to result in adverse effects on recreationists as described in Chapter 8, *Water Quality* (Section 8.3.3.9). Furthermore, depending on the level of recreational access granted by management plans, habitat restoration and enhancement could increase or decrease opportunities for recreationists within the study area. Mechanisms that permit public access could increase opportunities related to upland hunting, hiking, walking, wildlife and botanical viewing, nature photography, picnicking, and sightseeing. Alternatively, land acquisition that would exclude public recreational use would decrease opportunities for these activities, thus limiting recreationists' potential exposure to pathogens. Even if recreationists were allowed in the ROAs, the characteristics of pathogens in water as described by the conceptual model would not substantially increase recreationists' exposure. Accordingly, implementation of the restoration conservation measures under Alternative 4 would not result in a substantial increase in recreationists' exposure to pathogens. There would be no adverse effect.

CEQA Conclusion: Implementation of the restoration conservation measures would support habitat types, such as wetlands and agricultural lands, that could produce pathogens as a result of the biological productivity in these areas (e.g., migrating birds, application of fertilizers, waste products of animals). However, the localized nature of pathogen generation, as well as the quick die-off of pathogens once released into water bodies, would generally prevent substantial pathogen exposure to recreationists. Therefore, impacts would be less than significant. No mitigation is required.

Impact PH-7: Substantial Mobilization of or Increase in Constituents Known to Bioaccumulate as a Result of Implementing CM2, CM4, CM5, and CM10

NEPA Effects: The primary concern with habitat restoration regarding constituents known to bioaccumulate is the potential for mobilizing contaminants sequestered in sediments of the newly inundated floodplains and marshes. The mobilization depends on the presence of the constituent and the biogeochemical behavior of the constituent to determine whether it could re-enter the water column or be reintroduced into the food chain.

Pesticides

Organochlorines and other relatively water insoluble pesticides would likely be sequestered in the former agricultural soils in ROAs. Additionally, because these chemicals tend to bind to particulates, concentrations are typically highest in sediment. Flooding of former agricultural land, as would occur under CM4, CM5, and CM10, is expected to result in some level of accessibility to biota through uptake by benthic organisms. Moreover, CM2 and CM5 may be managed alongside continuing agriculture, where pesticides may be used on a seasonal basis and where water during flood events may come in contact with residues of these pesticides. However, rapid dissipation would be expected, particularly in the large volumes of water involved in flooding; therefore, it is unlikely that a substantial increase in bioaccumulation by fish would result. Further, implementation of CM2, CM4, CM5, and CM10 would not include the use of bioaccumulative pesticides. Additionally, significant increases in concentrations of organochlorine and other legacy pesticides are not expected in the water column because these lipophilic chemicals strongly partition to sediments, and concentrations in the water column would be relatively short-lived because these pesticides settle out of the water column via sediment adsorption in low-velocity flow.

As described in Section D.4.6.1 of BDCP Appendix 5.D, if pesticide-laden sediment erodes and is transported from an ROA, it is likely that the pesticides would not be transported very far from the source area, and would settle out with suspended particulates and be deposited close to the ROA. For these reasons, a substantial mobilization of, or a substantial increase in, bioaccumulative pesticides in the study area is not anticipated. Therefore, no adverse effect on public health with respect to bioaccumulation of pesticides is expected.

Methylmercury

Conversion of inorganic mercury to methylmercury occurs in flooded fine sediments subjected to periodic drying-out periods and is associated with anaerobic (oxygen-depleted), reducing environments (Alpers et al. 2008; Ackerman and Eagles-Smith 2010). Methylmercury production is greatest in high marshes that are subjected to wet and dry periods over the highest monthly tidal cycles; production appears to be less in low marshes that are always inundated and not subject to dry periods (Alpers et al. 2008).

Methylmercury generation rates are ultimately dependent on the concentrations of mercury in the soils, and on the specific biogeochemistry of the system. The biogeochemistry and fate and transport of mercury and methylmercury are very complex. Restoration would involve inundation of areas where mercury has been sequestered in soils, and, if methylation occurs, the methylmercury would be mobilized into the aquatic system. Results of the CALFED Mercury Project Annual Report for 2007 (Stephenson et al. 2007) indicate that river inputs (11.5 grams per day [g/day] methylmercury) and in-situ production from wetland/marsh sediments (11.3 g/day methylmercury) are the leading sources of methylmercury to the Delta waters, and have roughly comparable levels of input. Wood (2010) estimates that in-situ methylmercury production in open water and wetlands contributes approximately 36% of the overall methylmercury load to the Delta (approximately 5 g/day) but is less than riverine/tributary inputs (8 g/day). The higher estimate of methylmercury production from sediments reported by Stephenson is based on periods of higher water (wet) and may be more representative of what might occur when new ROAs are opened for inundation. Once in the aquatic system, the methylmercury can be transported with water flow, taken up by biota, volatilized, demethylated, or returned to sediment (but not necessarily at the original restoration site).

The Sacramento River watershed, and specifically the Yolo Bypass, is the primary source of mercury in the study area. The highest concentrations of mercury and methylmercury are in the Cache Creek area and the Yolo Bypass. The amount of methylmercury produced in the Yolo Bypass has been estimated to represent 40% of the total methylmercury production for the entire Sacramento River watershed (Foe et al. 2008). Water discharging from the Yolo Bypass at Prospect Slough has a reported average annual methylmercury concentration of 0.27 ng/L, more than four times greater than the 0.06 ng/L TMDL.

The highest levels of methylmercury generation, mobilization, and bioavailability are expected in the Yolo Bypass with implementation of CM2 under Alternative 4. Implementation of CM2 would subject Yolo Bypass to more frequent and wider areas of inundation. The concentrations of methylmercury in water exiting the Yolo Bypass would depend on many variables. However, implementation of CM2 has the potential to significantly increase the loading, concentrations, and bioavailability of methylmercury in the aquatic system.

As part of the implementation of conservation measures under Alternative 4, measures would be developed to reduce the production of methylmercury in ROAs, and these measures would be implemented as part of CM12, *Methylmercury Management*. These measures may include construction and grading in a way that minimizes exposure of mercury-containing soils to the water column; designing areas to support/enhance photodegradation; and pre-design field studies to identify depositional areas where mercury accumulation is most likely and characterization and/or design that avoids these areas. CM12 provides for consideration of new information related to methylmercury degradation that could effectively mitigate methylmercury production and mobilization.

In summary, Alternative 4 restoration actions are likely to result in increased production, mobilization, and bioavailability of methylmercury in the aquatic system. Methylmercury would be generated by inundation of restoration areas, with highest concentrations expected in the Yolo Bypass, Cosumnes River and Mokelumne River, and at ROAs closest to these source areas as a result of the BDCP actions. An increase in bioavailability in the aquatic system could result in a corresponding increase in bioaccumulation in fish tissue, biomagnification through the food chain, and human exposure. Because the increase in bioavailability in the food chain cannot be quantified, the increase in human exposure also cannot be quantified. OEHHA standards would continue to be implemented for the consumption of study area fish and thus would serve to protect people against the overconsumption of fish with increased body burdens of mercury. Furthermore, implementation of CM12, *Methylmercury Management*, would minimize effects because it provides for project-specific mercury management plans including a QA/QC program, and specific tidal habitat restoration design elements to reduce the potential for methylation of mercury and its bioavailability in tidal habitats. As such, adverse effects on public health due to the substantial mobilization of or increase in methylmercury are not expected to occur.

CEQA Conclusion**:** Flooding of former agricultural land under CM4, CM5, and CM10, could result in some level of accessibility of legacy organochlorine pesticides to biota through uptake by benthic organisms. Further, CM2 and CM5 may be managed alongside continuing agriculture, where pesticides may be used on a seasonal basis and where water during flood events may come in contact with organochlorine and legacy pesticide residues. However, rapid dissipation would be expected, particularly in the large volumes of water involved in flooding; therefore, it is unlikely that a substantial increase in bioaccumulation by fish would result. Additionally, while there would likely be an increase in mobilization of and potentially an increase in bioaccumulation of methylmercury in the study area's aquatic systems (e.g., fish and water) in the near term, it is unlikely to be substantial. Further, CM12, *Methylmercury Management*, as well as existing OEHHA standards, would serve to reduce the public's exposure to contaminated fish. Implementation of CM2, CM4, CM5, and CM10 under Alternative 4 would not substantially mobilize or substantially increase the public's exposure to constituents known to bioaccumulate and would be less than significant. No mitigation is required.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

Any modified reservoir operations under Alternative 4 are not expected to promote *Microcystis* production upstream of the Delta since large reservoirs upstream of the Delta are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*. Further, in the rivers and streams of the Sacramento River watershed, watersheds of the eastern tributaries (Cosumnes, Mokelumne, and Calaveras Rivers), and the San Joaquin River upstream of the Delta, bloom development would be limited by high water velocity and low hydraulic residence times.

Conditions in the Export Service Areas under the four operational scenarios of Alternative 4 are not expected to become more conducive to *Microcystis* bloom formation, relative to the No Action Alternative, because neither water residence time nor water temperatures will increase in the Export Service Areas. As described in Chapter 8, *Water Quality*, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis*, but the fraction of water flowing through the Delta that reaches the existing south Delta intakes is expected to be influenced by an increase *Microcystis* blooms. Therefore, relative to the No Action Alternative, the addition of Sacramento River water from the north Delta under Alternative 4 would dilute *Microcystis* and microcystins in water diverted from the south Delta. Because the degree to which *Microcystis* blooms, and thus microcystins concentrations, will increase in source water from the south Delta is unknown, it cannot be determined whether Alternative 4 will result in increased or decreased levels of microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Ambient meteorological conditions are the primary driver of Delta water temperatures, and therefore climate warming, and not water operations, would determine future water temperatures in the Delta. Increasing water temperatures due to climate change could lead to earlier attainment of the water temperature threshold of 19°C required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes under Alternative 4 would not be different from what would occur under the No Action Alternative. Under H1-H4 operational scenarios, the modeled increase in hydraulic residence time in the Delta indicate varying levels of change depending on Delta location and timeframe (see Chapter 8, *Water Quality*). The changes in hydraulic residence time are driven by several factors accounted for in the modeling, including the hydrodynamic effects of restoration actions planned under CM2 and CM4, diversion of Sacramento River water at the proposed north Delta intake facility, as well as changes in net Delta outflows. Siting and design of restoration areas would have a substantial influence on the magnitude of residence time increases under Alternative 4. The modeled increase in hydraulic residence time in the Delta under operational scenarios H1-H4 could potentially increase the frequency, magnitude, and geographic extent of *Microcystis* blooms, and therefore microcystin in the Delta. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and, as such, public health could be affected. Accordingly, this would be considered an adverse effect. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 4, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta because large reservoirs upstream are typically low in nutrient concentrations and phytoplankton outcompete cyanobacteria, including *Microcystis*, and high water velocity and low hydraulic residence times in the upstream area limit the development of *Microcystis* blooms. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not water conveyance facility operations. Residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 4 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which would result in an increase in the frequency, magnitude and geographic extent of *Microcystis*, and therefore microcystin levels. However, the potential water quality effects due to temperature increases would be due to climate change, not effects resulting from operation of the water conveyance facilities. Increases in Delta residence times under all Alternative 4 operational scenarios (i.e., H1-H4) would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would potentially be impacted and therefore, so would public health. Therefore this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to manage hydraulic residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** As described in Chapter 8, *Water Quality*, implementation of CM3 and CM6–CM21 is unlikely to affect *Microcystis* abundance in the rivers and reservoirs upstream of the Delta, in the Delta region, or the waters exported to the CVP and SWP service areas. Implementation of CM5, Seasonally Inundated Floodplain Restoration, could result in increased local water temperatures in areas near restored seasonally inundated floodplains. However, floodplain inundation typically occurs during spring and winter months when *Microcystis* growth is limited in general by low water temperatures and by insufficient surface water irradiance. Water temperatures would not increase sufficiently due to floodplain inundation such that effects on *Microcystis* growth would occur. Therefore, implementation of CM5 is unlikely to affect *Microcystis* blooms in the study area. Implementation of CM13, Invasive Aquatic Vegetation Control, may increase turbidity and flow velocity, particularly in restored aquatic habitats, which could discourage *Microcystis* growth in these areas. To the extent that IAV removal would affect turbidity and water velocity, it is possible that IAV removal could, to some degree, help offset the increase in *Microcystis* production expected under Alternative 4, relative to the No Action Alternative.

As discussed under Impact PH-8, development of restoration areas under CM2 and CM4 could potentially increase the frequency, magnitude, and geographic extent of *Microcystis* blooms due to the hydrodynamic impacts that are expected to increase water residence times throughout the Delta. Additionally, restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season, which could result in further degradation of water quality to the extent that beneficial uses are affected. Were *Microcystis* blooms to increase with implementation of CM2 and CM4, there would be an increase in the potential for impacts on public health as a result of potential effects on drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time, but the effects would be adverse.

CEQA Conclusion: Restoration activities implemented under Alternative 4 for CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: Alternative 5 would involve construction and operation of up to three solids lagoons, one sedimentation basin, an intermediate forebay and associated -350-acre inundation area adjacent, and Bryon Tract Forebay. ~~to the intermediate forebay~~; ~~however,~~ the mechanisms for potential public health effects are similar to those described above for Alternative 1A. Specifically, the sedimentation basin, solids lagoons, Byron Tract Forebay, the intermediate forebay, and the inundation area have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, During operation, t~~The depth, design, and operation of the sedimentation basin and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the 350-acre inundation area adjacent to the intermediate forebay would be limited to forebay emergency overflow situations and water would be ~~physically~~ pumped back to the intermediate forebay, creating circulation such that the inundation area would have a low potential for creating suitable vector habitat. Similarly, water in the Byron Tract Forebay and intermediate forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Accordingly, as described under Alternative 1A, construction and operation of the intakes, solids lagoons, ~~and/or~~ sedimentation basins, the forebays, and the intermediate forebay inundation area under Alternative 5 would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Therefore, no adverse effects would result.

CEQA Conclusion: Implementation of CM1 under Alternative 5 would involve the construction and operation of four fewer solids lagoons and one sedimentation basin relative to Alternative 1A, and construction and operation of an intermediate forebay and associated 350-acre inundation area, and Byron Tract Forebay ~~adjacent to the intermediate forebay~~. While these facilities could provide suitable habitat for vectors (e.g., mosquitoes), water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. ~~These areas could provide suitable habitat for vectors (e.g., mosquitoes).~~ The inundation area would only be used during emergency overflow situations and water would be pumped back into the intermediate forebay, creating circulation that would discourage mosquito breeding. The shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). ~~In addition, During operations, water depth and circulation would prevent the intakes, solids lagoons, and/or sedimentation basins from substantially increasing suitable vector habitat.~~ Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 5 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

***NEPA Effects*:** Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 5, *Microcystis* abundance, and thus microcystin concentrations, in water bodies of the affected environment under Alternative 5 would be very similar (i.e., nearly the same) to those discussed for Alternative 1A.

As described in Chapter 8, *Water Quality*, although *Microcystis* blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 5 may become more conducive to *Microcystis* bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities. Under Alternative 5, relative to No Action Alternative, water exported to the SWP/CVP Export Service Area will be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River, diverted at the north Delta intakes. It cannot be determined whether operations and maintenance under Alternative 5 will result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 5, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water Quality*, the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 5 compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta. Therefore, impacts on beneficial uses, including drinking water and recreational waters, could occur and public health could be affected. Although Mitigation Measure WQ-32a and WQ-32b are available to reduce the severity of degraded water quality in the Delta due to Microcystis blooms, this would be an adverse effect.

CEQA Conclusion: Under Alternative 5, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation.

Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 5 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta hydraulic residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to manage hydraulic residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 5 would be the same as that described under Alternative 1A, except that 25,000 rather than 65,000 acres of tidal habitat would be restored under CM4. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 5 are similar to those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

***NEPA Effects*:** As described for Alternative 1A, Alternative 6A would involve similar construction and operation of up to 15 solids lagoons, five sedimentation basins, Byron Tract Forebay, and an intermediate forebay and associated 350-acre inundation area adjacent ~~to the intermediate forebay~~. These ~~Sedimentation basins, solids lagoons, and the inundation area have~~features have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the inundation area would be limited to forebay emergency overflow situations and water would be physically pumped back to the intermediate forebay, creating circulation such that the inundation area would have a low potential for creating suitable vector habitat. Similarly, water in the Byron Tract Forebay and intermediate forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebays could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012).Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Therefore, as described for Alternative 1A, construction and operation of the intakes, solids lagoons, ~~and/or~~ sedimentation basins, the forebays and the intermediate forebay inundation area under Alternative 6A would not substantially increase suitable vector habitat, and would not substantially increase in vector-borne diseases. Accordingly, no adverse effects would result.

CEQA Conclusion: As described for Alternative 1A, implementation of CM1 under Alternative 6A would involve construction and operation of solids lagoons, sedimentation basins, intermediate forebay and associated 350-acre inundation area, and Bryon Tract Forebay ~~adjacent to the intermediate forebay,~~ which would have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes). While these facilities could provide suitable habitat for vectors (e.g., mosquitoes), water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. The shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A~~However, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 under Alternative 1A. During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat~~. Therefore, construction and operation of the water conveyance facilities ~~in~~ under Alternative 6A would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

***NEPA Effects*:** Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 6A, *Microcystis* abundance, and thus microcystin concentrations, in water bodies of the affected environment under Alternative 6A would be nearly the same as those discussed for Alternative 1A.

As described in Chapter 8, *Water* Quality, although *Microcystis* blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 6A may become more conducive to *Microcystis* bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities. In contrast to Alternative 1A, uthe effects of *Microcystis* on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6A relative to Alternative 1A.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 6A, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water Quality*, the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 6A compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta, similar to Alternative 1A.

CEQA Conclusion: Under Alternative 6A, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be diverted entirely from the Sacramento River from the north Delta, which is not affected by *Microcystis*. Thereforethe effects of *Microcystis* on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6A relative to Alternative 1A.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce hydraulic residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 6A would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 6A would be the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

***NEPA Effects*:** As described for Alternative 1A, Alternative 6B would involve construction and operation of five north Delta intakes, up to 15 solids lagoons, ~~and~~ five sedimentation basins, and Byron Tract Forebay. ~~Sedimentation basins and solids lagoons~~These facilities have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. During operation, t~~The depth, design, and operation of the sedimentation basins, ~~and~~ solids lagoons and Byron Tract Forebay would prevent the development of suitable mosquito habitat (Figure 25-1). ~~Specifically, t~~The sedimentation basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep.

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in this forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, as described for Alternative 1A, construction and operation of the water conveyance facilities intakes, solids lagoons, and/or sedimentation basins under Alternative 6B would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Accordingly, no adverse effects would result.

***CEQA Conclusion*:** As described for Alternative 1A, implementation of CM1 under Alternative 6B would involve construction and operation of solids lagoons, and sedimentation basins, and the Byron Tract Forebay. These areas could provide suitable habitat for vectors (e.g., mosquitoes). However, During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities inunder Alternative 6B would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Water operations under Alternative 6B would be the same as under Alternative 6A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same.

Any modified reservoir operations under Alternative 6B are not expected to promote *Microcystis* production in waters upstream of the Delta. As described in Chapter 8, *Water* Quality, *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to *Microcystis* bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by *Microcystis.* Under Alternative 6Bthe effects of *Microcystis* on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6B relative to Alternative 1A.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta. Increasing water temperatures could lead to earlier attainment of the water temperature threshold required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of residence time increases under Alternative 6B. The modeled increase in hydraulic residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms, and thus microcystin levels. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 6B, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be diverted entirely from the Sacramento River from the north Delta, which is not affected by *Microcystis*. Thereforethe effects of *Microcystis* on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6B relative to Alternative 1A.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, there could be potential impacts on public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*: **The amount and location of habitat restoration and enhancement that would occur under Alternative 6B would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 6B are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects**:** As described for Alternative 1A, Alternative 6C would involve construction and operation of five north Delta intakes, up to 15 solids lagoons, ~~and~~ five sedimentation basins, and the Bryon Tract Forebay. ~~Sedimentation basins and solids lagoons~~These facilities have the potential provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep.

Although the proposed Byron Tract Forebay would increase surface water within the study area, it is unlikely that the forebay would provide suitable breeding habitat for mosquitoes given that the water in this forebay would not be stagnant and would be too deep. However, the shallow edges of the forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. However, as part of the regular maintenance of the forebay, floating vegetation such as pond weed would be harvested to maintain flow and forebay capacity.

To minimize the potential for causing impacts related to increasing suitable mosquito habitat in the Plan Area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, as described for Alternative 1A, construction and operation of the ~~intakes, solids lagoons, and/or sedimentation basins~~water conveyance facilities under Alternative 6C would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Accordingly, there would be no adverse effects.

CEQA Conclusion: As described for Alternative 1A, implementation of CM1 under Alternative 6C would involve construction and operation of solids lagoons, and sedimentation basins, and the Byron Tract Forebay areas could provide suitable habitat for vectors (e.g., mosquitoes). However, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 under Alternative 1A. During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. However, the shallow edges on the periphery of Byron Tract Forebay could potentially provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow. To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. See Impact PH-1 under Alternative 1A. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities underin Alternative 6C would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Water operations under Alternative 6C would be the same as under Alternative 6A. Therefore, potential effects on public health due to changes in water quality and beneficial uses as a result of *Microcystis* blooms and microcystin levels would be the same.

Any modified reservoir operations under Alternative 6C are not expected to promote Microcystis production in waters upstream of the Delta. As described in Chapter 8, Water Quality, Microcystis blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Similarly, hydraulic residence times in the Export Service Area would not be affected by operations of CM1. Accordingly, conditions would not be more conducive to Microcystis bloom formation. Water diverted from the Sacramento River in the north Delta is expected to be unaffected by Microcystis. Under Alternative 6C, water exported to the SWP/CVP Export Service Area will consist entirely of water from the Sacramento River from the north Delta, which is unaffected by Microcystis. Accordingly, the effects of Microcystis on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6C relative to Alternative 1A.

Ambient meteorological conditions would be the primary driver of Delta water temperatures, and climate warming, not water operations, would determine future water temperatures in the Delta. Increasing water temperatures could lead to earlier attainment of the water temperature threshold required to initiate *Microcystis* bloom formation, and therefore earlier occurrences of *Microcystis* blooms in the Delta, as well as increases in the duration and magnitude. However, these temperature-related changes would not be different from what would occur under the No Action Alternative. Siting and design of restoration areas would have a substantial influence on the magnitude of hydraulic residence time increases under Alternative 6C. The modeled increase in residence time in the Delta could result in an increase in the frequency, magnitude, and geographic extent of *Microcystis* blooms, and thus microcystin levels. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality, and therefore potential public health effects, in the Delta due to *Microcystis*. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, the effect would still be considered adverse.

CEQA Conclusion: Under Alternative 6C, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be diverted entirely from the Sacramento River from the north Delta, which is not affected by *Microcystis*. Thereforethe effects of *Microcystis* on water exported to the SWP/CVP Export Service Areas could be lower under Alternative 6C relative to Alternative 1A.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change primarily and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, there could be potential impacts on public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce hydraulic residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 6C would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 6C are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: Alternative 7 would involve construction and operation of up to nine solids lagoons, three sedimentation basins, Byron Tract Forebay, and an intermediate forebay and associated 350-acre inundation ~~area adjacent to the intermediate forebay; however, the~~area. The mechanisms for potential public health effects are similar to those ~~described for Alternative 1A. Specifically, sedimentation~~these water conveyance features ~~basins, solids and lagoons, and the inundation area~~ have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the inundation area would be limited to forebay emergency overflow situations and water would be ~~physically~~ pumped back to the intermediate forebay, creating circulation such that the inundation area would have a low potential for creating suitable vector habitat. Similarly, water in the Byron Tract Forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebay could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012).Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Therefore, as described under Alternative 1A, construction and operation of the intakes, solids lagoons, ~~and/or~~ sedimentation basins, the forebays, and the intermediate forebay inundation area ~~under Alternative 7~~ would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases under Alternative 7. Accordingly, no adverse effects on public health would result.

CEQA Conclusion: As described for Alternative 1A, implementation of CM1 under Alternative 7 would involve construction and operation of solids lagoons, sedimentation basins, intermediate forebay and~~and~~ associated 350-acre inundation area, and Byron Tract Forebay ~~adjacent to the intermediate forebay~~. While ~~T~~these areas could provide suitable habitat for vectors (e.g., mosquitoes), water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. ~~However,~~ The inundation area would only be used during emergency overflow situations and water would be pumped back into the intermediate forebay, creating circulation that would discourage mosquito breeding. The shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Therefore, construction and operation of the water conveyance facilities under ~~in~~ Alternative 7 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 7, *Microcystis* abundance, and thus microcystins concentrations, in water bodies of the affected environment under Alternative 7 would be very similar to those discussed for Alternative 1A.

As described in Chapter 8, *Water Quality, although Microcystis* blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 7 may become more conducive to *Microcystis* bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 7, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water*

Quality, the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 7 compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality in the Delta. Although there is uncertainty regarding this impact, the effects on Microcystis from implementing CM1 is determined to be adverse.

CEQA Conclusion: Under Alternative 7, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic Residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 7 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*: ** The amount and location of habitat restoration and enhancement that would occur under Alternative 7 would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 7 are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

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

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of ~~the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with~~ the Water Conveyance Facilities

NEPA Effects: Alternative 8 would involve CM1 construction and operation of three intakes, up to nine solids lagoons, three sedimentation basins, Byron Tract Forebay, and an intermediate forebay and associated 350-acre inundation area.~~, adjacent to the intermediate forebay.~~ Alternative 8 would have two fewer intakes than Alternative 1A would have. Accordingly, there would be fewer solids lagoons and sedimentation basins~~ and fewer transmission lines~~.

Sedimentation basins, solids lagoons, Byron Tract Forebay, and the intermediate forebay and~~and the~~ inundation area have the potential to provide habitat for vectors that transmit diseases (e.g., mosquitoes) because of the large volumes of water that would be held within these areas. ~~However, During operation, t~~The depth, design, and operation of the sedimentation basins and solids lagoons would prevent the development of suitable mosquito habitat (Figure 25-1). Specifically, the basins would be too deep and the constant movement of water would prevent mosquitoes from breeding and multiplying. Sedimentation basins would be 120 feet long by 40 feet wide by 55 feet deep, and solids lagoons would be 165 feet long by 86 feet wide by 10 feet deep. Furthermore, use of the inundation area adjacent to the intermediate forebay would be limited to forebay emergency overflow situations and water would be ~~physically~~ pumped back to the intermediate forebay, creating circulation such that the inundation area would have a low potential for creating suitable vector habitat. Similarly, water in the Byron Tract Forebay would be circulated regularly and, with the exception of shallower areas around the periphery, would be too deep to provide suitable mosquito habitat. The shallower edges of the forebay could provide suitable mosquito breeding habitat if emergent vegetation or other aquatic plants (e.g., pond weed) were allowed to grow.

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (see Impact PH-1 under Alternative 1A). These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012).Implementation of these BMPs would reduce the likelihood that BDCP operations would require an increase in abatement activities by the local MVCDs. Therefore, construction and operation of the intakes, solids lagoons, and/or sedimentation basins under Alternative 8 would not substantially increase suitable vector habitat, and would not substantially increase vector-borne diseases. Accordingly, no adverse effects would result.

CEQA Conclusion: As described for Alternative 7 and Alternative 1A, implementation of CM1 under Alternative 8 would involve construction and operation of solids lagoons, sedimentation basins, Byron Tract Forebay, and an intermediate forebay and associated~~and a~~ 350-acre inundation area. ~~adjacent to the intermediate forebay, areas that could provide suitable habitat for vectors (e.g., mosquitoes).~~ While these facilities could provide suitable habitat for vectors (e.g., mosquitoes), water depth and circulation would prevent the areas from substantially increasing suitable vector habitat. The inundation area would only be used during emergency overflow situations and water would be pumped back into the intermediate forebay, creating circulation that would discourage mosquito breeding. The shallower periphery of the intermediate forebay and Bryon Tract Forebay could provide suitable mosquito breeding habitat. ~~However, During operations, water depth and circulation would prevent the areas from substantially increasing suitable vector habitat.~~

To minimize the potential for impacts related to increasing suitable vector habitat within the study area, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes. These BMPs would be consistent with practices presented in the California Department of Public Health's Best Management Practices for Mosquito Control in California (California Department of Public Health 2012). See Impact PH-1 under Alternative 1A. Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 8 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

NEPA Effects: Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 8, *Microcystis* abundance, and thus microcystins concentrations, in water bodies of the affected environment under Alternative 8 would be very similar to those discussed for Alternative 1A.

As described in Chapter 8, *Water Quality, although Microcystis* blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 8 may become more conducive to *Microcystis* bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities.

Like Alternative 1A, elevated ambient water temperatures would occur in the Delta under Alternative 8, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water*

Quality, the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 8 compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality in the Delta. Although there is uncertainty regarding this impact, the effects on Microcystis from implementing CM1 is determined to be adverse.

CEQA Conclusion: Under Alternative 8, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 8 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects is uncertain, and therefore potential public health effects, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount and location of habitat restoration and enhancement that would occur under Alternative 8 would be the same as that described under Alternative 1A. Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters.   Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 8 are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

25.3.3.16 Alternative 9—Through Delta/Separate Corridors (15,000 cfs; Operational Scenario G)

Impact PH-1: Increase in Vector-Borne Diseases as a Result of Construction and Operation of the Intakes, Solids Lagoons, and/or Sedimentation Basins Associated with the Water Conveyance Facilities

***NEPA Effects*:** Alternative 9 would not have solids lagoons or sedimentation basins. Should construction activities create temporary areas of standing water that could provide suitable habitat for mosquitoes to breed, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes~~.~~ (~~S~~see Impact PH-1 under Alternative 1A).These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California* (California Department of Public Health 2012). Activities would include, but not be limited to: testing for mosquito larvae during the high mosquito season (June through September);~~,~~ introducing biological controls such as mosquitofish if mosquitoes are present; reducing or eliminating emergent vegetation;~~,~~ and introducing physical controls (e.g., discharging water more frequently or increasing circulation) if mosquitoes are present. Therefore, Alternative 9 would not significantly increase the public's risk of exposure to vector-borne diseases. Accordingly, adverse effects on public health would not result.

***CEQA Conclusion*:** Because solid lagoons or sedimentation basins would not be constructed or operated, there would be no impacts. If necessary, DWR would consult and coordinate with San Joaquin County and Sacramento-Yolo County MVCDs and prepare and implement MMPs. BMPs to be implemented as part of the MMPs would help control mosquitoes (~~. S~~see Impact PH-1 under Alternative 1A These BMPs would be consistent with practices presented in the California Department of Public Health's *Best Management Practices for Mosquito Control in California*. Therefore, construction and operation of the water conveyance facilities ~~in~~under Alternative 9 would not result in a substantial increase in vector-borne diseases and the impact on public health would be less than significant. No mitigation is required.

Impact PH-2: Exceedances of Water Quality Criteria for Constituents of Concern Such That There Is an Adverse Effect on Public Health as a Result of Operation of the Water Conveyance Facilities

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

Impact PH-8: Increase in *Microcystis* Bloom Formation as a Result of Operation of the Water Conveyance Facilities.

***NEPA Effects*: **Because factors that affect *Microcystis* abundance in waters upstream of the Delta, in the Delta, and in the SWP/CVP Export Services Areas under Alternative 1A would similarly change under Alternative 8, *Microcystis* abundance, and thus microcystins concentrations, in water bodies of the affected environment under Alternative 9 would be very similar to those discussed for Alternative 1A.

As described in Chapter 8, *Water Quality, although Microcystis* blooms have not occurred in the Export Service Areas, conditions in the Export Service Areas under Alternative 8 may become more conducive to *Microcystis* bloom formation because water temperatures will increase in the Export Service Areas due to the expected increase in ambient air temperatures resulting from climate change, but not from operation of the water conveyance facilities.

Like Alternative 1A, elevated ambient water temperatures relative would occur in the Delta under Alternative 9, which could lead to earlier occurrences of *Microcystis* blooms in the Delta, and increase the overall duration and magnitude of blooms. However, as described in Chapter 8, *Water Quality,* the increase in Delta water temperatures, and consequent potential increase in *Microcystis* blooms, would be driven entirely by climate change, not by operation of water conveyance facilities. There would be differences in the direction and magnitude of water residence time changes during the *Microcystis* bloom period due to operation of the water conveyance facilities under Alternative 9 compared to Alternative 1A, relative to the No Action Alternative. As a result, *Microcystis* blooms, and therefore microcystin, could increase in surface waters throughout the Delta. Mitigation Measure WQ-32a and WQ-32b are available to reduce the effects of degraded water quality in the Delta. Although there is uncertainty regarding this impact, the effects on Microcystis from implementing CM1 is determined to be adverse.

CEQA Conclusion: Under Alternative 9, operation of the water conveyance facilities is not expected to promote *Microcystis* bloom formation in the reservoirs and watersheds upstream of the Delta. *Microcystis* blooms in the Export Service Areas could increase due to increased water temperatures resulting from climate change, but not due to water conveyance facility operations. Hydraulic residence times in the Export Service Area would not be affected by operations of CM1, and therefore conditions in those areas would not be more conducive to *Microcystis* bloom formation. Water exported from the Delta to the Export Service Area is expected to be a mixture of *Microcystis*-affected source water from the south Delta intakes and unaffected source water from the Sacramento River. Because of this, it cannot be determined whether operations and maintenance under Alternative 9 would result in increased or decreased levels of *Microcystis* and microcystins in the mixture of source waters exported from Banks and Jones pumping plants.

Water temperatures and hydraulic residence times in the Delta are expected to increase, which could result in an increase in *Microcystis* blooms and therefore microcystin levels. However, the water temperature increases in the Delta would be due to climate change and not due to operation of the water conveyance facilities. Increases in Delta residence times would be due in small part to climate change and sea level rise, but due to a greater degree to operation of the water conveyance facilities and hydrodynamic impacts of restoration included in CM2 and CM4. Consequently, it is possible that increases in the frequency, magnitude, and geographic extent of *Microcystis* blooms in the Delta would occur due to the operations and maintenance of the water conveyance facilities and the hydrodynamic impacts of restoration under CM2 and CM4. Accordingly, beneficial uses including drinking water and recreational waters would be impacted and, as a result, public health. Therefore, this impact would be significant.

Implementation of Mitigation Measure WQ-32a and WQ-32b may reduce degradation of Delta water quality due to *Microcystis*. Mitigation Measure WQ-32a requires that hydraulic residence time considerations be incorporated into restoration area site design for CM2 and CM4 using the best available science at the time of design. Mitigation Measure WQ-32b requires that the project proponents monitor for *Microcystis* abundance in the Delta and use appropriate statistical methods to determine whether increases in abundance are significant. This mitigation measure also requires that if *Microcystis* abundance increases (relative to Existing Conditions), the project proponents will investigate and evaluate measures that could be taken to reduce residence time in the affected areas of the Delta. However, because the effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Impact PH-9: Increase in *Microcystis* Bloom Formation as a Result of Implementing CM2 and CM4.

***NEPA Effects*:** The amount of habitat restoration and enhancement that would occur under Alternative 9 would be the same as that described under Alternative 1A. However, different locations for restoration or enhancement activities could be chosen in the south Delta based on the creation of separate corridors with differing purposes.

Restoration activities implemented under CM2 and CM4 that would create shallow backwater areas could result in local increases in water temperature that may encourage *Microcystis* growth during the summer bloom season. This would result in further degradation of water quality beyond the hydrodynamic effects of CM2 and CM4 on *Microcystis* blooms identified in Impact PH-8. An increase in *Microcystis* blooms with implementation of CM2 and CM4 could potentially result in adverse effects on public health through exposure via drinking water quality and recreational waters. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects related to *Microcystis* is uncertain. This would be an adverse effect.

CEQA Conclusion: The effects of CM2 and CM4 on *Microcystis* under Alternative 9 are the same as those discussed for Alternative 1A. Restoration activities implemented under CM2 and CM4 that create shallow backwater areas could result in local increases in water temperature conducive to *Microcystis* growth during summer bloom season. This could compound the water quality degradation that may result from the hydrodynamic impacts from CM2 and CM4 discussed in Impact PH-8 and result in additional water quality degradation such that beneficial uses are affected. An increase in *Microcystis* blooms could potentially result in impacts on public health through exposure via drinking water quality and recreational waters. Therefore, this impact would be significant. Mitigation Measures WQ-32a and WQ-32b may reduce the combined effect on *Microcystis* from increased local water temperatures and water residence time. The effectiveness of these mitigation measures to result in feasible measures for reducing water quality effects, and therefore potential public health effects, is uncertain. Therefore, this impact would be significant and unavoidable.

Mitigation Measure WQ-32a: Design Restoration Sites to Reduce Potential for Increased *Microcystis* Blooms

Please see Mitigation Measure WQ-32a under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

Mitigation Measure WQ-32b: Investigate and Implement Operational Measures to Manage Water Residence Time

Please see Mitigation Measure WQ-32b under Impact WQ-32 in the discussion of Alternative 1A in Chapter 8, *Water Quality*.

25.4 Cumulative Analysis

25.4.1.1 Assessment Methodology

Impact PH-810: Cumulative Impact on Public Health from Constituents of Concern (DBPs and Pesticides)

Alternatives 6A–C, 7, 8, and 9 (DBPs [from increases in DOC concentrations])

Mitigation Measure WQ-5: Avoid, Minimize, or Offset, as Feasible, Adverse Water Quality Conditions; Site and Design Restoration Sites to Reduce Bromide Increases in Barker Slough

Please see Mitigation Measure WQ-5 under Impact PH-2 in the discussion of Alternative 1A.

25.5 References Cited

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