Appendix 8M
Selenium

This appendix includes a description of the modeling used in the selenium assessment, as well as figures and tables to support the assessment.

8M.1 Selenium Methodology

Project-related changes in waterborne concentrations of selenium in the Delta may result in increased selenium bioaccumulation and/or toxicity to aquatic and semi-aquatic receptors using the Delta. Historical fish tissue data from 2000, 2005, and 2007 and measured (for Sacramento River below Knights Landing and for San Joaquin River at Vernalis) or DSM2-modeled (other locations) waterborne selenium concentrations for selected locations in 2000, 2005, and 2007 were used to model water-to-tissue relationships, generally following procedures described by Presser and Luoma (2010a, 2010b). Implementation of the Grassland Bypass Project (GBP) has led to a 60 percent decrease in selenium loads from the Grassland Drainage Area in comparison to pre-project conditions (Tetra Tech 2008). These changes are reflected in data for the San Joaquin River at Vernalis, where water quality is monitored frequently because the river is a primary source of selenium to the Delta. Vernalis water data for two years (1999-2000, 2004-2005, and 2006-2007) were used for each year when fish data were available because of the GBP-related changes and because the lag time for selenium bioaccumulation in the piscivorous largemouth bass (*Micropterus salmoides*), the species for which the Delta-wide bioaccumulation model was calibrated, may be more than one year (Beckon 2014).

The output from the DSM2 model (expressed as percent inflow from different sources) was used in combination with the available measured waterborne selenium concentrations to model concentrations of selenium at locations throughout the Delta. These modeled waterborne selenium concentrations were used in the relationship model to estimate bioaccumulation of selenium in whole-body fish and bird eggs. Selenium concentrations in fish fillets were then estimated from those in whole-body fish. The following text, in addition to the selenium discussions in Sections 8.3.1.3, 8.3.1.5, and 8.3.1.7, provide detailed information regarding the assessment methodology for selenium.

In addition to the Delta-wide modeling for fish and birds that was calibrated with data for largemouth bass, selenium uptake and food-chain transfer information from the ecosystem-scale selenium model for the San Francisco Bay-Delta Regional Ecosystem Restoration Implementation Plan (Presser and Luoma 2013) informed our selenium bioaccumulation model. The largemouth bass has lower selenium bioaccumulation rates than those observed for sturgeon (green sturgeon, *Acipenser medirostris,* and white sturgeon, *A. transmontanus*) and is not an appropriate model species that would be protective of sturgeon. Sturgeon differ by feeding, in part, on overbite clams (*Corbula* [*Potamocorbula*] *amurensis*) in Suisun Bay and may do so in the western portion of the Delta under future conditions. Therefore, DSM2-modeled waterborne selenium concentrations from the two western-most locations in the Delta (Sacramento River at Mallard Island and San Joaquin River at Antioch Ship Channel) were used to model selenium bioaccumulation for sturgeon at those two locations to supplement the modeling done for largemouth bass.

The models described in this appendix were used to compare project alternatives to Existing Conditions and the No Action Alternative for impact assessment.

8M.2 Selenium Concentrations in Water

Dissolved or total selenium data were available for six inflow locations to the Delta (Table M-1; all tables are provided at the end of this appendix):

- Sacramento River below Knights Landing
- Sacramento River at Freeport
- Mildred Island, Center
- Mokelumne, Calaveras, and Cosumnes Rivers
- San Joaquin River at Vernalis (Airport Way)
- San Joaquin River near Mallard Island

Both dissolved and total selenium data were considered suitable for purposes of the modeling conducted for the Delta, because they typically do not differ greatly. Statements related to waterborne selenium concentrations in this appendix would be applicable to either dissolved or total concentrations.

Whole-body largemouth bass data for selenium were available from the following DSM2 output locations:

- Big Break
- Cache Slough Ryer
- Franks Tract
- Middle River Bullfrog
- Old River Near Paradise Cut
- Sacramento River Mile (RM) 44
- San Joaquin River Potato Slough

Largemouth bass data also were available from the Veterans Bridge on the Sacramento River and from Vernalis on the San Joaquin River, but DSM2 data were not available for those locations; therefore, historical data for selenium concentrations in water collected nearby (Table M-1) were used to represent quarterly averages. The geometric mean of total selenium concentrations in water collected from the Sacramento River below Knights Landing in years 2004, 2007, and 2008 (DWR Website 2009) were used to represent quarterly averages of selenium concentrations in water for Veterans Bridge in all years. The geometric means of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2000, 2004-2005, and 2006-2007 (SWAMP 2009) were used to represent quarterly averages for selenium concentrations in water at Vernalis during 2000, 2005, and 2007, respectively.

For DSM2 output locations, the geometric mean selenium concentrations from the inflow locations were combined with the modeled quarterly average percent inflow for each DSM2 output location to estimate waterborne selenium concentrations at those locations. The quarterly average mix of water

from the six inflow sources (Table M-1) was calculated from daily percent inflows provided by the DSM2 model output for the DSM2 output locations for which fish data were available. The quarterly waterborne selenium concentrations at DSM2 locations were calculated using the following equation:

$$C_{water\,quarterly} = \frac{(I_1 \bullet C_1) + (I_2 \bullet C_2) + (I_3 \bullet C_3) + (I_4 \bullet C_4) + (I_5 \bullet C_5) + (I_6 \bullet C_6)}{100} \quad \text{[Eq.1]}$$

Where:

$C_{water\,quarterly}$ = quarterly average selenium concentration in water (micrograms/liter [µg/L]) at a DSM2 output location

$I_{1\text{-}6}$ = modeled quarterly inflow from each of the six sources of water to the Delta for each DSM2 output location (percentage)

$C_{1\text{-}6}$ = selenium concentration in water (µg/L) from each of the six inflow sources to the Delta (1-6)

Example Calculation: Modeled Selenium Concentration at Franks Tract Year 2000, First Quarter:

(43.94 [% inflow from Sacramento River water source at Franks Tract] × 0.09 µg/L [Selenium concentration at Sacramento River at Freeport]) + (11.56 [% inflow from East Delta Tributaries water source at Franks Tract] × 0.10 µg/L [Selenium concentration at Mokelumne, Calaveras, and Cosumnes Rivers]) + (15.79 [% inflow from San Joaquin River water source at Franks Tract] × 0.83 µg/L [Selenium concentration at San Joaquin River at Vernalis]) + (0.02 [% inflow from Martinez/Suisun Bay water source at Franks Tract] × 0.10 µg/L [Selenium concentration at San Joaquin River near Mallard Island]) + (0.32 [% inflow from Yolo Bypass water source at Franks Tract] × 0.23 µg/L [Selenium concentration at Sacramento River below Knights Landing]) + (5.06 [% inflow from Delta Agriculture water source at Franks Tract] × 0.11 µg/L [Selenium concentration at Mildred Island, Center])/100 = 0.19 µg/L

The quarterly and average annual waterborne selenium concentrations for the DSM2 output locations are shown in Table M-2 (Year 2000), Table M-3 (Year 2005), and Table M-4 (Year 2007).

8M.3 Bioaccumulation of Selenium into Whole-body Fish and Bird Eggs

Selenium concentrations in whole-body fish and in bird eggs were calculated using ecosystem-scale models developed by Presser and Luoma (2010a, 2010b, 2013). The models were based on biogeochemical and physiological factors from laboratory and field studies; loading rates, chemical speciation, and transformation to particulate material; bioavailability; bioaccumulation in invertebrates; and trophic transfer to predators. Important components of the methodology included (1) empirically determined environmental partitioning factors between water and particulate material that quantify the effects of dissolved speciation and phase transformation; (2) concentrations of selenium in living and non-living particulates at the base of the food web that determine selenium bioavailability to invertebrates; and (3) selenium biodynamic food web transfer factors that quantify the physiological potential for bioaccumulation from particulate matter to consumer organisms and from prey to their predators.

8M.3.1 Selenium Concentration in Particulates

Phase transformation reactions from dissolved to particulate selenium are the primary form by which selenium enters the food web. Presser and Luoma (2010a, 2010b, 2013) used field observations to quantify the relationship between particulate material and dissolved selenium as provided below.

$$C_{particulate} = K_d \bullet C_{water\,column} \quad \text{[Eq. 2]}$$

Where:

$C_{particulate}$ = selenium concentration in particulate material (micrograms/kilogram, dry weight [µg/kg dw])

$C_{water\,column}$ = selenium concentration in water column (µg/L)

K_d = particulate/water ratio

The K_d describes the particulate/water ratio at the moment the sample was taken and should not be interpreted as an equilibrium constant (as it sometimes is mistaken to be). It can vary widely among hydrologic environments and potentially among seasons (Presser and Luoma 2010a, 2010b, 2013). In addition, other factors such as speciation, residence time, and particle type affect K_d. Residence time of selenium is usually the most influential factor on the conditions in the receiving water environment. Short water residence times (e.g., streams and rivers) limit partitioning of selenium into particulate material. Conversely, longer residence times (e.g., sloughs, lakes, estuaries) allow greater uptake by plants, algae, and microorganisms. Furthermore, environments in downstream portions of a watershed can receive cumulative contributions of upstream recycling in a hydrologic system. Due to its high variability, K_d is a large source of uncertainty in any selenium model where extrapolations from selenium concentrations in the water column to those in aquatic organism tissues, or from tissue to waterborne concentrations, are necessary.

In calibrating the Delta-wide bioaccumulation model for bass, the particulate selenium concentration initially was estimated using Equation 2 and a default K_d of 1,000 (Presser and Luoma 2010a). Because the K_d is typically much more variable than other steps in the bioaccumulation model, the K_d was then adjusted to calibrate the model so that the modeled concentrations for fish approximated the measured concentrations in bass for normal and wet years (2000 and 2005) and for dry years (2007), as described in more detail in Section 8M.4. Presser and Luoma (2013) determined K_d values for San Francisco Bay (including Carquinez Strait – Suisun Bay) during "low flow" conditions (5,986) and "average" conditions (3,317). These values were used to model selenium concentrations in particulates in bioaccumulation modeling for sturgeon under "Drought" and "All" year conditions at the two locations in the western Delta. (By comparison, calibration of the Delta-wide models for the western-most location from which bass had been collected [Big Break] resulted in an average K_d = 3,736 for 2000/2005 [Model 4, normal/wet years] and average K_d = 7,166 for 2007 [Model 5, dry year].)

8M.3.2 Selenium Concentrations in Invertebrates

Species-specific trophic transfer factors (TTFs) for transfer of selenium from particulates to prey and to predators were developed using data from laboratory experiments and field studies (Presser and Luoma 2010a, 2010b, 2013). TTFs are species-specific, but the range of TTFs for freshwater

invertebrates was found to be similar to TTFs for marine invertebrates determined in laboratory experiments.

TTFs for estimating selenium concentrations in invertebrates were calculated using the following equation:

$$TTF_{invertebrate} = \frac{C_{invertebrate}}{C_{particulate}} \quad \text{[Eq. 3]}$$

Where:

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

$C_{invertebrate}$ = concentration of selenium in invertebrate (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

An average aquatic insect TTF was calculated from TTFs for aquatic insect species with similar bioaccumulative potential, including mayfly (Baetidae; Heptageniidae; Ephemerellidae), caddisfly (Rhyacophilidae; Hydropsychidae), crane fly (Tipulidae), stonefly (Perlodidae/Perlidae; Chloroperlidae), damselfly (Coenagrionidae), corixid (*Cenocorixa* sp.), and chironomid (*Chironomus* sp.) aquatic life stages. Species-specific TTFs ranged from 2.1 to 3.2; the average TTF of 2.8 was used in the Delta-wide model.

Sturgeon in the western Delta, Carquinez Strait, and Suisun Bay typically prey on a mix of clams (including *Corbula amurensis*, which is known to be an efficient bioaccumulator of selenium; Stewart et al. 2010) and crustaceans. Presser and Luoma (2013) assumed a sturgeon diet of 50 percent clams and 50 percent amphipods and other crustaceans in their model. Based on this diet, the authors reported a TTF of 9.2 (identified as TTF_{prey} in Table 1 of Presser and Luoma [2013]). This TTF was used to calculate concentrations in sturgeon invertebrate prey for the San Joaquin River at Antioch and Sacramento River at Mallard Island locations to compare project alternatives to Existing Conditions and the No Action Alternative for impact assessment.

8M.3.3 Selenium Concentrations in Whole-body Fish

The mechanistic equation for modeling of selenium bioaccumulation in fish tissue is similar to that for invertebrates if whole-body concentrations are the endpoint (Presser and Luoma 2010a, 2010b, 2013), as follows:

$$TTF_{fish} = \frac{C_{fish}}{C_{invertebrate}}$$

where:

$$C_{invertebrate} = C_{particulate} \bullet TTF_{invertebrate}$$

therefore:

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \quad \text{[Eq. 4]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

$C_{invertebrate}$ = concentration of selenium in invertebrate (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

Modeling selenium bioaccumulation into a particular fish species considers organism physiology and its preferred foods. However, variability in fish tissue concentrations of selenium for present modeling purposes is driven more by dietary choices and their respective levels of bioaccumulation (i.e., $TTF_{invertebrate}$) than by differences in fish physiology or the dietary transfer to the fish (TTF_{fish}). A diet of mixed prey (including invertebrates or other fish) can be modeled as follows:

$$C_{fish} = TTF_{fish} \bullet \left[\left(C_1 \bullet F_1 \right) + \left(C_2 \bullet F_2 \right) + \left(C_3 \bullet F_3 \right) \right] \quad \text{[Eq. 5]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

TTF_{fish} = trophic transfer factor for fish species

$C_{1\text{-}3}$ = concentration of selenium in invertebrate or fish prey items 1, 2, and 3 (µg/g dw)

$F_{1\text{-}3}$ = fraction of diet composed of prey items 1, 2, and 3

Modeling of selenium concentrations in longer food webs with higher trophic levels (e.g., predator fish consuming forage fish) can be completed by incorporating additional TTFs; for example:

$$C_{predatorfish} = C_{particulate} \bullet TTF_{inverterbrate} \bullet TTF_{foragefish} \bullet TTF_{predatorfish} \quad \text{[Eq. 6]}$$

Where:

$C_{predator\ fish}$ = concentration of selenium in fish (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{forage\ fish}$ = trophic transfer factor for invertebrates to foraging fish species

$TTF_{predator\ fish}$ = trophic transfer factor for forage fish to predator species

The fish TTFs reported in Presser and Luoma (2010a) ranged from 0.5 to 1.6, so the average fish TTF of 1.1 was used for all trophic levels of fish in the Delta-wide model. A TTF of 1.3 (identified as $TTF_{predator}$) was reported for sturgeon in Presser and Luoma (2013) and was used to calculate concentrations of selenium in sturgeon for the two western Delta locations.

Modeled selenium concentrations in whole-body fish were used to estimate selenium concentrations in fish fillets, as described in Section 8M.5.

8M.3.4 Selenium Concentrations in Bird Eggs

Selenium concentrations in bird tissues can be estimated, but the transfer of selenium into bird eggs is more meaningful for evaluating reproductive endpoints (Presser and Luoma 2010a; Ohlendorf and Heinz 2011). Examples of models for selenium transfer to bird eggs are as follows:

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{birdegg} \quad \text{[Eq. 7]}$$

Or:

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{birdegg} \quad \text{[Eq. 8]}$$

Where:

$C_{bird\ egg}$ = concentration of selenium in bird egg (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate to fish

$TTF_{bird\ egg}$ = trophic transfer factor from invertebrate or fish (depending on diet) to bird egg

Equation 8 is based on birds such as herons or terns feeding on small fish. Presser and Luoma (2010b, 2013) reviewed the available data for selenium bioaccumulation from diet to bird eggs and concluded that the mean $TTF_{bird\ egg}$ = 2.6 was most appropriate for modeling. This TTF was based on laboratory studies in which mallards (*Anas platyrhynchos*) were fed selenium-fortified diets to evaluate reproductive effects. Mallards are considered a sensitive species to selenium based on reproductive endpoints. In their previous evaluation of those data, Presser and Luoma (2010a) concluded that a $TTF_{bird\ egg}$ = 1.8 was appropriate. The form of selenium included in the mallard diet (selenomethionine) has been used as a surrogate in many laboratory studies to represent exposure of fish and birds under field conditions. Other laboratory studies were conducted with black-crowned night-herons (*Nycticorax nycticorax*; Smith et al. 1988), eastern screech-owls (*Otus asio*; Wiemeyer and Hoffman 1996), and American kestrels (*Falco sparverius*; Santolo et al. 1999). In each of these studies, the experimental groups also received supplemental selenium in the form of selenomethionine. Transfer factors for the selenium-supplemented birds varied from about 1.0 to 2.2, with a mean of 1.5.

In field studies conducted at Kesterson Reservoir and the Volta Wildlife Area reference site, extensive sampling of food-chain biota and bird eggs was conducted during 1983-1985, and birds were collected to determine qualitatively the kinds of aquatic organisms they had eaten (Saiki and Lowe 1987; Hothem and Ohlendorf 1989; Schuler et al. 1990; Ohlendorf and Hothem 1995). Based on the kinds of food items found in each of the sampled species and the mean selenium concentrations in those kinds of organisms, a mean selenium concentration was estimated for each species at each site during each nesting season. In contrast to the findings with selenomethionine-supplemented diets in the laboratory, TTFs from diet to eggs were almost always less than 2.0. At the Volta Wildlife Area, where diet and egg selenium concentrations were representative of "background" conditions, transfer factors ranged from 0.63 to 2.0, with a mean of 1.35. At Kesterson, the transfer factors ranged from <0.2 to 0.48.

Given that selenomethionine in the mallard diet is probably more readily transferred to eggs than are the selenium forms in field-collected food-chain biota, the $TTF_{bird\ egg}$ = 1.8 value from Presser and Luoma (2010a) was used in the bioaccumulation model.

8M.4 Refinement of Selenium Bioaccumulation Models for the Delta

Several models were evaluated and refined to estimate selenium uptake in fish and in bird eggs from waters in the Delta. Input parameters to the model (K_ds and the number of trophic levels) were varied among the models as refinements were made. Data for largemouth bass collected in the Delta from areas near DSM2 output locations were used to calculate the geometric mean selenium concentration in whole-body fish (Foe 2010a). The ratio of the estimated selenium concentration in fish to measured selenium in whole-body bass was used to evaluate each fish model and to focus refinements of the model. These Delta-wide models are presented in the following subsections (modeling for sturgeon at the two western-most locations did not require refinement because it relied on recent data provided by Presser and Luoma [2013]), as described in Section 8M.3.

Characteristics of water flow in the Delta affect selenium bioaccumulation and the model refinements, because longer residence time for the water can be expected to increase bioaccumulation by increasing K_d. Foe (2010a) reported the water year type for 2000 as "above normal" for both the Sacramento River and San Joaquin River watersheds. It came after "wet" water years and was followed by "dry" water years. Year 2005 was wetter than 2000, was reported as "above normal" for the Sacramento River watershed and wet for the San Joaquin River watershed, and occurred between periods of wet water years. Water Year 2007 was reported as dry (Sacramento River watershed) and "critically dry" (San Joaquin River watershed). It came after wet water years and was followed by critically dry water years.

There was no difference in bass selenium concentrations in the Sacramento River at Rio Vista in comparison to the San Joaquin River at Vernalis in 2000, 2005, and 2007 (Foe 2010a). The lack of a difference in bioavailable selenium between the two river systems was unexpected because the San Joaquin River is considered a significant source of selenium to the Delta. Year 2005 selenium concentrations in bass were comparatively lower than those estimated for Year 2000. As expected in a wet water year, the water residence time was shorter, resulting in less selenium recycling, lower K_d values, and lower concentrations of selenium entering the food web. The dry water year (2007) resulted in a longer water residence time, higher K_d values, greater selenium recycling, and higher concentrations of bioavailable selenium entering the food web. These differences among years were considered when refining the selenium bioaccumulation model.

8M.4.1 Bioaccumulation in Whole-body Fish

Models estimating whole-body selenium concentrations in fish were refined by modifying dietary composition and input parameters to closely represent measured conditions in the Delta. Each model is described in this section.

Model 1 was a basic representative of uptake by a forage fish, while Model 2 calculated sequential bioaccumulation in a more complex food web that included predatory fish eating forage fish, as shown below:

- Model 1: Trophic level 3 (TL-3) fish eating invertebrates

$$C_{fish} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \quad \text{[Eq. 9]}$$

- Model 2: Trophic level 4 (TL-4) fish eating TL-3 fish

$$C_{predatorfish} = C_{particulate} \bullet TTF_{inverterbrate} \bullet TTF_{foragefish} \bullet TTF_{predatorfish} \quad \text{[Eq. 10]}$$

Where:

C_{fish} = concentration of selenium in fish (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

$TTF_{invertebrate}$ = Trophic transfer factor from particulate material to invertebrate

TTF_{fish} = Trophic transfer factor from invertebrate or fish to fish

Equation 9 is the same as Equation 4 and Equation 10 is the same as Equation 6 that were described above for the generalized model. In both Models 1 and 2, the particulate selenium concentration was estimated using Equation 2 and a default K_d of 1,000. The average TTFs for invertebrates (2.8) and fish (1.1) were used in each model. The outputs of estimated selenium concentrations and the ratios of predicted-to-observed bass selenium concentrations for Models 1 and 2 are presented in Table M-5 and Figure M-1 (all figures are provided at the end of this appendix).

Models 1 and 2 tended to substantially underestimate the whole-body selenium concentrations in fish when compared to bass data reported in Foe (2010a). This was partly because Model 1 was estimating selenium concentration in a forage fish (TL-3), whereas bass are a predatory fish with expected higher dietary exposure. Consequently, Model 1 was not further developed as the selenium bioaccumulation model to represent fish in the Delta.

Model 2 is representative of predatory fish, but Model 2 was very similar to Model 1 in distribution of data and in underestimating bass data, even though an additional trophic-level transfer was included in the model. As noted in Section 8M.3 and described in much greater detail by Presser and Luoma (2010a, 2010b, 2013), the K_ds for uptake from water are far more variable than the TTFs for invertebrates or fish. Models 1 and 2 also apparently reflect the tendency of selenium (as an essential nutrient) to be more bioaccumulative when waterborne concentrations are low (as described by Stewart et al. [2010]), which they were for the DSM2-modeled concentrations (i.e., 0.09 to 0.85 µg/L). Available K_d values from various sampling efforts in the Delta provided by Presser and Luoma (2010b) were reviewed for potential applicability in the modeling effort. Those values varied on the basis of locations within the Delta and Suisun Bay and also by water year and flow characteristics (often greater than 5,000 and sometimes exceeding 10,000). However, efforts to incorporate various selected K_ds (e.g., 2,000 or 3,000) into the model uniformly for different DSM2

locations failed to produce ratios of modeled-to-measured fish selenium concentrations that approximated 1 (they either over- or underestimated fish selenium because of variability in site conditions).

The available bass data and the assumed TTFs for fish (1.1) and invertebrates (2.8) were used to back-calculate a location and sample-specific K_d. It is recognized that some of the variability in bioaccumulation may be associated with the TTFs, but there were no reasonable assumptions for selection of alternative values to plug into the model.

When TTFs were held constant, back-calculation of K_d values revealed a concentration-related influence on the values. For waterborne selenium concentrations in the range of 0.09 to 0.13 µg/L (N = 50), the median K_d was 5,575; when waterborne selenium concentrations were in the range of 0.14 to 0.40 µg/L (N = 19), the median K_d was 2,431; for waterborne selenium concentrations in the range of 0.41 to 0.85 µg/L (N = 19), the median K_d was 748. These observations are consistent with an inverse relationship between waterborne selenium concentrations and bioaccumulation in aquatic organisms.

Figure M-2 shows the log-log regression relation of K_d to waterborne selenium concentration when all years are included and the TTFs are held constant, while Figure M-3 shows the relationship for normal/wet years (2000 and 2005) and Figure 4 shows the regression for dry years (2007), when the K_ds were generally higher.

Model 3 is based on Model 2 (with TTFs as described above) but includes the K_d estimated from the log-log regression relation for all years (Figure M-2). This produced a median ratio of predicted-to-observed whole-body selenium in bass that slightly exceeded 1 (Figure M-1); details are provided in Table M-6. Because of the noticeable differences between 2007 (the dry year) in comparison to the other two years, the next step in modeling was to evaluate 2007 separately from 2000 and 2005.

Model 4 was developed using the log-log relationship between K_d and water selenium concentrations for 2000/2005 (Figure M-3), and Model 5 was developed using log-log relationship between K_d and water selenium concentrations for 2007 (Figure M-4) (Table M-7). These two models produced ratios of predicted-to-observed whole-body selenium in bass approximating 1, as shown in Figure M-1.

As expected in a large, complex, and diverse ecological habitat such as the Delta, variations in the data distribution and in the outputs of the models are not surprising. However, it should be noted that the estimated K_ds for Models 3 (674-6,060; Table M-6), 4 (651-4,997; Table M-7), and 5 (1,206-8,064; Table M-7) are consistent with those summarized by Presser and Luoma (2010b) for the Delta.

Figures M-5 and M-6 illustrate the distribution of data for selenium concentrations in largemouth bass (Foe 2010a) relative to the measured or DSM2-modeled waterborne selenium concentrations (Tables M-1 through M-4) and Models 3, 4, and 5 to complement the boxplots shown in Figure M-1. There is notably more variability in selenium concentrations in bass between 0.09 and 0.13 µg/L than at higher waterborne selenium concentrations (as shown in both Figures M-5 and M-6); most of the higher values are from 2007 and most of the lower ones are from 2005.

Figure M-5 shows the available data for 2000, 2005, and 2007 plotted with the Model 3 prediction of selenium concentrations. As noted above in text and in Figure M-1, the model slightly over-predicts the median concentrations in fish on the basis of waterborne selenium concentrations. This effect is reflected in Figure M-1 by the outliers above the 90th percentile bar (i.e., the higher over-predictions

for fish, which are those from 2000/2005). However, overall, the model is within 1 µg/g for all values below the prediction, and within about 1.2 µg/g for the values that are above the prediction (Figure M-5).

Because of the notable differences between data for 2007 in comparison to combined 2000 and 2005, we developed Model 4 for 2000/2005 and Model 5 for 2007; Figure M-6 shows those model predictions in comparison to the data. These two models improved the predictions; although the figure shows more differences between data and the models at the lower waterborne concentrations (i.e., < 0.30 µg/L) than at higher ones, the divergence is generally < 0.5 µg/g at the higher waterborne concentrations. The outliers for Model 4 are mostly above the 90th percentile (i.e., over-predicting concentrations in fish), rather than below, as shown in Figure M-1. For Model 5, the predictions are "tighter" with just a few outliers above or below the 90th percentile.

Overall, evaluation of water-year effects on selenium concentration in bass concluded that Model 4 is relatively predictive of selenium concentration in whole-body bass during normal to wet water years, Model 5 is considered predictive for dry water years (e.g., 2007), and Model 3 incorporates the varying bioaccumulation when all years are considered (i.e., 2000, 2005, and 2007). Although Model 3 tends to slightly overestimate selenium bioaccumulation (Table M-6 and Figure M-1), it was used for estimating selenium concentrations in whole-body fish to compare project alternatives to Existing Conditions and the No Action Alternative for impact assessment for "All" years, and Model 5 was used for "Drought" years.

8M.4.2 Bioaccumulation in Bird Eggs

The K_d, invertebrate TTF, and fish TTFs developed for use in fish bioaccumulation Models 4 and 5 were also used to estimate selenium uptake into bird eggs using the following two bird egg models (Table M-8):

- Bird Egg: Uptake from invertebrates

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{birdegg}$$
$$where:$$
$$C_{particulate} = K_d \bullet C_{water} \quad \text{[Eq. 11]}$$

- Bird Egg: Uptake from fish

$$C_{birdegg} = C_{particulate} \bullet TTF_{invertebrate} \bullet TTF_{fish} \bullet TTF_{fish} \bullet TTF_{birdegg}$$
$$where: \quad \text{[Eq. 12]}$$
$$C_{particulate} = K_d \bullet C_{water}$$

Where:

$C_{bird\ egg}$ = concentration of selenium in bird egg (µg/g dw)

$C_{particulate}$ = concentration of selenium in particulate material (µg/g dw)

C_{water} = selenium concentration in water column (µg/L)

K_d = particulate/water ratio

$TTF_{invertebrate}$ = trophic transfer factor from particulate material to invertebrate

TTF_{fish} = trophic transfer factor from invertebrate or fish to fish

$TTF_{bird\ egg}$ = trophic transfer factor from invertebrate or fish (depending on diet) to bird egg

Equation 11 is the same as Equation 7, but Equation 12 differs from Equation 8 in that it assumes birds are eating larger predatory fish such as bass.

8M.5 Bioaccumulation in Fish Fillets

Selenium concentrations in whole-body fish from the bioaccumulation model were converted to selenium concentrations in skinless fish fillets for evaluation of potential human health effects in the EIR/EIS. The regression equation provided in Saiki et al. (1991) for largemouth bass from the San Joaquin River system was considered to be the most representative of fish in the Delta and was used for the conversion of these selenium concentrations as follows:

$$SF = -0.388 + 1.322\,WB \quad \text{[Eq. 13]}$$

Where:

SF = selenium concentration in skinless fish fillet (µg/g dw)

WB = selenium concentration in whole-body fish (µg/g dw)

To compare project alternatives to Existing Conditions and the No Action Alternative for impact assessment, fish fillet data were compared to the advisory tissue level (2.5 µg/g) in wet weight (ww) (OEHHA 2008); therefore, wet-weight concentrations were estimated from dry-weight concentrations using the equation provided by Saiki et al. (1991) as follows:

$$WW = DW \bullet (100 - Moist)/100 \quad \text{[Eq. 14]}$$

Where:

WW = selenium concentration in wet weight (µg/g ww)

DW = selenium concentration in dry weight (µg/g dw)

Moist = mean moisture content of the species

Because moisture content in fish varies among species, sample handling, and locations, the mean moisture content of 70 percent used by Foe (2010b) was used as an assumed approximation for fish in the Delta. The final equation used to estimate selenium concentration in skinless fish fillets (wet weight) from selenium concentration in whole-body fish (dry weight) is as follows:

$$SF = (-0.388 + 1.322\,WB) \bullet 0.3 \quad \text{[Eq. 15]}$$

Where:

SF = selenium concentrations in skinless fish fillet (µg/g ww)

WB = selenium concentration in whole-body fish (µg/g dw)

8M.6 References

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ABBREVIATIONS

µg/L	micrograms/liter
µg/g dw	micrograms/gram, dry weight
µg/g ww	micrograms/gram, wet weight
GM	geometric mean (in separate Excel tables)
NA	not available (in separate Excel tables)
OEHHA	Office of Environmental Health Hazard Assessment
RM	River Mile
SFEI	San Francisco Estuary Institute
SWAMP	Central Valley Regional Water Quality Control Board Surface Water Ambient Monitoring Program
TL	trophic level
TTF	trophic transfer factor
USGS	U.S. Geological Survey

TABLES

Table M-1. Selenium Concentrations in Water at Inflow Sources to the Delta

Delta Sources	Representative Inflow Site	GM Se Concentration in Water (µg/L)[a]	Years	Source
Delta Agriculture	Mildred Island, Center	0.11	2000	Lucas and Stewart 2007
East Delta Tributaries	Mokelumne, Calaveras, and Cosumnes Rivers	0.10[b]	None	None
Martinez/Suisun Bay	San Joaquin River near Mallard Island	0.10	02/2000–08/2008	SFEI Website 2014
Sacramento River	Sacramento River at Freeport	0.09	11/2007–07/2014	USGS Website 2014
San Joaquin River	San Joaquin River at Vernalis (Airport Way)	0.45[c]	11/2007-08/2014	USGS Website 2014
San Joaquin River	San Joaquin River at Vernalis (Airport Way)	0.83[d]	1999-2000	SWAMP Website 2009
		0.85	2004-2005	SWAMP Website 2009
		0.58	2006-2007	SWAMP Website 2009
Yolo Bypass	Sacramento River below Knights Landing	0.23[e]	2004, 2007, 2008	DWR Website 2009

Notes:
[a] Selenium concentrations are in dissolved fraction unless otherwise noted.
[b] Dissolved selenium concentration is assumed to be 0.1 µg/L due to lack of available data and lack of sources that would be expected to result in concentrations greater than 0.1 µg/L.
[c] Data used to represent current/baseline conditions for comparison of alternatives.
[d] Not specified whether total or dissolved selenium; data for 1999-2000 used for bioaccumulation by bass in 2000; data for 2004-2005 for bass in 2005; and data for 2006-2007 for bass in 2007.
[e] Total selenium concentration in water.
µg/L = microgram(s) per liter
GM = geometric mean
Se = selenium

Table M-2. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations Based on Percentage of Flow at Each Location from Different Sources: Year 2000

DSM2 Output Water Location		First Quarter Inflow Percentage						Second Quarter Inflow Percentage						Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
	Inflow Source →	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*					
	Selenium (µg/L) →	0.11	0.10	0.09	0.83	0.10	0.23	0.11	0.10	0.09	0.83	0.10	0.23	0.11	0.10	0.09	0.83	0.10	0.23	0.11	0.10	0.09	0.83	0.10	0.23	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
Water Location	**Location ID**																													
Big Break	BIGBRK_MID	2.94	6.88	53.15	6.59	0.18	5.70	2.95	6.37	73.59	13.55	0.27	3.12	3.13	0.45	85.63	0.44	4.15	6.12	2.13	0.20	84.85	0.02	8.76	3.96	0.13	0.20	0.10	0.10	0.13
Cache Slough	CACHS_LEN	1.46	0	53.38	0	0	31.91	1.24	1.5E-05	85.07	2.5E-05	0	13.25	1.66	4.7E-07	85.95	4.3E-07	5.9E-07	12.23	1.32	2.8E-06	89.83	1.1E-07	2.3E-05	8.67	0.12	0.11	0.11	0.10	0.11
Cache Slough Ryer	CACHSR_MID	2.88	0	54.86	0	0	20.48	3.36	9.8E-07	79.75	1.9E-06	0	16.25	1.90	9.3E-08	84.53	1.8E-07	9.2E-12	13.38	1.81	1.0E-07	89.45	6.2E-10	3.0E-06	8.54	0.10	0.11	0.11	0.10	0.11
Cosumnes R.	COSR_LEN	8.1E-06	98.82	0	0	0	0	0	100.00	0	0	0	0	0	100.00	0	0	0	0	0	100.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	5.06	11.56	43.94	15.79	0.02	0.32	4.17	9.42	61.16	23.89	0.01	1.22	4.04	0.57	90.34	0.41	0.80	3.78	2.76	0.62	91.38	0.12	2.42	2.64	0.19	0.27	0.10	0.10	0.16
Little Holland Tract	LHOLND_L0	72.35	0	5.06	0	0	6.50	23.38	8.2E-07	63.10	1.6E-06	0	13.03	18.48	2.2E-07	68.67	4.2E-07	7.2E-13	12.68	19.63	2.6E-09	72.79	0	0	7.42	0.10	0.11	0.11	0.10	0.11
Middle R Bullfrog	MIDRBULFRG_LEN	10.54	13.07	18.37	32.20	1.9E-03	3.2E-03	5.49	9.19	14.96	70.17	4.2E-04	0.10	7.81	6.43	69.63	14.94	0.12	1.02	4.86	6.31	59.79	27.84	1	0.68	0.31	0.61	0.20	0.30	0.36
Mildred Island	MILDDRISL_MID	7.47	14.31	22.79	30.23	2.4E-03	1.8E-03	4.77	10.05	18.48	66.48	6.7E-04	0.13	6.57	4.57	83.28	4.14	0.15	1.25	4.50	6.63	71.28	16.13	0.61	0.82	0.29	0.58	0.12	0.21	0.30
Mok. R. below Cosum.	MOKBCOS_LEN	2.07	96.19	0	0	0	0	1.65	98.35	0	0	0	0	7.23	92.77	4.7E-09	0	0	0	2.47	97.53	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Cosum.	MOKDCOS_MID	2.07	96.43	0	0	0	0	1.68	98.32	0	0	0	0	7.08	92.92	0	0	0	0	2.34	97.66	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R near Paradise Cut	OLDRNPARADSEC_MID	6.24	0	0	87.26	0	0	14.40	1.67	5.21	78.66	1.2E-05	0.04	10.56	3.9E-05	1.3E-04	89.44	8.8E-28	3.0E-07	2.50	1.1E-04	3.5E-04	97.50	2.8E-20	1.7E-07	0.73	0.68	0.75	0.81	0.74
Paradise Cut	PARADSECUT_LEN	4.69	0	0	91.37	0	0	2.62	0.06	0.15	97.16	1.5E-07	1.1E-03	3.43	0	0	96.57	0	0	0.96	0	0	99.04	0	0	0.76	0.81	0.81	0.82	0.80
Port of Stockton	PORTOSTOCK_L0	1.67	0	0	18.85	0	0	2.22	0	0	60.73	0	0	3.09	0	0	81.32	0	0	2.70	0	0	89.89	0	0	0.16	0.51	0.68	0.75	0.52
Sac. R. at Isleton	SACRISLTON_L0	0.33	0	95.77	0	0	0	0.31	0.00	99.60	0	0	5.5E-05	0.44	0	99.55	0	0	1.3E-05	0.28	0	99.72	0	0	1.1E-03	0.09	0.09	0.09	0.09	0.09
Sac River RM 44	SACR44_L0	0.14	0	97.93	0	0	0	0.11	0	99.81	0	0	0	0.13	0	99.86	0	0	0	0.05	0	99.94	0	0	0	0.09	0.09	0.09	0.09	0.09
Sandmound Sl.	SANDMND_MID	6.36	10.51	43.82	12.90	0.03	0.57	5.22	8.81	63.78	20.40	0.03	1.63	5.24	0.61	87.78	0.49	1.22	4.59	3.31	0.43	89.58	0.06	3.44	3.11	0.17	0.25	0.10	0.10	0.15
Sherman Island	SHERMNILND_L0	1.64	3.45	52.71	3.93	0.60	12.10	2.48	4.95	76.80	10.96	0.96	3.67	2.60	0.40	81.69	0.46	8.21	6.56	1.77	0.11	77.64	0.01	16.46	3.94	0.11	0.18	0.10	0.10	0.12
SJR Bowman	SJRBOWMN_MID	1.40	0	0	94.03	0	0	1.52	0	0	98.48	0	0	3.00	0	0	97.00	0	0	0.33	0	0	99.67	0	0	0.78	0.82	0.81	0.83	0.81
SJR N Hwy4	SJRNHWY4_MID	3.49	0	0	89.96	0	0	1.87	0	0	98.13	0	0	3.91	0	0	96.09	0	0	0.72	0	0	99.28	0	0	0.75	0.82	0.80	0.82	0.80
SJR Naval st	SJRNAVLST_L0	8.89	12.70	0.00	65.44	0	0	2.69	6.26	0	90.94	0	0	5.98	10.89	0	83.00	0	0	2.02	3.10	0.00	94.84	0	0	0.57	0.76	0.71	0.79	0.71
SJR Potato Slough	SJRPOTSL_MID	3.15	12.62	55.38	12.40	0.01	0.06	3.05	10.32	65.93	19.73	0.01	0.86	2.63	0.35	93.54	0.20	0.45	2.79	2.06	0.80	93.46	0.06	1.47	2.11	0.17	0.24	0.10	0.09	0.15
SJR Turner	SJRTURNR_MID	8.81	9.28	2.55	56.31	5.3E-05	1.0E-05	3.33	5.77	0.41	90.39	6.3E-06	2.4E-03	8.69	13.75	17.87	59.41	0.01	0.16	3.23	4.83	7.34	84.49	0.03	0.05	0.49	0.76	0.53	0.72	0.62
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	1.92	4.35	55.13	4.50	0.44	10.23	2.45	4.72	77.70	10.28	0.76	3.91	2.64	0.35	83.38	0.38	6.66	6.52	1.82	0.12	80.54	0.01	13.33	4.11	0.12	0.17	0.10	0.10	0.12
Suisun Bay	SUISNB_LEN	0.81	1.22	45.93	1.24	16.49	15.94	0.92	1.66	49.51	3.61	41.10	2.95	0.80	0.23	27.56	0.40	68.55	2.42	0.60	0.03	28.62	0.01	69.16	1.54	0.11	0.13	0.10	0.10	0.11
Sycamore Slough	SYCAMOR_MID	6.50	50.69	15.18	0	0	0	5.89	76.86	16.89	2.8E-07	0	0	5.04	14.29	80.66	1.2E-31	0	0	4.23	31.10	64.66	0	0	0	0.07	0.10	0.09	0.09	0.09
White Slough	WHITESL_L0	22.32	11.88	17.97	25.51	1.7E-08	6.0E-11	16.54	12.10	16.87	54.46	3.7E-09	6.1E-05	9.89	7.76	82.34	3.8E-03	3.0E-05	5.3E-04	11.19	12.92	75.64	0.24	4.2E-04	6.4E-04	0.26	0.50	0.09	0.10	0.24
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	14.83	22.63	29.02	22.45	5.4E-08	0	12.45	13.97	21.21	52.32	2.2E-09	2.3E-04	8.74	7.78	83.47	2.4E-03	4.0E-05	5.6E-04	5.28	14.84	79.82	0.05	5.0E-04	7.3E-04	0.25	0.48	0.09	0.09	0.23

Table M-3. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations Based on Percentage of Flow at Each Location from Different Sources: Year 2005

		First Quarter Inflow Percentage						Second Quarter Inflow Percentage					
	Inflow Source →	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*
DSM2 Output	Selenium (µg/L) →	0.11	0.10	0.09	0.85	0.10	0.23	0.11	0.10	0.09	0.85	0.10	0.23
Water Location	**Location ID**												
Big Break	BIGBRK_MID	5.87	7.57	83.73	2.41	0.24	0.18	2.90	17.21	52.77	26.69	1.6E-03	0.43
Cache Slough	CACHS_LEN	4.89	2.2E-07	93.64	8.E-07	3.8E-07	1.47	1.48	7.1E-07	94.13	8.0E-07	1.1E-08	4.38
Cache Slough Ryer	CACHSR_MID	8.13	3.0E-07	91.14	1.2E-06	1.3E-06	0.73	3.74	2.5E-08	91.89	1.0E-07	2.9E-08	4.38
Cosumnes R.	COSR_LEN	0	100.00	0	0	0	0	0.00	100.00	0.00	0	0	0
Franks Tract	FRANKST_MID	8.65	11.65	72.50	7.E+00	0.19	0.05	4.63	16.63	26.97	51.74	1.1E-04	0.03
Little Holland Tract	LHOLND_L0	97.11	3.2E-09	2.88	9.E-09	3.9E-09	0.01	44.12	6.5E-09	53.25	2E-08	1.2E-08	2.63
Middle R Bullfrog	MIDRBULFRG_LEN	13.67	9.76	28.26	48.24	0.08	0.01	5.55	5.64	2.70	86.11	7.1E-05	8.4E-04
Mildred Island	MILDDRISL_MID	12.36	11.39	32.28	43.87	8.4E-02	0.01	4.81	6.98	2.78	85.43	3.6E-05	6.7E-04
Mok. R. below Cosum.	MOKBCOS_LEN	2.18	97.82	0	0.00	0	0	0.53	99.47	0	0	0	0
Mok. R. downstream Cosum.	MOKDCOS_MID	2.22	97.78	0	0.00	0	0	0.53	99.47	0	0	0	0
Old R near Paradise Cut	OLDRNPARADSEC_MID	8.95	4.7E-05	1.5E-03	91.05	1.4E-05	1.4E-06	1.43	1.7E-07	1.6E-05	98.57	1.7E-08	3.5E-10
Paradise Cut	PARADSECUT_LEN	10.28	1.6E-07	6.8E-07	89.72	1.6E-11	1.7E-08	0.82	0	0	99.18	0	0
Port of Stockton	PORTOSTOCK_L0	4.70	0	0	95.30	0	0	2.83	0	0	97.16	0	0
Sac. R. at Isleton	SACRISLTON_L0	0.55	0	99.45	0.00	0	0	0.18	0	99.82	0.00	0	0
Sac River RM 44	SACR44_L0	0.21	0	99.79	0.00	0	0	0.07	0	99.93	0.00	0	0
Sandmound Sl.	SANDMND_MID	10.51	10.17	74.35	4.65	0.25	0.07	5.35	18.03	32.15	44.41	1.5E-04	0.06
Sherman Island	SHERMNILND_L0	4.89	5.04	87.74	1.52	0.56	0.23	2.43	14.17	61.17	21.31	0.03	0.89
SJR Bowman	SJRBOWMN_MID	1.10	0	0.00	98.90	0	0	0.45	0	0	99.55	0	0
SJR N Hwy4	SJRNHWY4_MID	1.89	0	0.00	98.11	0	0	0.59	0	0	99.41	0	0
SJR Naval st	SJRNAVLST_L0	4.70	5.45	0.00	89.85	0	0	1.06	5.10	0	93.84	0	0
SJR Potato Slough	SJRPOTSL_MID	6.24	16.03	71.18	6.45	0.07	0.03	2.65	23.15	38.61	35.59	1.1E-05	0.01
SJR Turner	SJRTURNR_MID	6.75	4.55	1.37	87.31	0.01	0	1.49	3.20	0.00	95.31	0	0
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	4.87	5.29	87.53	1.67	0.37	0.27	2.37	13.56	62.61	20.61	0.02	0.84
Suisun Bay	SUISNB_LEN	2.63	1.36	66.87	0.33	28.58	0.23	1.35	6.21	59.91	8.33	22.38	1.82
Sycamore Slough	SYCAMOR_MID	14.41	68.02	17.57	8.8E-17	0	3.5E-29	3.66	95.02	1.31	1.E-18	0	3.9E-33
White Slough	WHITESL_L0	47.62	12.39	33.06	6.93	8.2E-04	2.7E-06	15.95	8.06	2.95	73.04	1.4E-05	1.5E-07
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	20.77	29.09	44.03	6.11	2.4E-04	3.6E-06	14.40	8.89	3.00	73.72	7.9E-06	0

		Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
	Inflow Source →	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*					
DSM2 Output	Selenium (µg/L) →	0.11	0.10	0.09	0.85	0.10	0.23	0.11	0.10	0.09	0.85	0.10	0.23	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
Water Location	**Location ID**																	
Big Break	BIGBRK_MID	3.31	2.21	88.77	1.70	3.98	0.03	2.39	0.24	90.17	0.01	6.48	0.70	0.11	0.30	0.10	0.09	0.15
Cache Slough	CACHS_LEN	1.94	1.7E-05	98.02	1.0E-05	1.6E-06	0.05	2.30	1.2E-05	92.72	4.6E-07	0.00	4.98	0.09	0.10	0.09	0.10	0.09
Cache Slough Ryer	CACHSR_MID	2.15	5.6E-07	97.77	2.6E-07	4.5E-09	0.08	2.66	8.8E-07	96.37	1.9E-08	7.6E-06	0.97	0.09	0.10	0.09	0.09	0.09
Cosumnes R.	COSR_LEN	0	100	0	0	0	0	1.2E-04	100.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	4.27	3.20	89.93	1.81	0.77	0.02	3.17	0.81	94.16	0.06	1.74	0.05	0.15	0.49	0.11	0.09	0.21
Little Holland Tract	LHOLND_L0	18.61	5.6E-07	81.24	0.00	0.00	0.16	46.22	6.1E-08	53.77	2.8E-08	2.6E-09	0.01	0.11	0.10	0.09	0.10	0.10
Middle R Bullfrog	MIDRBULFRG_LEN	7.43	12.50	53.07	26.88	0.12	3.1E-03	5.54	8.75	65.65	19.67	0.39	1.1E-03	0.46	0.75	0.30	0.24	0.44
Mildred Island	MILDDRISL_MID	6.73	12.68	65.46	14.98	0.15	3.9E-03	4.81	7.16	77.85	9.71	0.47	1.8E-03	0.43	0.74	0.21	0.17	0.38
Mok. R. below Cosum.	MOKBCOS_LEN	3.05	96.95	0	0	0	0	3.00	97.00	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Cosum.	MOKDCOS_MID	3.05	96.95	0	0	0	0	2.93	97.07	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R near Paradise Cut	OLDRNPARADSEC_MID	6.64	0	5.E-09	93.36	0	0	14.49	0.24	3.16	82.09	0.02	8.1E-05	0.78	0.84	0.80	0.72	0.79
Paradise Cut	PARADSECUT_LEN	2.39	0	0	97.61	0	0	1.08	0	0	98.92	0	0	0.77	0.84	0.83	0.84	0.82
Port of Stockton	PORTOSTOCK_L0	2.20	0	0	97.80	0	0	2.20	0	0	97.79	0	0	0.82	0.83	0.83	0.83	0.83
Sac. R. at Isleton	SACRISLTON_L0	0.45	0	99.55	0.00	0	0	0.41	0	99.59	0	0	8.2E-08	0.09	0.09	0.09	0.09	0.09
Sac River RM 44	SACR44_L0	0.14	0	99.86	0.00	0	0	0.17	0	99.83	0	0	0	0.09	0.09	0.09	0.09	0.09
Sandmound Sl.	SANDMND_MID	5.61	3.13	87.97	2.10	1.17	0.02	3.93	0.55	92.97	0.03	2.45	0.07	0.13	0.43	0.11	0.09	0.19
Sherman Island	SHERMNILND_L0	2.76	1.84	86.03	1.72	7.62	0.04	1.95	0.11	84.69	0.01	11.76	1.48	0.10	0.26	0.10	0.09	0.14
SJR Bowman	SJRBOWMN_MID	2.06	0	0	97.94	0	0	0.80	0	0	99.20	0	0	0.84	0.85	0.83	0.84	0.84
SJR N Hwy4	SJRNHWY4_MID	2.64	0	0	97.36	0	0	1.94	0.00	0	98.06	0	0	0.84	0.85	0.83	0.84	0.84
SJR Naval st	SJRNAVLST_L0	4.11	9.43	0	86.46	0	0	4.97	12.46	0	82.57	0	0	0.77	0.80	0.75	0.72	0.76
SJR Potato Slough	SJRPOTSL_MID	2.75	2.58	93.40	0.83	0.42	0.01	2.16	1.30	95.35	0.02	1.04	0.13	0.14	0.36	0.10	0.09	0.17
SJR Turner	SJRTURNR_MID	6.05	11.77	4.90	77.27	0.01	8.4E-05	5.55	16.96	10.99	66.44	0.06	7.4E-05	0.76	0.81	0.68	0.60	0.71
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	2.82	1.68	87.76	1.46	6.24	0.03	2.05	0.14	86.70	0.01	9.68	1.42	0.10	0.25	0.10	0.09	0.14
Suisun Bay	SUISNB_LEN	0.83	0.82	31.47	1.16	65.65	0.07	0.68	0.05	32.01	0.03	66.56	0.68	0.10	0.16	0.11	0.10	0.11
Sycamore Slough	SYCAMOR_MID	4.79	40.41	54.81	2.9E-20	0	1.1E-32	5.24	32.04	62.72	2.6E-18	7.7E-14	1.0E-30	0.10	0.10	0.09	0.09	0.10
White Slough	WHITESL_L0	10.03	26.20	63.17	0.61	3.0E-05	8.1E-08	9.32	12.33	78.34	0.01	4.6E-04	4.6E-08	0.15	0.65	0.10	0.09	0.25
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	9.10	26.19	64.27	0.45	3.1E-05	0	6.26	14.39	79.35	1.9E-03	6.8E-04	0	0.14	0.65	0.10	0.09	0.25

Table M-4. Calculation of Quarterly Average Selenium Concentrations for DSM2 Output Locations Based on Percentage of Flow at Each Location from Different Sources: Year 2007

		First Quarter Inflow Percentage						Second Quarter Inflow Percentage						Third Quarter Inflow Percentage						Fourth Quarter Inflow Percentage						Estimated Waterborne Selenium Concentrations (µg/L)				
	Inflow Source →	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass	Delta Ag.	East Delta Tributaries	Sac. R.	San Joaq. R.	Martinez/ Suisun Bay	Yolo Bypass					
	Inflow Location →	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*	*Mildred Island, Center*	*Mokelumne Calaveras Cosumnes Rivers*	*Freeport*	*Vernalis*	*San Joaq. R. near Mallard Island*	*Sac. R. below Knights Landing*					
DSM2 Output	Selenium (µg/L) →	0.11	0.10	0.09	0.58	0.10	0.23	0.11	0.10	0.09	0.58	0.10	0.23	0.11	0.10	0.09	0.58	0.10	0.23	0.11	0.10	0.09	0.58	0.10	0.23	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Annual
Water Location	**Location ID**																													
Big Break	BIGBRK_MID	2.66	1.75	93.01	0.07	2.30	0.21	4.40	3.10	84.13	4.24	1.24	2.89	3.58	0.32	81.60	0.79	9.45	4.27	2.60	0.11	84.06	0.04	8.53	4.65	0.09	0.12	0.10	0.10	0.10
Cache Slough	CACHS_LEN	1.86	1.4E-05	97.14	2.2E-07	2.8E-05	1.01	1.99	5.1E-04	88.84	8.8E-04	1.6E-05	9.17	1.92	9.1E-06	89.20	1.9E-05	1.6E-06	8.88	1.64	1.9E-05	91.73	8.5E-06	5.1E-04	6.62	0.09	0.10	0.10	0.10	0.10
Cache Slough Ryer	CACHSR_MID	2.85	1.8E-06	96.46	4.7E-08	1.5E-05	0.68	2.66	1.2E-04	88.76	1.8E-04	1.4E-06	8.58	2.16	1.5E-05	88.35	3.1E-05	3.1E-07	9.49	1.96	4.5E-06	90.83	2.8E-06	1.9E-04	7.21	0.09	0.10	0.10	0.10	0.10
Cosumnes R.	COSR_LEN	0.00	100.00	0	0	0	0.00	0.01	99.99	0	0	0	0	0.09	99.91	0	0	0	0	0	100.00	0	0	0	0.00	0.10	0.10	0.10	0.10	0.10
Franks Tract	FRANKST_MID	3.85	4.08	90.69	0.32	0.94	0.11	6.16	5.35	77.86	9.10	0.16	1.38	4.86	0.34	88.03	0.84	2.96	2.98	3.19	0.32	91.15	0.17	2.23	2.95	0.09	0.14	0.10	0.10	0.11
Little Holland Tract	LHOLND_L0	29.80	0.00	69.38	1.2E-07	5.3E-05	0.81	22.80	8.0E-05	71.18	1.1E-04	5.2E-06	6.02	18.52	2.4E-05	73.18	0.00	4.9E-07	8.30	21.64	5.2E-07	71.72	1.4E-06	4.9E-05	6.64	0.10	0.10	0.11	0.10	0.10
Middle R Bullfrog	MIDRBULFRG_LEN	8.32	10.69	59.08	21.39	0.48	0.04	9.69	10.67	38.75	40.64	0.03	0.22	8.41	3.92	81.16	4.51	0.87	1.14	5.81	4.90	72.42	15.36	0.57	0.94	0.20	0.29	0.12	0.17	0.19
Mildred Island	MILDDRISL_MID	7.42	11.13	68.24	12.63	0.54	0.04	8.53	10.39	42.57	38.23	0.03	0.25	6.49	1.12	88.25	1.83	1.00	1.30	4.91	4.55	80.81	7.99	0.66	1.08	0.15	0.28	0.10	0.13	0.17
Mok. R. below Cosum.	MOKBCOS_LEN	1.46	98.54	0	0	0	0	6.32	93.68	6.5E-04	0	0	0	15.09	84.81	0.10	6.2E-35	0	0	2.30	97.70	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Mok. R. downstream Cosum.	MOKDCOS_MID	1.46	98.54	0	0	0	0	6.42	93.58	0	0	0	0	15.19	84.81	3.2E-04	0	0	0	2.27	97.73	0	0	0	0	0.10	0.10	0.10	0.10	0.10
Old R near Paradise Cut	OLDRNPARADSEC_MID	3.95	5E-12	3E-06	96.05	1.7E-16	2.5E-17	15.73	1.81	12.66	69.68	0.02	0.10	10.18	1.9E-05	1.6E-04	89.82	6.9E-08	6.5E-07	2.31	9.2E-04	0.01	97.68	0	9.7E-05	0.56	0.43	0.53	0.57	0.52
Paradise Cut	PARADSECUT_LEN	1.91	0	0	98.09	0	0	4.98	0.11	0.61	94.29	6.7E-04	3.7E-03	7.14	0	0	92.86	0	0	1.24	4.1E-03	0.05	98.71	4.1E-04	4.5E-04	0.57	0.55	0.55	0.57	0.56
Port of Stockton	PORTOSTOCK_L0	1.48	0	0	98.52	0	0	2.29	0	0	97.71	0	0	6.32	0.04	0	93.64	0	0	7.16	0.05	0	92.78	0	0	0.57	0.57	0.55	0.55	0.56
Sac. R. at Isleton	SACRISLTON_L0	0.45	0	99.55	0	0	2.1E-06	0.63	8.8E-05	99.36	5.7E-08	0	0.01	0.49	0	99.51	0	0	2.9E-04	0.39	1.0E-08	99.61	0	6.7E-07	0.01	0.09	0.09	0.09	0.09	0.09
Sac River RM 44	SACR44_L0	0.20	0	99.80	0	0	0	0.30	0	99.70	0	0	0	0.15	0	99.85	0	0	0	0.11	0	99.89	0	0	0	0.09	0.09	0.09	0.09	0.09
Sandmound Sl.	SANDMND_MID	4.47	3.23	90.83	0.17	1.17	0.13	7.20	4.64	79.23	6.98	0.23	1.71	6.15	0.39	84.96	0.98	4.06	3.46	3.79	0.22	89.26	0.10	3.11	3.51	0.09	0.13	0.10	0.10	0.10
Sherman Island	SHERMNILND_L0	2.14	0.95	92.16	0.04	4.49	0.23	3.69	2.31	83.94	2.94	4.01	3.11	2.99	0.32	77.36	0.77	14.22	4.34	2.22	0.06	75.89	0.03	17.11	4.68	0.09	0.11	0.10	0.10	0.10
SJR Bowman	SJRBOWMN_MID	0.88	0	0	99.12	0	0	3.52	0	0	96.48	0	0	8.49	2.5E-04	0	91.51	0	0	0.91	0	0	99.09	0	0	0.58	0.56	0.54	0.58	0.56
SJR N Hwy4	SJRNHWY4_MID	1.82	2.8E-08	0	98.18	0	0	4.35	1.4E-07	0	95.65	0	0	12.54	0.08	4.0E-26	87.39	0	0	1.89	1.3E-04	0	98.11	0	0	0.57	0.56	0.52	0.57	0.56
SJR Naval st	SJRNAVLST_L0	4.83	6.83	0	88.35	0	0	5.86	11.12	1.3E-06	83.02	0	0	12.06	40.15	3.4E-03	47.78	6.2E-07	6.3E-06	4.73	6.37	2.5E-04	88.90	5.4E-09	7.0E-09	0.52	0.50	0.33	0.53	0.47
SJR Potato Slough	SJRPOTSL_MID	2.91	5.22	91.00	0.15	0.61	0.10	4.89	5.67	79.70	8.49	0.10	1.16	3.16	0.19	91.86	0.46	1.88	2.44	2.37	0.33	93.43	0.10	1.44	2.33	0.09	0.13	0.10	0.09	0.10
SJR Turner	SJRTURNR_MID	7.22	10.11	10.82	71.76	0.08	0.01	7.49	11.95	7.23	73.31	2.9E-03	0.02	11.09	11.29	65.50	11.02	0.46	0.63	6.16	6.57	36.18	50.55	0.19	0.35	0.44	0.45	0.15	0.34	0.35
SJR/Pt. Antioch/fish pier	ASRANTFSH_MID	2.17	1.01	92.90	0.04	3.62	0.26	3.74	2.30	84.37	3.04	3.24	3.31	3.00	0.27	79.62	0.65	12.05	4.40	2.27	0.07	78.73	0.03	14.08	4.82	0.09	0.11	0.10	0.10	0.10
Suisun Bay	SUISNB_LEN	0.87	0.23	46.77	0.01	51.97	0.14	0.94	0.51	31.58	0.43	65.55	0.98	0.84	0.16	21.30	0.36	76.08	1.25	0.59	0.02	21.39	0.01	76.63	1.36	0.10	0.10	0.10	0.10	0.10
Sycamore Slough	SYCAMOR_MID	10.20	72.58	17.22	5.1E-10	9.7E-14	4.3E-29	13.62	50.90	35.47	0.01	4.0E-09	1.1E-07	5.33	3.90	90.77	1.9E-16	3.8E-25	1.1E-22	3.69	20.36	75.95	6.0E-19	1.1E-37	2.4E-31	0.10	0.10	0.09	0.09	0.10
White Slough	WHITESL_L0	20.35	16.73	61.67	1.25	4.8E-03	2.4E-04	33.31	13.41	23.49	29.78	3.9E-04	3.2E-03	15.53	1.33	83.05	0.09	1.2E-03	2.0E-03	9.35	8.62	81.98	0.04	3.7E-04	7.1E-04	0.10	0.24	0.09	0.09	0.13
White Slough DS Disappointment Sl.	WHTSLDISPONT_LEN	10.09	24.12	65.07	0.71	4.1E-03	1.9E-04	17.00	13.60	32.29	37.10	1.4E-03	0.01	7.70	1.46	90.83	1.5E-03	1.3E-03	2.2E-03	5.21	9.69	85.06	0.03	9.7E-04	2.1E-03	0.10	0.28	0.09	0.09	0.14

1 **Table M-5. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 1 and 2**

DSM2 Delta Water Location	Year 2000								Year 2005								Year 2007							
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2
First Quarter																								
Sacramento River RM 44	0.09	0.09	0.25	0.27	0.30	2.6	0.10	0.11	0.09	0.09	0.25	0.28	0.31	1.5	0.19	0.21	0.09	0.09	0.25	0.28	0.31	1.8	0.15	0.17
Cache Slough Ryer[b]	0.10	0.10	0.28	0.31	0.34	1.5	0.21	0.23	0.09	0.09	0.26	0.29	0.31	1.7	0.17	0.18	0.09	0.09	0.26	0.28	0.31	2.5	0.11	0.12
San Joaquin River Potato Slough	0.17	0.17	0.47	0.52	0.57	1.4	0.38	0.42	0.14	0.14	0.40	0.44	0.48	1.3	0.33	0.37	0.09	0.09	0.26	0.28	0.31	2.5	0.11	0.13
Franks Tract	0.19	0.19	0.53	0.58	0.64	1.6	0.35	0.39	0.15	0.15	0.41	0.45	0.49	1.1	0.39	0.43	0.09	0.09	0.26	0.29	0.32	3.0	0.10	0.11
Big Break	0.13	0.13	0.35	0.39	0.43	1.6	0.25	0.28	0.11	0.11	0.31	0.34	0.37	1.0	0.33	0.37	0.09	0.09	0.26	0.28	0.31	2.8	0.10	0.11
Middle River Bullfrog	0.31	0.31	0.86	0.95	1.05	NA	NA	NA	0.46	0.46	1.29	1.42	1.56	1.9	0.7	0.8	0.20	0.20	0.55	0.61	0.67	2.1	0.3	0.3
Old River near Paradise Cut[c]	0.73	0.73	2.05	2.25	2.48	NA	NA	NA	0.78	0.78	2.19	2.41	2.66	2.4	1.0	1.1	0.56	0.56	1.57	1.73	1.90	NA	NA	NA
Knights Landing[d]	0.23	0.23	0.64	0.71	0.78	NA	NA	NA	0.23	0.23	0.64	0.71	0.78	2.2	0.3	0.4	0.23	0.23	0.64	0.71	0.78	NA	NA	NA
Vernalis[e]	0.83	0.83	2.32	2.56	2.81	1.7	1.50	1.65	0.85	0.85	2.38	2.62	2.88	1.9	1.38	1.52	0.58	0.58	1.62	1.79	1.97	2.4	0.74	0.82
Second Quarter																								
Sacramento River RM 44	0.09	0.09	0.25	0.28	0.30	2.6	0.11	0.12	0.09	0.09	0.25	0.28	0.30	1.5	0.19	0.21	0.09	0.09	0.25	0.28	0.31	1.8	0.15	0.17
Cache Slough Ryer[b]	0.11	0.11	0.32	0.35	0.38	1.5	0.23	0.26	0.10	0.10	0.27	0.30	0.33	1.7	0.17	0.19	0.10	0.10	0.29	0.32	0.35	2.5	0.12	0.14
San Joaquin River Potato Slough	0.24	0.24	0.67	0.74	0.81	1.4	0.54	0.60	0.36	0.36	1.02	1.12	1.23	1.3	0.86	0.94	0.13	0.13	0.38	0.42	0.46	2.5	0.17	0.18
Franks Tract	0.27	0.27	0.76	0.83	0.92	1.6	0.51	0.56	0.49	0.49	1.36	1.50	1.65	1.1	1.31	1.44	0.14	0.14	0.39	0.43	0.47	3.0	0.14	0.16
Big Break	0.20	0.20	0.55	0.60	0.66	1.6	0.39	0.43	0.30	0.30	0.83	0.91	1.00	1.0	0.89	0.98	0.12	0.12	0.33	0.36	0.39	2.8	0.13	0.14
Middle River Bullfrog	0.61	0.61	1.71	1.88	2.07	NA	NA	NA	0.75	0.75	2.09	2.30	2.53	1.9	1.2	1.3	0.29	0.29	0.82	0.90	0.99	2.1	0.4	0.5
Old River near Paradise Cut[c]	0.68	0.68	1.89	2.08	2.29	NA	NA	NA	0.84	0.84	2.35	2.59	2.84	2.4	1.1	1.2	0.43	0.43	1.22	1.34	1.47	NA	NA	NA
Knights Landing[d]	0.23	0.23	0.64	0.71	0.78	NA	NA	NA	0.23	0.23	0.64	0.71	0.78	2.2	0.3	0.4	0.23	0.23	0.64	0.71	0.78	NA	NA	NA
Vernalis[e]	0.83	0.83	2.32	2.56	2.81	1.7	1.50	1.65	0.85	0.85	2.38	2.62	2.88	1.9	1.38	1.52	0.58	0.58	1.62	1.79	1.97	2.4	0.74	0.82
Third Quarter																								
Sacramento River RM 44	0.09	0.09	0.25	0.28	0.30	2.6	0.11	0.12	0.09	0.09	0.25	0.28	0.31	1.5	0.19	0.21	0.09	0.09	0.25	0.28	0.31	1.8	0.15	0.17
Cache Slough Ryer[b]	0.11	0.11	0.31	0.34	0.37	1.5	0.22	0.25	0.09	0.09	0.25	0.28	0.31	1.7	0.16	0.18	0.10	0.10	0.29	0.32	0.35	2.5	0.13	0.14
San Joaquin River Potato Slough	0.10	0.10	0.27	0.30	0.32	1.4	0.22	0.24	0.10	0.10	0.27	0.30	0.33	1.3	0.23	0.25	0.10	0.10	0.27	0.30	0.33	2.5	0.12	0.13
Franks Tract	0.10	0.10	0.28	0.31	0.34	1.6	0.19	0.20	0.11	0.11	0.29	0.32	0.36	1.1	0.28	0.31	0.10	0.10	0.28	0.31	0.34	3.0	0.10	0.11
Big Break	0.10	0.10	0.29	0.32	0.35	1.6	0.20	0.22	0.10	0.10	0.29	0.32	0.35	1.0	0.31	0.35	0.10	0.10	0.28	0.31	0.34	2.8	0.11	0.12
Middle River Bullfrog	0.20	0.20	0.57	0.63	0.69	NA	NA	NA	0.30	0.30	0.83	0.91	1.01	1.9	0.5	0.5	0.12	0.12	0.32	0.36	0.39	2.1	0.2	0.2
Old River near Paradise Cut[c]	0.75	0.75	2.11	2.32	2.55	NA	NA	NA	0.80	0.80	2.24	2.47	2.71	2.4	1.0	1.1	0.53	0.53	1.49	1.64	1.80	NA	NA	NA
Knights Landing[d]	0.23	0.23	0.64	0.71	0.78	NA	NA	NA	0.23	0.23	0.64	0.71	0.78	2.2	0.3	0.4	0.23	0.23	0.64	0.71	0.78	NA	NA	NA
Vernalis[e]	0.83	0.83	2.32	2.56	2.81	1.7	1.50	1.65	0.85	0.85	2.38	2.62	2.88	1.9	1.38	1.52	0.58	0.58	1.62	1.79	1.97	2.4	0.74	0.82

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Table M-5 (continued). Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Models 1 and 2

DSM2 Delta Water Location	Year 2000								Year 2005								Year 2007							
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 1 Fish	Model 2 Fish		Model 1	Model 2
	Fourth Quarter								Fourth Quarter								Fourth Quarter							
Sacramento River RM 44	0.09	0.09	0.25	0.28	0.30	2.6	0.11	0.12	0.09	0.09	0.25	0.28	0.31	1.5	0.19	0.21	0.09	0.09	0.25	0.28	0.30	1.8	0.15	0.17
Cache Slough Ryer[b]	0.10	0.10	0.29	0.31	0.35	1.5	0.21	0.23	0.09	0.09	0.26	0.28	0.31	1.7	0.16	0.18	0.10	0.10	0.28	0.31	0.34	2.5	0.12	0.13
San Joaquin River Potato Slough	0.09	0.09	0.26	0.29	0.32	1.4	0.21	0.23	0.09	0.09	0.25	0.28	0.31	1.3	0.21	0.24	0.09	0.09	0.26	0.29	0.32	2.5	0.12	0.13
Franks Tract	0.10	0.10	0.27	0.29	0.32	1.6	0.18	0.20	0.09	0.09	0.26	0.28	0.31	1.1	0.25	0.27	0.10	0.10	0.27	0.30	0.32	3.0	0.10	0.11
Big Break	0.10	0.10	0.27	0.30	0.33	1.6	0.19	0.21	0.09	0.09	0.26	0.28	0.31	1.0	0.28	0.31	0.10	0.10	0.27	0.30	0.33	2.8	0.11	0.12
Middle River Bullfrog	0.30	0.30	0.84	0.92	1.01	NA	NA	NA	0.24	0.24	0.68	0.74	0.82	1.9	0.4	0.4	0.17	0.17	0.47	0.52	0.57	2.1	0.2	0.3
Old River near Paradise Cut[c]	0.81	0.81	2.27	2.50	2.75	NA	NA	NA	0.72	0.72	2.01	2.21	2.43	2.4	0.9	1.0	0.57	0.57	1.59	1.75	1.93	NA	NA	NA
Knights Landing[d]	0.23	0.23	0.64	0.71	0.78	NA	NA	NA	0.23	0.23	0.64	0.71	0.78	2.2	0.3	0.4	0.23	0.23	0.64	0.71	0.78	NA	NA	NA
Vernalis[e]	0.83	0.83	2.32	2.56	2.81	1.7	1.50	1.65	0.85	0.85	2.38	2.62	2.88	1.9	1.38	1.52	0.58	0.58	1.62	1.79	1.97	2.4	0.74	0.82

Notes:

Equations from Presser and Luoma (2010a, 2010b) were used to calculate selenium concentrations for fish. Models 1 and 2 used the default K_d (1000) and the average selenium trophic transfer factors to aquatic insects (2.8) and fish (1.1 for all trophic levels).

Model 1 = TL-3 Fish Eating Invertebrates

Model 2 = TL-4 Fish Eating TL-3 Fish

Invert. = invertebrate

K_d = particulate concentration/water concentration ratio

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulates and biota (DSM2 data were not available). Fish data collected from Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2000 (SWAMP Website 2009) was used to estimate Year 2000 selenium concentrations in particulates and biota (DSM2 data were not available); years 2004-2005 were used for Year 2005 estimates; and years 2006-2007 were used for Year 2007 estimates.

1 **Table M-6. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Model 2 with Estimated Kd from All Years Regression for Model 3**

DSM2 Delta Water Location	Year 2000							Year 2005							Year 2007						
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3
First Quarter																					
Sacramento River RM 44	0.09	0.54	1.50	1.81	6060	2.6	0.69	0.09	0.54	1.50	1.81	5945	1.5	1.25	0.09	0.54	1.50	1.81	5946	1.8	0.98
Cache Slough Ryer[b]	0.10	0.54	1.50	1.82	5389	1.5	1.22	0.09	0.54	1.50	1.82	5783	1.7	1.05	0.09	0.54	1.50	1.81	5852	2.5	0.71
San Joaquin River Potato Slough	0.17	0.55	1.53	1.85	3229	1.4	1.36	0.14	0.54	1.52	1.84	3824	1.3	1.41	0.09	0.54	1.50	1.81	5819	2.5	0.73
Franks Tract	0.19	0.55	1.53	1.85	2904	1.6	1.13	0.15	0.54	1.52	1.84	3724	1.1	1.61	0.09	0.54	1.50	1.82	5762	3.0	0.61
Big Break	0.13	0.54	1.51	1.83	4295	1.6	1.18	0.11	0.54	1.51	1.82	4873	1.0	1.79	0.09	0.54	1.50	1.81	5850	2.8	0.64
Middle River Bullfrog	0.31	0.56	1.56	1.88	1801	NA	NA	0.46	0.56	1.57	1.90	1221	1.9	1.0	0.20	0.55	1.53	1.86	2773	2.1	0.87
Old River near Paradise Cut[c]	0.73	0.57	1.60	1.93	780	NA	NA	0.78	0.57	1.60	1.94	729	2.4	0.8	0.56	0.57	1.58	1.92	1007	NA	NA
Knights Landing[d]	0.23	0.55	1.54	1.87	2394	NA	NA	0.23	0.55	1.54	1.87	2394	2.2	0.8	0.23	0.55	1.54	1.87	2394	NA	NA
Vernalis[e]	0.83	0.57	1.60	1.94	689	1.7	1.14	0.85	0.57	1.60	1.94	674	1.9	1.02	0.58	0.57	1.59	1.92	976	2.4	0.80
Second Quarter																					
Sacramento River RM 44	0.09	0.54	1.50	1.81	5952	2.6	0.69	0.09	0.54	1.50	1.81	5947	1.5	1.25	0.09	0.54	1.50	1.81	5944	1.8	0.98
Cache Slough Ryer[b]	0.11	0.54	1.51	1.83	4777	1.5	1.22	0.10	0.54	1.50	1.82	5538	1.7	1.05	0.10	0.54	1.50	1.82	5241	2.5	0.72
San Joaquin River Potato Slough	0.24	0.55	1.54	1.87	2309	1.4	1.38	0.36	0.56	1.56	1.89	1537	1.3	1.45	0.13	0.54	1.52	1.84	4020	2.5	0.74
Franks Tract	0.27	0.55	1.55	1.87	2048	1.6	1.14	0.49	0.56	1.58	1.91	1159	1.1	1.67	0.14	0.54	1.52	1.84	3921	3.0	0.61
Big Break	0.20	0.55	1.53	1.86	2800	1.6	1.20	0.30	0.55	1.55	1.88	1876	1.0	1.84	0.12	0.54	1.51	1.83	4645	2.8	0.64
Middle River Bullfrog	0.61	0.57	1.59	1.92	928	NA	NA	0.75	0.57	1.60	1.93	764	1.9	1.0	0.29	0.55	1.55	1.88	1896	2.1	0.9
Old River near Paradise Cut[c]	0.68	0.57	1.59	1.93	842	NA	NA	0.84	0.57	1.60	1.94	682	2.4	0.8	0.43	0.56	1.57	1.90	1291	NA	NA
Knights Landing[d]	0.23	0.55	1.54	1.87	2394	NA	NA	0.23	0.55	1.54	1.87	2394	2.2	0.8	0.23	0.55	1.54	1.87	2394	NA	NA
Vernalis[e]	0.83	0.57	1.60	1.94	689	1.7	1.14	0.85	0.57	1.60	1.94	674	1.9	1.02	0.58	0.57	1.59	1.92	976	2.4	0.80
Third Quarter																					
Sacramento River RM 44	0.09	0.54	1.50	1.81	5947	2.6	0.69	0.09	0.54	1.50	1.81	5946	1.5	1.25	0.09	0.54	1.50	1.81	5946	1.8	0.98
Cache Slough Ryer[b]	0.11	0.54	1.51	1.82	4942	1.5	1.22	0.09	0.54	1.50	1.81	5914	1.7	1.05	0.10	0.54	1.51	1.82	5184	2.5	0.72
San Joaquin River Potato Slough	0.10	0.54	1.50	1.82	5592	1.4	1.34	0.10	0.54	1.50	1.82	5523	1.3	1.39	0.10	0.54	1.50	1.82	5557	2.5	0.73
Franks Tract	0.10	0.54	1.50	1.82	5412	1.6	1.10	0.11	0.54	1.51	1.82	5121	1.1	1.59	0.10	0.54	1.50	1.82	5393	3.0	0.61
Big Break	0.10	0.54	1.50	1.82	5227	1.6	1.17	0.10	0.54	1.51	1.82	5159	1.0	1.79	0.10	0.54	1.50	1.82	5291	2.8	0.64
Middle River Bullfrog	0.20	0.55	1.54	1.86	2688	NA	NA	0.30	0.55	1.55	1.88	1868	1.9	1.0	0.12	0.54	1.51	1.83	4656	2.1	0.86
Old River near Paradise Cut[c]	0.75	0.57	1.60	1.93	757	NA	NA	0.80	0.57	1.60	1.94	714	2.4	0.8	0.53	0.56	1.58	1.91	1061	NA	NA
Knights Landing[d]	0.23	0.55	1.54	1.87	2394	NA	NA	0.23	0.55	1.54	1.87	2394	2.2	0.8	0.23	0.55	1.54	1.87	2394	NA	NA
Vernalis[e]	0.83	0.57	1.60	1.94	689	1.7	1.14	0.85	0.57	1.60	1.94	674	1.9	1.02	0.58	0.57	1.59	1.92	976	2.4	0.80

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1 **Table M-6 (continued). Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Model 2 with Estimated Kd from All Years Regression for Model 3**

DSM2 Delta Water Location	Year 2000							Year 2005							Year 2007						
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 3 Fish	K_d		Model 3
	Fourth Quarter							Fourth Quarter							Fourth Quarter						
Sacramento River RM 44	0.09	0.54	1.50	1.81	5948	2.6	0.69	0.09	0.54	1.50	1.81	5946	1.5	1.25	0.09	0.54	1.50	1.81	5947	1.8	0.98
Cache Slough Ryer[b]	0.10	0.54	1.50	1.82	5261	1.5	1.22	0.09	0.54	1.50	1.81	5830	1.7	1.05	0.10	0.54	1.50	1.82	5345	2.5	0.71
San Joaquin River Potato Slough	0.09	0.54	1.50	1.82	5704	1.4	1.34	0.09	0.54	1.50	1.81	5885	1.3	1.39	0.09	0.54	1.50	1.82	5678	2.5	0.73
Franks Tract	0.10	0.54	1.50	1.82	5621	1.6	1.10	0.09	0.54	1.50	1.81	5859	1.1	1.59	0.10	0.54	1.50	1.82	5596	3.0	0.61
Big Break	0.10	0.54	1.50	1.82	5534	1.6	1.17	0.09	0.54	1.50	1.82	5809	1.0	1.78	0.10	0.54	1.50	1.82	5470	2.8	0.64
Middle River Bullfrog	0.30	0.55	1.55	1.88	1859	NA	NA	0.24	0.55	1.54	1.87	2283	1.9	1.0	0.17	0.55	1.53	1.85	3241	2.1	0.87
Old River near Paradise Cut[c]	0.81	0.57	1.60	1.94	704	NA	NA	0.72	0.57	1.60	1.93	795	2.4	0.8	0.57	0.57	1.58	1.92	994	NA	NA
Knights Landing[d]	0.23	0.55	1.54	1.87	2394	NA	NA	0.23	0.55	1.54	1.87	2394	2.2	0.8	0.23	0.55	1.54	1.87	2394	NA	NA
Vernalis[e]	0.83	0.57	1.60	1.94	689	1.7	1.14	0.85	0.57	1.60	1.94	674	1.9	1.02	0.58	0.57	1.59	1.92	976	2.4	0.80

Notes:

Equations from Presser and Luoma (2010a, 2010b) were used to calculate selenium concentrations for fish. Model 3 used the average selenium trophic transfer factors to aquatic insects (2.8) and fish (1.1 for all trophic levels).

Model 3 = Model 2 (TL-4 Fish Eating TL-3 Fish) with K_d estimated using all years regression (log K_d = 2.76-0.97(logDSM2))

Invert. = invertebrate

K_d = particulate concentration/water concentration ratio

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

a Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulates and biota (DSM2 data were not available). Fish data collected from Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2000 (SWAMP Website 2009) was used to estimate Year 2000 selenium concentrations in particulates and biota (DSM2 data were not available); years 2004-2005 were used for Year 2005 estimates; and years 2006-2007 were used for Year 2007 estimates.

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1 **Table M-7. Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Model 2 with Estimated Kd from Normal/Wet Years Regression for Model 4 and Dry Years Regression for Model 5**

	Year 2000							Year 2005							Year 2007						
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio
DSM2 Delta Water Location	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 5 Fish	K_d		Model 5
First Quarter																					
Sacramento River RM 44	0.09	0.44	1.24	1.49	4997	2.6	0.57	0.09	0.44	1.24	1.50	4909	1.5	1.03	0.09	0.73	2.03	2.46	8063	1.8	1.33
Cache Slough Ryer[b]	0.10	0.45	1.25	1.51	4481	1.5	1.01	0.09	0.44	1.24	1.50	4784	1.7	0.87	0.09	0.73	2.03	2.46	7929	2.5	0.97
San Joaquin River Potato Slough	0.17	0.47	1.32	1.59	2786	1.4	1.17	0.14	0.46	1.30	1.57	3260	1.3	1.20	0.09	0.73	2.03	2.46	7883	2.5	0.99
Franks Tract	0.19	0.48	1.33	1.61	2525	1.6	0.98	0.15	0.46	1.30	1.57	3181	1.1	1.37	0.09	0.73	2.03	2.46	7802	3.0	0.82
Big Break	0.13	0.46	1.28	1.55	3630	1.6	1.00	0.11	0.45	1.26	1.53	4082	1.0	1.50	0.09	0.73	2.03	2.46	7926	2.8	0.87
Middle River Bullfrog	0.31	0.50	1.40	1.69	1621	NA	NA	0.46	0.52	1.46	1.76	1130	1.9	0.9	0.20	0.71	2.00	2.42	3616	2.1	1.14
Old River near Paradise Cut[c]	0.73	0.55	1.53	1.85	745	NA	NA	0.78	0.55	1.54	1.86	700	2.4	0.8	0.56	0.70	1.96	2.37	1247	NA	NA
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	0.23	0.49	1.36	1.64	2111	2.2	0.7	0.23	0.71	1.99	2.41	3098	NA	NA
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	0.85	0.55	1.55	1.87	651	1.9	0.99	0.58	0.70	1.96	2.37	1206	2.4	0.99
Second Quarter																					
Sacramento River RM 44	0.09	0.44	1.24	1.50	4914	2.6	0.57	0.09	0.44	1.24	1.50	4910	1.5	1.03	0.09	0.73	2.03	2.46	8061	1.8	1.33
Cache Slough Ryer[b]	0.11	0.45	1.27	1.53	4007	1.5	1.03	0.10	0.45	1.25	1.51	4596	1.7	0.87	0.10	0.72	2.03	2.45	7061	2.5	0.96
San Joaquin River Potato Slough	0.24	0.49	1.36	1.65	2041	1.4	1.22	0.36	0.51	1.42	1.72	1399	1.3	1.32	0.13	0.72	2.02	2.44	5343	2.5	0.98
Franks Tract	0.27	0.49	1.38	1.67	1826	1.6	1.02	0.49	0.52	1.46	1.77	1077	1.1	1.55	0.14	0.72	2.02	2.44	5204	3.0	0.82
Big Break	0.20	0.48	1.34	1.62	2441	1.6	1.04	0.30	0.50	1.39	1.69	1683	1.0	1.65	0.12	0.72	2.02	2.45	6220	2.8	0.86
Middle River Bullfrog	0.61	0.54	1.50	1.81	876	NA	NA	0.75	0.55	1.53	1.85	732	1.9	1.0	0.29	0.71	1.99	2.40	2424	2.1	1.1
Old River near Paradise Cut[c]	0.68	0.54	1.51	1.83	801	NA	NA	0.84	0.55	1.55	1.87	658	2.4	0.8	0.43	0.70	1.97	2.38	1617	NA	NA
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	0.23	0.49	1.36	1.64	2111	2.2	0.7	0.23	0.71	1.99	2.41	3098	NA	NA
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	0.85	0.55	1.55	1.87	651	1.9	0.99	0.58	0.70	1.96	2.37	1206	2.4	0.99
Third Quarter																					
Sacramento River RM 44	0.09	0.44	1.24	1.50	4910	2.6	0.57	0.09	0.44	1.24	1.50	4910	1.5	1.03	0.09	0.73	2.03	2.46	8064	1.8	1.33
Cache Slough Ryer[b]	0.11	0.45	1.26	1.53	4135	1.5	1.02	0.09	0.44	1.24	1.50	4885	1.7	0.87	0.10	0.72	2.03	2.45	6980	2.5	0.96
San Joaquin River Potato Slough	0.10	0.44	1.25	1.51	4637	1.4	1.11	0.10	0.45	1.25	1.51	4584	1.3	1.15	0.10	0.72	2.03	2.46	7510	2.5	0.99
Franks Tract	0.10	0.45	1.25	1.51	4499	1.6	0.92	0.11	0.45	1.26	1.52	4274	1.1	1.33	0.10	0.72	2.03	2.45	7276	3.0	0.82
Big Break	0.10	0.45	1.25	1.52	4356	1.6	0.98	0.10	0.45	1.26	1.52	4304	1.0	1.49	0.10	0.72	2.03	2.45	7131	2.8	0.87
Middle River Bullfrog	0.20	0.48	1.34	1.63	2350	NA	NA	0.30	0.50	1.39	1.69	1677	1.9	0.9	0.12	0.72	2.02	2.45	6235	2.1	1.15
Old River near Paradise Cut[c]	0.75	0.55	1.53	1.85	725	NA	NA	0.80	0.55	1.54	1.86	687	2.4	0.8	0.53	0.70	1.96	2.37	1317	NA	NA
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	0.23	0.49	1.36	1.64	2111	2.2	0.7	0.23	0.71	1.99	2.41	3098	NA	NA
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	0.85	0.55	1.55	1.87	651	1.9	0.99	0.58	0.70	1.96	2.37	1206	2.4	0.99

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Table M-7 (continued). Selenium Bioaccumulation from Water (µg/L) to Particulates and Fish (µg/g, dw) Using Model 2 with Estimated Kd from Normal/Wet Years Regression for Model 4 and Dry Years Regression for Model 5

DSM2 Delta Water Location	Year 2000							Year 2005							Year 2007						
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 5 Fish	K_d		Model 5
	Fourth Quarter							Fourth Quarter							Fourth Quarter						
Sacramento River RM 44	0.09	0.44	1.24	1.50	4911	2.6	0.57	0.09	0.44	1.24	1.50	4909	1.5	1.03	0.09	0.73	2.03	2.46	8064	1.8	1.33
Cache Slough Ryer[b]	0.10	0.45	1.25	1.52	4383	1.5	1.02	0.09	0.44	1.24	1.50	4820	1.7	0.87	0.10	0.72	2.03	2.45	7209	2.5	0.96
San Joaquin River Potato Slough	0.09	0.44	1.24	1.50	4723	1.4	1.11	0.09	0.44	1.24	1.50	4862	1.3	1.15	0.09	0.73	2.03	2.46	7682	2.5	0.99
Franks Tract	0.10	0.44	1.24	1.51	4660	1.6	0.91	0.09	0.44	1.24	1.50	4843	1.1	1.31	0.10	0.73	2.03	2.46	7564	3.0	0.82
Big Break	0.10	0.45	1.25	1.51	4593	1.6	0.97	0.09	0.44	1.24	1.50	4804	1.0	1.47	0.10	0.72	2.03	2.46	7386	2.8	0.87
Middle River Bullfrog	0.30	0.50	1.40	1.69	1669	NA	NA	0.24	0.49	1.37	1.65	2020	1.9	0.9	0.17	0.72	2.01	2.43	4260	2.1	1.14
Old River near Paradise Cut[c]	0.81	0.55	1.54	1.87	678	NA	NA	0.72	0.54	1.52	1.84	759	2.4	0.8	0.57	0.70	1.96	2.37	1229	NA	NA
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	0.23	0.49	1.36	1.64	2111	2.2	0.7	0.23	0.71	1.99	2.41	3098	NA	NA
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	0.85	0.55	1.55	1.87	651	1.9	0.99	0.58	0.70	1.96	2.37	1206	2.4	0.99

Notes:

Equations from Presser and Luoma (2010a, 2010b) were used to calculate selenium concentrations for fish. Models 4 and 5 used the average selenium trophic transfer factors to aquatic insects (2.8) and fish (1.1 for all trophic levels).

Model 4 = Model 2 (TL-4 Fish Eating TL-3 Fish) with K_d estimated using normal/wet years regression (log K_d = 2.75-0.90(logDSM2))

Model 5 = Model 2 (TL-4 Fish Eating TL-3 Fish) with K_d estimated using dry years (2007) regression (log K_d = 2.84-1.02(logDSM2))

Invert. = invertebrate

K_d = particulate concentration/water concentration ratio

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulates and biota (DSM2 data were not available). Fish data collected from Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2000 (SWAMP Website 2009) was used to estimate Year 2000 selenium concentrations in particulates and biota (DSM2 data were not available); years 2004-2005 were used for Year 2005 estimates; and years 2006-2007 were used for Year 2007 estimates.

Table M-8. Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish (µg/g, dw), and Bird Eggs (µg/g, dw) Using Model 2 with Estimated Kd from Normal/Wet Years Regression for Model 4 and Dry Years Regression for Model 5

DSM2 Delta Water Location	Year 2000									Year 2005									Year 2007								
	Concentration				K_d	Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs		Concentration				K_d	Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs		Concentration				K_d	Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs	
	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish			Model 4	From Invert.	From Fish	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish			Model 4	From Invert.	From Fish	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 5 Fish			Model 5	From Invert.	From Fish
First Quarter										**First Quarter**									**First Quarter**								
Sacramento River RM 44	0.09	0.44	1.24	1.49	4997	2.6	0.57	2.22	2.69	0.09	0.44	1.24	1.50	4909	1.5	1.03	2.23	2.70	0.09	0.73	2.03	2.46	8063	1.8	1.33	3.66	4.43
Cache Slough Ryer[b]	0.10	0.45	1.25	1.51	4481	1.5	1.01	2.25	2.72	0.09	0.44	1.24	1.50	4784	1.7	0.87	2.23	2.70	0.09	0.73	2.03	2.46	7929	2.5	0.97	3.66	4.43
San Joaquin River Potato Slough	0.17	0.47	1.32	1.59	2786	1.4	1.17	2.37	2.87	0.14	0.46	1.30	1.57	3260	1.3	1.20	2.33	2.82	0.09	0.73	2.03	2.46	7883	2.5	0.99	3.66	4.43
Franks Tract	0.19	0.48	1.33	1.61	2525	1.6	0.98	2.40	2.90	0.15	0.46	1.30	1.57	3181	1.1	1.37	2.34	2.83	0.09	0.73	2.03	2.46	7802	3.0	0.82	3.66	4.42
Big Break	0.13	0.46	1.28	1.55	3630	1.6	1.00	2.30	2.79	0.11	0.45	1.26	1.53	4082	1.0	1.50	2.27	2.75	0.09	0.73	2.03	2.46	7926	2.8	0.87	3.66	4.43
Middle River Bullfrog	0.31	0.50	1.40	1.69	1621	NA	NA	2.52	3.05	0.46	0.52	1.46	1.76	1130	1.9	0.9	2.62	3.17	0.20	0.71	2.00	2.42	3616	2.1	1.14	3.60	4.36
Old River near Paradise Cut[c]	0.73	0.55	1.53	1.85	745	NA	NA	2.75	3.32	0.78	0.55	1.54	1.86	700	2.4	0.8	2.77	3.35	0.56	0.70	1.96	2.37	1247	NA	NA	3.53	4.27
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	2.45	2.96	0.23	0.49	1.36	1.64	2111	2.2	0.7	2.45	2.96	0.23	0.71	1.99	2.41	3098	NA	NA	3.59	4.34
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	2.78	3.37	0.85	0.55	1.55	1.87	651	1.9	0.99	2.79	3.37	0.58	0.70	1.96	2.37	1206	2.4	0.99	3.53	4.27
Second Quarter										**Second Quarter**									**Second Quarter**								
Sacramento River RM 44	0.09	0.44	1.24	1.50	4914	2.6	0.57	2.23	2.70	0.09	0.44	1.24	1.50	4910	1.5	1.03	2.23	2.70	0.09	0.73	2.03	2.46	8061	1.8	1.33	3.66	4.43
Cache Slough Ryer[b]	0.11	0.45	1.27	1.53	4007	1.5	1.03	2.28	2.76	0.10	0.45	1.25	1.51	4596	1.7	0.87	2.24	2.72	0.10	0.72	2.03	2.45	7061	2.5	0.96	3.65	4.42
San Joaquin River Potato Slough	0.24	0.49	1.36	1.65	2041	1.4	1.22	2.46	2.97	0.36	0.51	1.42	1.72	1399	1.3	1.32	2.56	3.10	0.13	0.72	2.02	2.44	5343	2.5	0.98	3.63	4.39
Franks Tract	0.27	0.49	1.38	1.67	1826	1.6	1.02	2.49	3.01	0.49	0.52	1.46	1.77	1077	1.1	1.55	2.64	3.19	0.14	0.72	2.02	2.44	5204	3.0	0.82	3.63	4.39
Big Break	0.20	0.48	1.34	1.62	2441	1.6	1.04	2.41	2.91	0.30	0.50	1.39	1.69	1683	1.0	1.65	2.51	3.04	0.12	0.72	2.02	2.45	6220	2.8	0.86	3.64	4.40
Middle River Bullfrog	0.61	0.54	1.50	1.81	876	NA	NA	2.70	3.26	0.75	0.55	1.53	1.85	732	1.9	1.0	2.75	3.33	0.29	0.71	1.99	2.40	2424	2.1	1.1	3.57	4.32
Old River near Paradise Cut[c]	0.68	0.54	1.51	1.83	801	NA	NA	2.73	3.30	0.84	0.55	1.55	1.87	658	2.4	0.8	2.79	3.37	0.43	0.70	1.97	2.38	1617	NA	NA	3.55	4.29
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	2.45	2.96	0.23	0.49	1.36	1.64	2111	2.2	0.7	2.45	2.96	0.23	0.71	1.99	2.41	3098	NA	NA	3.59	4.34
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	2.78	3.37	0.85	0.55	1.55	1.87	651	1.9	0.99	2.79	3.37	0.58	0.70	1.96	2.37	1206	2.4	0.99	3.53	4.27
Third Quarter										**Third Quarter**									**Third Quarter**								
Sacramento River RM 44	0.09	0.44	1.24	1.50	4910	2.6	0.57	2.23	2.70	0.09	0.44	1.24	1.50	4910	1.5	1.03	2.23	2.70	0.09	0.73	2.03	2.46	8064	1.8	1.33	3.66	4.43
Cache Slough Ryer[b]	0.11	0.45	1.26	1.53	4135	1.5	1.02	2.27	2.75	0.09	0.44	1.24	1.50	4885	1.7	0.87	2.23	2.70	0.10	0.72	2.03	2.45	6980	2.5	0.96	3.65	4.41
San Joaquin River Potato Slough	0.10	0.44	1.25	1.51	4637	1.4	1.11	2.24	2.71	0.10	0.45	1.25	1.51	4584	1.3	1.15	2.24	2.72	0.10	0.72	2.03	2.46	7510	2.5	0.99	3.65	4.42
Franks Tract	0.10	0.45	1.25	1.51	4499	1.6	0.92	2.25	2.72	0.11	0.45	1.26	1.52	4274	1.1	1.33	2.26	2.74	0.10	0.72	2.03	2.45	7276	3.0	0.82	3.65	4.42
Big Break	0.10	0.45	1.25	1.52	4356	1.6	0.98	2.26	2.73	0.10	0.45	1.26	1.52	4304	1.0	1.49	2.26	2.74	0.10	0.72	2.03	2.45	7131	2.8	0.87	3.65	4.42
Middle River Bullfrog	0.20	0.48	1.34	1.63	2350	NA	NA	2.42	2.93	0.30	0.50	1.39	1.69	1677	1.9	0.9	2.51	3.04	0.12	0.72	2.02	2.45	6235	2.1	1.15	3.64	4.40
Old River near Paradise Cut[c]	0.75	0.55	1.53	1.85	725	NA	NA	2.76	3.33	0.80	0.55	1.54	1.86	687	2.4	0.8	2.77	3.35	0.53	0.70	1.96	2.37	1317	NA	NA	3.53	4.27
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	2.45	2.96	0.23	0.49	1.36	1.64	2111	2.2	0.7	2.45	2.96	0.23	0.71	1.99	2.41	3098	NA	NA	3.59	4.34
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	2.78	3.37	0.85	0.55	1.55	1.87	651	1.9	0.99	2.79	3.37	0.58	0.70	1.96	2.37	1206	2.4	0.99	3.53	4.27

Table M-8 (continued). Selenium Bioaccumulation from Water (µg/L) to Particulates, Whole-body Fish (µg/g, dw), and Bird Eggs (µg/g, dw) Using Model 2 with Estimated Kd from Normal/Wet Years Regression for Model 4 and Dry Years Regression for Model 5

	Year 2000									Year 2005									Year 2007								
	Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs		Concentration					Whole-body Bass[a]	Fish-to-Bass Ratio	Bird Eggs	
DSM2 Delta Water Location	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	From Invert.	From Fish	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 4 Fish	K_d		Model 4	From Invert.	From Fish	DSM2 Water	Particulate from Water	Invert. from Particulate	Model 5 Fish	K_d		Model 5	From Invert.	From Fish
	Fourth Quarter									Fourth Quarter									Fourth Quarter								
Sacramento River RM 44	0.09	0.44	1.24	1.50	4911	2.6	0.57	2.23	2.70	0.09	0.44	1.24	1.50	4909	1.5	1.03	2.23	2.70	0.09	0.73	2.03	2.46	8064	1.8	1.33	3.66	4.43
Cache Slough Ryer[b]	0.10	0.45	1.25	1.52	4383	1.5	1.02	2.26	2.73	0.09	0.44	1.24	1.50	4820	1.7	0.87	2.23	2.70	0.10	0.72	2.03	2.45	7209	2.5	0.96	3.65	4.42
San Joaquin River Potato Slough	0.09	0.44	1.24	1.50	4723	1.4	1.11	2.24	2.71	0.09	0.44	1.24	1.50	4862	1.3	1.15	2.23	2.70	0.09	0.73	2.03	2.46	7682	2.5	0.99	3.66	4.42
Franks Tract	0.10	0.44	1.24	1.51	4660	1.6	0.91	2.24	2.71	0.09	0.44	1.24	1.50	4843	1.1	1.31	2.23	2.70	0.10	0.73	2.03	2.46	7564	3.0	0.82	3.65	4.42
Big Break	0.10	0.45	1.25	1.51	4593	1.6	0.97	2.24	2.72	0.09	0.44	1.24	1.50	4804	1.0	1.47	2.23	2.70	0.10	0.72	2.03	2.46	7386	2.8	0.87	3.65	4.42
Middle River Bullfrog	0.30	0.50	1.40	1.69	1669	NA	NA	2.51	3.04	0.24	0.49	1.37	1.65	2020	1.9	0.9	2.46	2.98	0.17	0.72	2.01	2.43	4260	2.1	1.14	3.61	4.37
Old River near Paradise Cut[c]	0.81	0.55	1.54	1.87	678	NA	NA	2.78	3.36	0.72	0.54	1.52	1.84	759	2.4	0.8	2.74	3.32	0.57	0.70	1.96	2.37	1229	NA	NA	3.53	4.27
Knights Landing[d]	0.23	0.49	1.36	1.64	2111	NA	NA	2.45	2.96	0.23	0.49	1.36	1.64	2111	2.2	0.7	2.45	2.96	0.23	0.71	1.99	2.41	3098	NA	NA	3.59	4.34
Vernalis[e]	0.83	0.55	1.55	1.87	665	1.7	1.10	2.78	3.37	0.85	0.55	1.55	1.87	651	1.9	0.99	2.79	3.37	0.58	0.70	1.96	2.37	1206	2.4	0.99	3.53	4.27

Notes:

Equations from Presser and Luoma (2010a, 2010b) were used to calculate selenium concentrations for fish. Models 4 and 5 used the average selenium trophic transfer factors to aquatic insects (2.8), fish (1.1 for all trophic levels) and bird eggs (1.8).

Model 4 = Model 2 (TL-4 Fish Eating TL-3 Fish) with K_d estimated using normal/wet years regression (log K_d = 2.75-0.90(logDSM2))

Model 5 = Model 2 (TL-4 Fish Eating TL-3 Fish) with K_d estimated using dry years (2007) regression (log K_d = 2.84-1.02(logDSM2))

Invert. = invertebrate

K_d = particulate concentration/water concentration ratio

µg/g, dw = micrograms per gram, dry weight

NA = not available; bass not collected here

RM = river mile

TL = trophic level

[a] Geometric mean calculated from whole-body largemouth bass data presented in Foe (2010a).

[b] Fish data collected at Rio Vista (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[c] Fish data collected at Old River near Tracy (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[d] Geometric mean of total selenium concentrations in water collected from years 2004, 2007, and 2008 (DWR Website 2009) was used to estimate selenium concentrations in particulates and biota (DSM2 data were not available). Fish data collected from Sacramento River at Veterans Bridge (Foe 2010a) were used to calculate geometric mean whole-body largemouth bass and ratios.

[e] Geometric mean of selenium concentrations (total or dissolved was not specified) in water collected from years 1999–2000 (SWAMP Website 2009) was used to estimate Year 2000 selenium concentrations in particulates and biota (DSM2 data were not available); years 2004-2005 were used for Year 2005 estimates; and years 2006-2007 were used for Year 2007 estimates.

Table M-9a. Modeled Selenium Concentrations in Water for Existing Conditions and All Alternatives (Except 4)

Source	Location	Period *	Period Average Concentration (µg/L)									
			Existing Conditions	No Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
Delta Interior	Mokelumne River (SF) at Staten Island	ALL	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
		DROUGHT	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
	San Joaquin River at Buckley Cove	ALL	0.41	0.38	0.38	0.40	0.38	0.39	0.40	0.38	0.39	0.16
		DROUGHT	0.39	0.34	0.35	0.39	0.35	0.37	0.38	0.35	0.37	0.11
	Franks Tract	ALL	0.14	0.14	0.16	0.17	0.15	0.15	0.23	0.21	0.21	0.29
		DROUGHT	0.10	0.10	0.10	0.11	0.10	0.11	0.16	0.15	0.15	0.23
	Old River at Rock Slough	ALL	0.16	0.16	0.17	0.20	0.16	0.17	0.33	0.29	0.30	0.37
		DROUGHT	0.10	0.11	0.11	0.13	0.11	0.11	0.27	0.24	0.25	0.33
Western Delta	Sacramento River at Emmaton	ALL	0.10	0.10	0.11	0.11	0.11	0.11	0.13	0.12	0.12	0.11
		DROUGHT	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.10	0.10	0.11
	San Joaquin River at Antioch	ALL	0.12	0.12	0.13	0.14	0.13	0.13	0.17	0.15	0.15	0.16
		DROUGHT	0.10	0.10	0.10	0.10	0.10	0.10	0.12	0.12	0.12	0.13
	Sacramento River at Mallard Island	ALL	0.11	0.11	0.12	0.12	0.12	0.11	0.14	0.13	0.13	0.13
		DROUGHT	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough Pumping Plant	ALL	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
		DROUGHT	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
	Contra Costa Pumping Plant #1	ALL	0.14	0.14	0.16	0.18	0.15	0.16	0.33	0.28	0.29	0.35
		DROUGHT	0.11	0.11	0.11	0.13	0.11	0.11	0.28	0.25	0.25	0.32
	Banks Pumping Plant	ALL	0.21	0.21	0.15	0.15	0.17	0.19	0.09	0.12	0.13	0.16
		DROUGHT	0.15	0.15	0.15	0.15	0.15	0.15	0.09	0.10	0.11	0.11
	Jones Pumping Plant	ALL	0.28	0.29	0.22	0.19	0.24	0.25	0.09	0.13	0.13	0.17
		DROUGHT	0.24	0.26	0.23	0.20	0.23	0.23	0.09	0.11	0.11	0.11

Notes:

* All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

Notes:

µg/L - microgram per liter

SF - south fork

Table M-9b. Modeled Selenium Concentrations in Water for Existing Conditions, No Action Alternative and Alternatives 4H1, 4H2, 4H3, 4H4

Source	Location	Period *	Period Average Concentration (µg/L)					
			Existing Conditions	No Action Alternative	Alternative 4H1	Alternative 4H2	Alternative 4H3	Alternative 4H4
Delta Interior	Mokelumne River (SF) at Staten Island	ALL	0.09	0.09	0.09	0.09	0.09	0.09
		DROUGHT	0.09	0.09	0.09	0.09	0.09	0.09
	San Joaquin River at Buckley Cove	ALL	0.41	0.38	0.40	0.40	0.40	0.40
		DROUGHT	0.39	0.34	0.39	0.39	0.39	0.39
	Franks Tract	ALL	0.14	0.14	0.16	0.17	0.17	0.17
		DROUGHT	0.10	0.10	0.11	0.11	0.11	0.12
	Old River at Rock Slough	ALL	0.16	0.16	0.18	0.19	0.19	0.20
		DROUGHT	0.10	0.11	0.12	0.12	0.13	0.13
Western Delta	Sacramento River at Emmaton	ALL	0.10	0.10	0.11	0.11	0.11	0.11
		DROUGHT	0.09	0.09	0.10	0.10	0.10	0.10
	San Joaquin River at Antioch	ALL	0.12	0.12	0.14	0.14	0.14	0.14
		DROUGHT	0.10	0.10	0.10	0.10	0.10	0.10
	Sacramento River at Mallard Island	ALL	0.11	0.11	0.12	0.12	0.12	0.12
		DROUGHT	0.10	0.10	0.10	0.10	0.10	0.10
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough Pumping Plant	ALL	0.10	0.10	0.11	0.11	0.11	0.11
		DROUGHT	0.09	0.10	0.10	0.10	0.10	0.10
	Contra Costa Pumping Plant #1	ALL	0.14	0.14	0.17	0.17	0.18	0.19
		DROUGHT	0.11	0.11	0.12	0.12	0.13	0.13
	Banks Pumping Plant	ALL	0.21	0.21	0.16	0.16	0.16	0.16
		DROUGHT	0.15	0.15	0.15	0.14	0.15	0.14
	Jones Pumping Plant	ALL	0.28	0.29	0.21	0.20	0.21	0.20
		DROUGHT	0.24	0.26	0.21	0.20	0.21	0.20

Notes:

* All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

µg/L - microgram per liter

SF - south fork

Table M-10. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions and No Action Alternative

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])							
			Whole-body Fish		Bird Eggs (Invertebrate Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)	
			EX	NAA	EX	NAA	EX	NAA	EX	NAA
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	2.70	2.70	3.27	3.27	0.60	0.60
		Drought	2.46	2.46	3.66	3.66	4.42	4.42	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	2.82	2.82	3.42	3.41	0.64	0.63
		Drought	2.39	2.40	3.55	3.56	4.30	4.31	0.83	0.83
	Franks Tract	All	1.84	1.84	2.73	2.73	3.31	3.30	0.61	0.61
		Drought	2.46	2.45	3.65	3.65	4.42	4.42	0.86	0.86
	Old River at Rock Slough	All	1.84	1.84	2.74	2.74	3.32	3.32	0.62	0.61
		Drought	2.45	2.45	3.65	3.64	4.41	4.41	0.86	0.86
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	2.71	2.71	3.28	3.28	0.61	0.61
		Drought	2.46	2.46	3.66	3.66	4.42	4.42	0.86	0.86
	SJR at Antioch	All	1.83	1.83	2.72	2.72	3.29	3.29	0.61	0.61
		Drought	2.46	2.46	3.65	3.65	4.42	4.42	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	2.71	2.71	3.28	3.29	0.61	0.61
		Drought	2.46	2.46	3.65	3.65	4.42	4.42	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough Pumping Plant	All	1.82	1.82	2.71	2.71	3.28	3.28	0.61	0.61
		Drought	2.46	2.46	3.66	3.65	4.42	4.42	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	2.73	2.74	3.31	3.31	0.61	0.61
		Drought	2.45	2.45	3.65	3.64	4.41	4.41	0.86	0.85
	Banks Pumping Plant	All	1.86	1.86	2.77	2.77	3.35	3.35	0.62	0.62
		Drought	2.43	2.43	3.62	3.62	4.38	4.38	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	2.79	2.80	3.38	3.38	0.63	0.63
		Drought	2.41	2.41	3.59	3.58	4.34	4.34	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-11. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 1

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 1	EX	NAA	Alt. 1	EX	NAA	Alt. 1	EX	NAA	Alt. 1
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.89	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.63
		Drought	2.39	2.40	2.39	3.55	3.56	3.56	4.30	4.31	4.31	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.84	2.73	2.73	2.74	3.31	3.30	3.32	0.61	0.61	0.61
		Drought	2.46	2.45	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Old River at Rock Slough	All	1.84	1.84	1.85	2.74	2.74	2.75	3.32	3.32	3.33	0.62	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.65	4.41	4.41	4.41	0.86	0.86	0.86
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.83	2.72	2.72	2.73	3.29	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.75	3.31	3.31	3.32	0.61	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.41	0.86	0.85	0.86
	Banks Pumping Plant	All	1.86	1.86	1.84	2.77	2.77	2.74	3.35	3.35	3.32	0.62	0.62	0.61
		Drought	2.43	2.43	2.44	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.77	3.38	3.38	3.35	0.63	0.63	0.62
		Drought	2.41	2.41	2.41	3.59	3.58	3.59	4.34	4.34	4.34	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-12. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 2

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 2	EX	NAA	Alt. 2	EX	NAA	Alt. 2	EX	NAA	Alt. 2
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.85	2.73	2.73	2.75	3.31	3.30	3.33	0.61	0.61	0.62
		Drought	2.46	2.45	2.45	3.65	3.65	3.64	4.42	4.42	4.41	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.86	2.74	2.74	2.76	3.32	3.32	3.34	0.62	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.40	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.73	3.29	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.76	3.31	3.31	3.34	0.61	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.40	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.84	2.77	2.77	2.74	3.35	3.35	3.32	0.62	0.62	0.61
		Drought	2.43	2.43	2.43	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.76	3.38	3.38	3.34	0.63	0.63	0.62
		Drought	2.41	2.41	2.42	3.59	3.58	3.60	4.34	4.34	4.36	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-13. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 3

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 3	EX	NAA	Alt. 3	EX	NAA	Alt. 3	EX	NAA	Alt. 3
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.89	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.63
		Drought	2.39	2.40	2.39	3.55	3.56	3.56	4.30	4.31	4.31	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.84	2.73	2.73	2.74	3.31	3.30	3.31	0.61	0.61	0.61
		Drought	2.46	2.45	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Old River at Rock Slough	All	1.84	1.84	1.85	2.74	2.74	2.75	3.32	3.32	3.32	0.62	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.41	0.86	0.86	0.86
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.83	2.72	2.72	2.73	3.29	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.84	2.73	2.74	2.74	3.31	3.31	3.32	0.61	0.61	0.61
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.41	0.86	0.85	0.86
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.75	3.35	3.35	3.33	0.62	0.62	0.62
		Drought	2.43	2.43	2.43	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.87	2.79	2.80	2.78	3.38	3.38	3.36	0.63	0.63	0.62
		Drought	2.41	2.41	2.41	3.59	3.58	3.59	4.34	4.34	4.35	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-14a. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 4-H1

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1	EX	NAA	Alt. 4H1
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.85	2.73	2.73	2.75	3.31	3.30	3.32	0.61	0.61	0.62
		Drought	2.46	2.45	2.45	3.65	3.65	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	Old River at Rock Slough	All	1.84	1.84	1.85	2.74	2.74	2.76	3.32	3.32	3.33	0.62	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.40	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.73	3.29	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.75	3.31	3.31	3.33	0.61	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.40	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.84	2.77	2.77	2.74	3.35	3.35	3.32	0.62	0.62	0.62
		Drought	2.43	2.43	2.43	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.77	3.38	3.38	3.35	0.63	0.63	0.62
		Drought	2.41	2.41	2.42	3.59	3.58	3.60	4.34	4.34	4.35	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-14b. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 4-H2

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2	EX	NAA	Alt. 4H2
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.42	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.85	2.73	2.73	2.75	3.31	3.30	3.33	0.61	0.61	0.62
		Drought	2.46	2.45	2.45	3.65	3.65	3.64	4.42	4.42	4.41	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.85	2.74	2.74	2.76	3.32	3.32	3.34	0.62	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.64	4.41	4.41	4.40	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.73	3.29	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.75	3.31	3.31	3.33	0.61	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.64	4.41	4.41	4.40	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.75	3.35	3.35	3.32	0.62	0.62	0.62
		Drought	2.43	2.43	2.44	3.62	3.62	3.62	4.38	4.38	4.39	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.77	3.38	3.38	3.35	0.63	0.63	0.62
		Drought	2.41	2.41	2.42	3.59	3.58	3.60	4.34	4.34	4.36	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-14c. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 4-H3

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3	EX	NAA	Alt. 4H3
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.85	2.73	2.73	2.75	3.31	3.30	3.33	0.61	0.61	0.62
		Drought	2.46	2.45	2.45	3.65	3.65	3.64	4.42	4.42	4.41	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.86	2.74	2.74	2.76	3.32	3.32	3.34	0.62	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.40	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.73	3.29	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.76	3.31	3.31	3.33	0.61	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.40	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.75	3.35	3.35	3.32	0.62	0.62	0.62
		Drought	2.43	2.43	2.43	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.77	3.38	3.38	3.35	0.63	0.63	0.62
		Drought	2.41	2.41	2.42	3.59	3.58	3.60	4.34	4.34	4.35	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-14d. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 4-H4

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4	EX	NAA	Alt. 4H4
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.42	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.85	2.73	2.73	2.75	3.31	3.30	3.33	0.61	0.61	0.62
		Drought	2.46	2.45	2.45	3.65	3.65	3.64	4.42	4.42	4.40	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.86	2.74	2.74	2.76	3.32	3.32	3.34	0.62	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.39	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.73	3.29	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.85	2.73	2.74	2.76	3.31	3.31	3.34	0.61	0.61	0.62
		Drought	2.45	2.45	2.44	3.65	3.64	3.63	4.41	4.41	4.39	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.75	3.35	3.35	3.32	0.62	0.62	0.62
		Drought	2.43	2.43	2.44	3.62	3.62	3.62	4.38	4.38	4.39	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.86	2.79	2.80	2.76	3.38	3.38	3.34	0.63	0.63	0.62
		Drought	2.41	2.41	2.42	3.59	3.58	3.60	4.34	4.34	4.36	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-15. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 5

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 5	EX	NAA	Alt. 5	EX	NAA	Alt. 5	EX	NAA	Alt. 5
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.56	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.84	2.73	2.73	2.74	3.31	3.30	3.32	0.61	0.61	0.61
		Drought	2.46	2.45	2.45	3.65	3.65	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	Old River at Rock Slough	All	1.84	1.84	1.85	2.74	2.74	2.75	3.32	3.32	3.33	0.62	0.61	0.62
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.41	0.86	0.86	0.85
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.66	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.83	2.72	2.72	2.73	3.29	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.72	3.28	3.29	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.84	2.73	2.74	2.74	3.31	3.31	3.32	0.61	0.61	0.61
		Drought	2.45	2.45	2.45	3.65	3.64	3.64	4.41	4.41	4.41	0.86	0.85	0.85
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.76	3.35	3.35	3.34	0.62	0.62	0.62
		Drought	2.43	2.43	2.43	3.62	3.62	3.62	4.38	4.38	4.38	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.87	2.79	2.80	2.78	3.38	3.38	3.37	0.63	0.63	0.63
		Drought	2.41	2.41	2.41	3.59	3.58	3.59	4.34	4.34	4.35	0.84	0.84	0.84

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-16. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 6

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 6	EX	NAA	Alt. 6	EX	NAA	Alt. 6	EX	NAA	Alt. 6
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.55	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.87	2.73	2.73	2.77	3.31	3.30	3.36	0.61	0.61	0.62
		Drought	2.46	2.45	2.43	3.65	3.65	3.62	4.42	4.42	4.38	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.89	2.74	2.74	2.81	3.32	3.32	3.39	0.62	0.61	0.63
		Drought	2.45	2.45	2.41	3.65	3.64	3.58	4.41	4.41	4.33	0.86	0.86	0.84
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.73	3.28	3.28	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.85	2.72	2.72	2.75	3.29	3.29	3.33	0.61	0.61	0.62
		Drought	2.46	2.46	2.44	3.65	3.65	3.64	4.42	4.42	4.40	0.86	0.86	0.85
	Sacramento River at Mallard Island	All	1.82	1.83	1.84	2.71	2.71	2.73	3.28	3.29	3.31	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.64	4.42	4.42	4.41	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.89	2.73	2.74	2.80	3.31	3.31	3.39	0.61	0.61	0.63
		Drought	2.45	2.45	2.40	3.65	3.64	3.58	4.41	4.41	4.33	0.86	0.85	0.84
	Banks Pumping Plant	All	1.86	1.86	1.81	2.77	2.77	2.70	3.35	3.35	3.26	0.62	0.62	0.60
		Drought	2.43	2.43	2.46	3.62	3.62	3.66	4.38	4.38	4.43	0.85	0.85	0.86
	Jones Pumping Plant	All	1.88	1.88	1.81	2.79	2.80	2.70	3.38	3.38	3.26	0.63	0.63	0.60
		Drought	2.41	2.41	2.46	3.59	3.58	3.66	4.34	4.34	4.43	0.84	0.84	0.86

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-17. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 7

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 7	EX	NAA	Alt. 7	EX	NAA	Alt. 7	EX	NAA	Alt. 7
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.89	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.63
		Drought	2.39	2.40	2.39	3.55	3.56	3.56	4.30	4.31	4.31	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.86	2.73	2.73	2.77	3.31	3.30	3.35	0.61	0.61	0.62
		Drought	2.46	2.45	2.43	3.65	3.65	3.62	4.42	4.42	4.38	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.88	2.74	2.74	2.80	3.32	3.32	3.38	0.62	0.61	0.63
		Drought	2.45	2.45	2.41	3.65	3.64	3.59	4.41	4.41	4.34	0.86	0.86	0.84
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.74	3.29	3.29	3.32	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.64	4.42	4.42	4.40	0.86	0.86	0.85
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.73	3.28	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.41	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.88	2.73	2.74	2.79	3.31	3.31	3.38	0.61	0.61	0.63
		Drought	2.45	2.45	2.41	3.65	3.64	3.59	4.41	4.41	4.34	0.86	0.85	0.84
	Banks Pumping Plant	All	1.86	1.86	1.83	2.77	2.77	2.72	3.35	3.35	3.29	0.62	0.62	0.61
		Drought	2.43	2.43	2.46	3.62	3.62	3.65	4.38	4.38	4.42	0.85	0.85	0.86
	Jones Pumping Plant	All	1.88	1.88	1.84	2.79	2.80	2.73	3.38	3.38	3.30	0.63	0.63	0.61
		Drought	2.41	2.41	2.45	3.59	3.58	3.64	4.34	4.34	4.41	0.84	0.84	0.85

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-18. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 8

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 8	EX	NAA	Alt. 8	EX	NAA	Alt. 8	EX	NAA	Alt. 8
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.42	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.90	2.82	2.82	2.82	3.42	3.41	3.41	0.64	0.63	0.64
		Drought	2.39	2.40	2.39	3.55	3.56	3.56	4.30	4.31	4.30	0.83	0.83	0.83
	Franks Tract	All	1.84	1.84	1.86	2.73	2.73	2.77	3.31	3.30	3.35	0.61	0.61	0.62
		Drought	2.46	2.45	2.43	3.65	3.65	3.62	4.42	4.42	4.38	0.86	0.86	0.85
	Old River at Rock Slough	All	1.84	1.84	1.88	2.74	2.74	2.80	3.32	3.32	3.38	0.62	0.61	0.63
		Drought	2.45	2.45	2.41	3.65	3.64	3.59	4.41	4.41	4.34	0.86	0.86	0.84
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.84	2.72	2.72	2.74	3.29	3.29	3.32	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.64	4.42	4.42	4.40	0.86	0.86	0.85
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.73	3.28	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.65	4.42	4.42	4.41	0.86	0.86	0.86
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.88	2.73	2.74	2.79	3.31	3.31	3.38	0.61	0.61	0.63
		Drought	2.45	2.45	2.41	3.65	3.64	3.58	4.41	4.41	4.34	0.86	0.85	0.84
	Banks Pumping Plant	All	1.86	1.86	1.83	2.77	2.77	2.73	3.35	3.35	3.30	0.62	0.62	0.61
		Drought	2.43	2.43	2.45	3.62	3.62	3.65	4.38	4.38	4.41	0.85	0.85	0.86
	Jones Pumping Plant	All	1.88	1.88	1.84	2.79	2.80	2.73	3.38	3.38	3.30	0.63	0.63	0.61
		Drought	2.41	2.41	2.45	3.59	3.58	3.64	4.34	4.34	4.41	0.84	0.84	0.86

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-19. Summary Table for Annual Average Selenium Concentrations in Biota for Existing Conditions, No Action Alternative, and Alternative 9

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])											
			Whole-body Fish			Bird Eggs (Invertebrate Diet)			Bird Eggs (Fish Diet)			Fish Fillets (ww)		
			EX	NAA	Alt. 9	EX	NAA	Alt. 9	EX	NAA	Alt. 9	EX	NAA	Alt. 9
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	1.82	2.70	2.70	2.70	3.27	3.27	3.27	0.60	0.60	0.60
		Drought	2.46	2.46	2.46	3.66	3.66	3.66	4.42	4.42	4.43	0.86	0.86	0.86
	San Joaquin River at Buckley Cove	All	1.90	1.89	1.85	2.82	2.82	2.75	3.42	3.41	3.32	0.64	0.63	0.62
		Drought	2.39	2.40	2.45	3.55	3.56	3.64	4.30	4.31	4.41	0.83	0.83	0.86
	Franks Tract	All	1.84	1.84	1.88	2.73	2.73	2.79	3.31	3.30	3.38	0.61	0.61	0.63
		Drought	2.46	2.45	2.41	3.65	3.65	3.59	4.42	4.42	4.35	0.86	0.86	0.84
	Old River at Rock Slough	All	1.84	1.84	1.89	2.74	2.74	2.82	3.32	3.32	3.41	0.62	0.61	0.63
		Drought	2.45	2.45	2.40	3.65	3.64	3.57	4.41	4.41	4.31	0.86	0.86	0.83
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	1.83	2.71	2.71	2.72	3.28	3.28	3.29	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.66	3.66	3.65	4.42	4.42	4.41	0.86	0.86	0.86
	SJR at Antioch	All	1.83	1.83	1.85	2.72	2.72	2.75	3.29	3.29	3.32	0.61	0.61	0.62
		Drought	2.46	2.46	2.44	3.65	3.65	3.63	4.42	4.42	4.39	0.86	0.86	0.85
	Sacramento River at Mallard Island	All	1.82	1.83	1.83	2.71	2.71	2.73	3.28	3.29	3.30	0.61	0.61	0.61
		Drought	2.46	2.46	2.45	3.65	3.65	3.64	4.42	4.42	4.41	0.86	0.86	0.85
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	1.82	2.71	2.71	2.71	3.28	3.28	3.28	0.61	0.61	0.61
		Drought	2.46	2.46	2.46	3.66	3.65	3.65	4.42	4.42	4.42	0.86	0.86	0.86
	Contra Costa Pumping Plant #1	All	1.84	1.84	1.89	2.73	2.74	2.81	3.31	3.31	3.40	0.61	0.61	0.63
		Drought	2.45	2.45	2.40	3.65	3.64	3.57	4.41	4.41	4.32	0.86	0.85	0.83
	Banks Pumping Plant	All	1.86	1.86	1.85	2.77	2.77	2.75	3.35	3.35	3.32	0.62	0.62	0.62
		Drought	2.43	2.43	2.45	3.62	3.62	3.64	4.38	4.38	4.41	0.85	0.85	0.85
	Jones Pumping Plant	All	1.88	1.88	1.85	2.79	2.80	2.75	3.38	3.38	3.33	0.63	0.63	0.62
		Drought	2.41	2.41	2.45	3.59	3.58	3.64	4.34	4.34	4.41	0.84	0.84	0.85

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index)

[b] Dry weight, except as noted for fish fillets

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-20. Summary Table for Selenium Concentrations in Biota and Comparisons to Benchmarks for Existing Conditions and No Action Alternative

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])								Exceedance Quotients[c]													
			Whole-body Fish		Bird Eggs (Invert Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish				Bird Eggs (Invert Diet)				Bird Eggs (Fish Diet)				Fish Fillets (ww)	
											Level of Concern[d]		Toxicity Level[e]		Level of Concern[f]		Toxicity Level[g]		Level of Concern[f]		Toxicity Level[g]		Advisory Tissue Level[h]	
			EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	1.82	2.70	2.70	3.27	3.27	0.60	0.60	0.45	0.45	0.22	0.22	0.45	0.45	0.27	0.27	0.54	0.54	0.33	0.33	0.24	0.24
		Drought	2.46	2.46	3.66	3.66	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
	San Joaquin River at Buckley Cove	All	1.90	1.89	2.82	2.82	3.42	3.41	0.64	0.63	0.47	0.47	0.23	0.23	0.47	0.47	0.28	0.28	0.57	0.57	0.34	0.34	0.25	0.25
		Drought	2.39	2.40	3.55	3.56	4.30	4.31	0.83	0.83	0.60	0.60	0.29	0.30	0.59	0.59	0.36	0.36	0.72	0.72	0.43	0.43	0.33	0.33
	Franks Tract	All	1.84	1.84	2.73	2.73	3.31	3.30	0.61	0.61	0.46	0.46	0.23	0.23	0.46	0.46	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.24
		Drought	2.46	2.45	3.65	3.65	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
	Old River at Rock Slough	All	1.84	1.84	2.74	2.74	3.32	3.32	0.62	0.61	0.46	0.46	0.23	0.23	0.46	0.46	0.27	0.27	0.55	0.55	0.33	0.33	0.25	0.25
		Drought	2.45	2.45	3.65	3.64	4.41	4.41	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.36	0.36	0.74	0.73	0.44	0.44	0.34	0.34
Western Delta	Sacramento River at Emmaton	All	1.82	1.82	2.71	2.71	3.28	3.28	0.61	0.61	0.46	0.46	0.22	0.22	0.45	0.45	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.24
		Drought	2.46	2.46	3.66	3.66	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
	SJR at Antioch	All	1.83	1.83	2.72	2.72	3.29	3.29	0.61	0.61	0.46	0.46	0.23	0.23	0.45	0.45	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.24
		Drought	2.46	2.46	3.65	3.65	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
	Sacramento River at Mallard Island	All	1.82	1.83	2.71	2.71	3.28	3.29	0.61	0.61	0.46	0.46	0.23	0.23	0.45	0.45	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.24
		Drought	2.46	2.46	3.65	3.65	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	1.82	2.71	2.71	3.28	3.28	0.61	0.61	0.46	0.46	0.22	0.22	0.45	0.45	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.24
		Drought	2.46	2.46	3.66	3.65	4.42	4.42	0.86	0.86	0.61	0.61	0.30	0.30	0.61	0.61	0.37	0.37	0.74	0.74	0.44	0.44	0.34	0.34
	Contra Costa Pumping Plant #1	All	1.84	1.84	2.73	2.74	3.31	3.31	0.61	0.61	0.46	0.46	0.23	0.23	0.46	0.46	0.27	0.27	0.55	0.55	0.33	0.33	0.24	0.25
		Drought	2.45	2.45	3.65	3.64	4.41	4.41	0.86	0.85	0.61	0.61	0.30	0.30	0.61	0.61	0.36	0.36	0.74	0.73	0.44	0.44	0.34	0.34
	Banks Pumping Plant	All	1.86	1.86	2.77	2.77	3.35	3.35	0.62	0.62	0.47	0.47	0.23	0.23	0.46	0.46	0.28	0.28	0.56	0.56	0.34	0.33	0.25	0.25
		Drought	2.43	2.43	3.62	3.62	4.38	4.38	0.85	0.85	0.61	0.61	0.30	0.30	0.60	0.60	0.36	0.36	0.73	0.73	0.44	0.44	0.34	0.34
	Jones Pumping Plant	All	1.88	1.88	2.79	2.80	3.38	3.38	0.63	0.63	0.47	0.47	0.23	0.23	0.47	0.47	0.28	0.28	0.56	0.56	0.34	0.34	0.25	0.25
		Drought	2.41	2.41	3.59	3.58	4.34	4.34	0.84	0.84	0.60	0.60	0.30	0.30	0.60	0.60	0.36	0.36	0.72	0.72	0.43	0.43	0.34	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] Exceedance Quotient = tissue concentration/benchmark

[d] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[e] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[f] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[g] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[h] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-21. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 1

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 1	Alt. 1	Alt. 1	Alt. 1	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.89	2.82	3.41	0.63	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.56	4.31	0.83	0	0	0	0	0	0	0	0	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.84	2.74	3.32	0.61	0	0	0	0	0	0	0	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Old River at Rock Slough	All	1.85	2.75	3.33	0.62	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.75	3.32	0.62	0	0	0	0	0	0	1	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.84	2.74	3.32	0.61	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.44	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.77	3.35	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.47	0.23	0.46	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.34	0.84	0	0	0	0	0	0	0	0	0.60	0.30	0.60	0.36	0.72	0.43	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-22. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 2

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 2	Alt. 2	Alt. 2	Alt. 2	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.86	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.73	3.31	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.30	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.84	2.74	3.32	0.61	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.76	3.34	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.42	3.60	4.36	0.84	0	0	0	0	0	0	0	1	0.61	0.30	0.60	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-23. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 3

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 3	Alt. 3	Alt. 3	Alt. 3	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.89	2.82	3.41	0.63	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.56	4.31	0.83	0	0	0	0	0	0	0	0	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.84	2.74	3.31	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Old River at Rock Slough	All	1.85	2.75	3.32	0.62	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.84	2.74	3.32	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.85	2.75	3.33	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.87	2.78	3.36	0.62	0	-1	0	-1	0	-1	-1	-1	0.47	0.23	0.46	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.35	0.84	0	0	0	0	0	0	0	0	0.60	0.30	0.60	0.36	0.72	0.43	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-24a. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4-H1

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]					
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 4H1	Alt. 4H1	Alt. 4H1	Alt. 4H1	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.85	2.75	3.32	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Old River at Rock Slough	All	1.85	2.76	3.33	0.62	0	0	0	0	0	0	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.45	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.73	3.31	0.61	0	0	0	0	0	0	0	1	0.46	0.23	0.46	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.45	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.84	2.74	3.32	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.77	3.35	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.47	0.23	0.46	0.28	0.56	0.34	0.25
		Drought	2.42	3.60	4.35	0.84	0	0	0	0	0	0	0	0	0.60	0.30	0.60	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-24b. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4-H2

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 4H2	Alt. 4H2	Alt. 4H2	Alt. 4H2	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.42	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.85	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.73	3.31	0.61	0	0	0	0	0	0	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.44	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.85	2.75	3.32	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.44	3.62	4.39	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.77	3.35	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.42	3.60	4.36	0.84	0	0	0	0	0	0	0	1	0.60	0.30	0.60	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-24c. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4-H3

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 4H3	Alt. 4H3	Alt. 4H3	Alt. 4H3	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.86	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.73	3.31	0.61	0	0	0	0	0	0	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.76	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.85	2.75	3.32	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.77	3.35	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.42	3.60	4.35	0.84	0	0	0	0	0	0	0	0	0.60	0.30	0.60	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-24d. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 4-H4

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 4H4	Alt. 4H4	Alt. 4H4	Alt. 4H4	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.42	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.45	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.86	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.39	0.85	0	0	0	0	0	0	-1	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.73	3.31	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.30	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.85	2.76	3.34	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.44	3.63	4.39	0.85	0	0	0	0	0	0	-1	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.85	2.75	3.32	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.44	3.62	4.39	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.86	2.76	3.34	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.42	3.60	4.36	0.84	0	1	0	1	0	1	0	1	0.61	0.30	0.60	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative

dw - dry weight

EX - Existing Conditions

mg/kg - milligram per kilogram

NAA - No Action Alternative Late Long Term

ww - wet weight

Table M-25. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 5

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 5	Alt. 5	Alt. 5	Alt. 5	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.56	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.84	2.74	3.32	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Old River at Rock Slough	All	1.85	2.75	3.33	0.62	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.28	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Western Delta	Sacramento River at Emmaton	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	SJR at Antioch	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.84	2.74	3.32	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Banks Pumping Plant	All	1.85	2.76	3.34	0.62	0	0	0	0	0	0	0	0	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.87	2.78	3.37	0.63	0	0	0	0	0	0	0	-1	0.47	0.23	0.46	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.35	0.84	0	0	0	0	0	0	0	0	0.60	0.30	0.60	0.36	0.72	0.43	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-26. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 6

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 6	Alt. 6	Alt. 6	Alt. 6	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.55	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.29	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.87	2.77	3.36	0.62	2	2	2	2	2	2	2	2	0.47	0.23	0.46	0.28	0.56	0.34	0.25
		Drought	2.43	3.62	4.38	0.85	-1	-1	-1	-1	-1	-1	-1	-1	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.89	2.81	3.39	0.63	2	2	2	2	2	2	3	3	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.41	3.58	4.33	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.73	3.30	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	SJR at Antioch	All	1.85	2.75	3.33	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.44	3.64	4.40	0.85	-1	0	-1	0	-1	0	-1	-1	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Sacramento River at Mallard Island	All	1.84	2.73	3.31	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.24
		Drought	2.45	3.64	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.89	2.80	3.39	0.63	3	2	3	2	3	2	3	3	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.40	3.58	4.33	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.33
	Banks Pumping Plant	All	1.81	2.70	3.26	0.60	-3	-3	-3	-3	-3	-3	-3	-3	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.43	0.86	1	1	1	1	1	1	1	1	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Jones Pumping Plant	All	1.81	2.70	3.26	0.60	-3	-3	-3	-3	-3	-3	-4	-4	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.43	0.86	2	2	2	2	2	2	2	2	0.61	0.30	0.61	0.37	0.74	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-27. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 7

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 7	Alt. 7	Alt. 7	Alt. 7	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.89	2.82	3.41	0.63	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.56	4.31	0.83	0	0	0	0	0	0	0	0	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.86	2.77	3.35	0.62	1	1	1	1	1	1	1	2	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	-1	-1	-1	-1	-1	-1	-1	-1	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.88	2.80	3.38	0.63	2	2	2	2	2	2	2	2	0.47	0.23	0.47	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.34	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	1	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.74	3.32	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	1	1	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.88	2.79	3.38	0.63	2	2	2	2	2	2	3	2	0.47	0.23	0.47	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.34	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
	Banks Pumping Plant	All	1.83	2.72	3.29	0.61	-2	-2	-2	-2	-2	-2	-2	-2	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	1	1	1	1	1	1	1	1	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Jones Pumping Plant	All	1.84	2.73	3.30	0.61	-2	-2	-2	-2	-2	-2	-3	-3	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.64	4.41	0.85	2	2	2	2	2	2	2	2	0.61	0.30	0.61	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-28. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 8

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 8	Alt. 8	Alt. 8	Alt. 8	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	San Joaquin River at Buckley Cove	All	1.90	2.82	3.41	0.64	0	0	0	0	0	0	0	0	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.39	3.56	4.30	0.83	0	0	0	0	0	0	0	0	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Franks Tract	All	1.86	2.77	3.35	0.62	1	1	1	1	1	1	1	2	0.46	0.23	0.46	0.28	0.56	0.33	0.25
		Drought	2.43	3.62	4.38	0.85	-1	-1	-1	-1	-1	-1	-1	-1	0.61	0.30	0.60	0.36	0.73	0.44	0.34
	Old River at Rock Slough	All	1.88	2.80	3.38	0.63	2	2	2	2	2	2	2	2	0.47	0.23	0.47	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.34	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	1	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	SJR at Antioch	All	1.84	2.74	3.32	0.61	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.40	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	1	1	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.88	2.79	3.38	0.63	2	2	2	2	2	2	3	2	0.47	0.23	0.47	0.28	0.56	0.34	0.25
		Drought	2.41	3.58	4.34	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
	Banks Pumping Plant	All	1.83	2.73	3.30	0.61	-2	-2	-2	-2	-2	-2	-2	-2	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	1	1	1	1	1	1	1	1	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	Jones Pumping Plant	All	1.84	2.73	3.30	0.61	-2	-2	-2	-2	-2	-2	-3	-3	0.46	0.23	0.46	0.27	0.55	0.33	0.24
		Drought	2.45	3.64	4.41	0.86	2	2	2	2	2	2	2	2	0.61	0.30	0.61	0.36	0.74	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-29. Summary Table for Selenium Concentrations in Biota, and Comparisons to Baseline Conditions and Benchmarks for Alternative 9

Source	Location	Period [a]	Estimated Concentrations of Selenium (mg/kg, dw[b])				% Change In Selenium Concentrations Compared to Baseline[c]								Exceedance Quotients[d]						
			Whole-body Fish	Bird Eggs (Invert. Diet)	Bird Eggs (Fish Diet)	Fish Fillets (ww)	Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)		Whole-body Fish		Bird Eggs (Invert. Diet)		Bird Eggs (Fish Diet)		Fish Fillets (ww)
			Alt. 9	Alt. 9	Alt. 9	Alt. 9	EX	NAA	EX	NAA	EX	NAA	EX	NAA	LOC[e]	TL[f]	LOC[g]	TL[h]	LOC[g]	TL[h]	ATL[i]
Delta Interior	Mokelumne River (South Fork) at Staten Island	All	1.82	2.70	3.27	0.60	0	0	0	0	0	0	0	0	0.45	0.22	0.45	0.27	0.54	0.33	0.24
		Drought	2.46	3.66	4.43	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.343
	San Joaquin River at Buckley Cove	All	1.85	2.75	3.32	0.62	-3	-3	-3	-3	-3	-3	-3	-3	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.86	3	2	3	2	3	2	3	3	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Franks Tract	All	1.88	2.79	3.38	0.63	2	2	2	2	2	2	3	3	0.47	0.23	0.47	0.28	0.56	0.34	0.25
		Drought	2.41	3.59	4.35	0.84	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.60	0.36	0.72	0.43	0.34
	Old River at Rock Slough	All	1.89	2.82	3.41	0.63	3	3	3	3	3	3	3	3	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.40	3.57	4.31	0.83	-2	-2	-2	-2	-2	-2	-3	-2	0.60	0.30	0.59	0.36	0.72	0.43	0.33
Western Delta	Sacramento River at Emmaton	All	1.83	2.72	3.29	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.65	4.41	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.74	0.44	0.34
	SJR at Antioch	All	1.85	2.75	3.32	0.62	1	1	1	1	1	1	1	1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.44	3.63	4.39	0.85	-1	-1	-1	-1	-1	-1	-1	-1	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Sacramento River at Mallard Island	All	1.83	2.73	3.30	0.61	0	0	0	0	0	0	1	1	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.45	3.64	4.41	0.85	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.36	0.73	0.44	0.34
Major Diversions (Pumping Stations)	North Bay Aqueduct at Barker Slough PP	All	1.82	2.71	3.28	0.61	0	0	0	0	0	0	0	0	0.46	0.23	0.45	0.27	0.55	0.33	0.24
		Drought	2.46	3.65	4.42	0.86	0	0	0	0	0	0	0	0	0.61	0.30	0.61	0.37	0.74	0.44	0.34
	Contra Costa Pumping Plant #1	All	1.89	2.81	3.40	0.63	3	3	3	3	3	3	3	3	0.47	0.23	0.47	0.28	0.57	0.34	0.25
		Drought	2.40	3.57	4.32	0.83	-2	-2	-2	-2	-2	-2	-2	-2	0.60	0.30	0.59	0.36	0.72	0.43	0.33
	Banks Pumping Plant	All	1.85	2.75	3.32	0.62	-1	-1	-1	-1	-1	-1	-1	-1	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	1	1	1	1	1	1	1	1	0.61	0.30	0.61	0.36	0.73	0.44	0.34
	Jones Pumping Plant	All	1.85	2.75	3.33	0.62	-2	-2	-2	-2	-2	-2	-2	-2	0.46	0.23	0.46	0.27	0.55	0.33	0.25
		Drought	2.45	3.64	4.41	0.85	1	2	1	2	1	2	2	2	0.61	0.30	0.61	0.36	0.73	0.44	0.34

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5 consecutive year (water years 1987-1991) drought period consisting of dry and critical water year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

[b] Dry weight, except as noted for fish fillets.

[c] % change indicates a negative change (increased concentrations) relative to baseline when values are positive and a positive change (lowered concentrations) relative to baseline when values are negative. Changes of 10% or more are highlighted.

[d] Exceedance Quotient = tissue concentration/benchmark

[e] Level of Concern for fish tissue (lower end of range) = 4 mg/kg dw (Beckon et al. 2008)

[f] Toxicity Level for fish tissue = 8.1 mg/kg dw (USEPA 2014)

[g] Level of Concern for bird eggs (lower end of range) = 6 mg/kg dw (Beckon et al. 2008)

[h] Toxicity Level for bird eggs = 10 mg/kg dw (Beckon et al. 2008)

[i] Advisory Tissue Level = 2.5 mg/kg ww (OEHHA 2008)

Alt. - alternative
dw - dry weight
EX - Existing Conditions
mg/kg - milligram per kilogram
NAA - No Action Alternative Late Long Term
ww - wet weight

Table M-30. Summary of Annual Average Selenium Concentrations in Whole-body Sturgeon for Existing Conditions, No Action Alternative - Late Long Term and Alternatives 1-9

Location	Period [a]	Estimated Concentrations of Selenium in Whole-body Sturgeon (mg/kg, dw)													
		Existing Conditions	No Action Alternative	Alternative 1	Alternative 2	Alternative 3	Alternative 4H1	Alternative 4H2	Alternative 4H3	Alternative 4H4	Alternative 5	Alternative 6	Alternative 7	Alternative 8	Alternative 9
San Joaquin River at Antioch	ALL	4.71	4.68	5.26	5.58	5.02	5.39	5.45	5.50	5.57	5.02	6.64	6.12	6.13	6.35
	DROUGHT	6.82	6.91	7.05	7.39	7.03	7.21	7.28	7.39	7.47	7.16	8.80	8.43	8.45	9.31
Sacramento River at Mallard Island	ALL	4.38	4.39	4.72	4.89	4.57	4.79	4.81	4.84	4.87	4.55	5.45	5.15	5.15	5.15
	DROUGHT	6.93	6.98	7.10	7.26	7.09	7.17	7.20	7.26	7.29	7.14	7.93	7.74	7.75	8.14

Notes:
dw - dry weight
mg/kg - milligram per kilogram
[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

Table M-31. Percent (%) Change in Annual Average Selenium Concentrations in Whole Body Sturgeon relative to Existing Condition and No Action Alternative Late Long Term

Location	Period [a]	NAA	Alternative 1		Alternative 2		Alternative 3		Alternative 4 (H1)		Alternative 4 (H2)		Alternative 4 (H3)		Alternative 4 (H4)		Alternative 5		Alternative 6		Alternative 7		Alternative 8		Alternative 9	
		EX	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA	EX	NAA
San Joaquin River at Antioch	ALL	-0.65	11.7	12.4	18.6	19.3	6.6	7.3	14.4	15.2	15.8	16.5	16.8	17.5	18.3	19.0	6.5	7.2	41.0	42.0	29.9	30.7	30.2	31.1	34.8	35.7
	DROUGHT	1.22	3.3	2.1	8.4	7.0	3.0	1.8	5.7	4.4	6.8	5.5	8.3	7.0	9.4	8.1	4.9	3.6	29.0	27.5	23.6	22.1	23.9	22.4	36.4	34.8
Sacramento River at Mallard Island	ALL	0.12	7.55	7.4	11.41	11.3	4.14	4.0	9.25	9.1	9.71	9.6	10.36	10.2	10.96	10.8	3.88	3.8	24.36	24.2	17.50	17.4	17.38	17.2	17.44	17.3
	DROUGHT	0.60	2.4	1.8	4.7	4.1	2.2	1.6	3.4	2.8	3.8	3.2	4.7	4.1	5.1	4.5	3.0	2.4	14.3	13.7	11.6	10.9	11.8	11.1	17.4	16.7

Notes:

[a] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

Table M-32. Comparison of Annual Average Selenium Concentrations in Whole-body Sturgeon to Toxicity Thresholds Sturgeon for Existing Conditions, No Action Alternative - Late Long Term and Alternatives 1-9

Location	Period [b]	Existing Conditions		No Action Alternative		Alternative 1		Alternative 2		Alternative 3		Alternative 4 (H1)		Alternative 4 (H2)		Alternative 4 (H3)		Alternative 4 (H4)		Alternative 5		Alternative 6		Alternative 7		Alternative 8		Alternative 9	
		Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]	Low [a]	High [a]
San Joaquin River at Antioch	ALL	0.94	0.59	0.94	0.59	1.1	0.66	1.1	0.70	1.0	0.63	1.1	0.67	1.1	0.68	1.1	0.69	1.1	0.70	1.0	0.63	1.3	0.83	1.2	0.76	1.2	0.77	1.3	0.79
	DROUGHT	1.4	0.85	1.4	0.86	1.4	0.88	1.5	0.92	1.4	0.88	1.4	0.90	1.5	0.91	1.5	0.92	1.5	0.93	1.4	0.89	1.8	1.1	1.7	1.1	1.7	1.1	1.9	1.2
Sacramento River at Mallard Island	ALL	0.88	0.55	0.88	0.55	0.94	0.59	0.98	0.61	0.91	0.57	0.96	0.60	0.96	0.60	0.97	0.60	0.97	0.61	0.91	0.57	1.1	0.68	1.0	0.64	1.0	0.64	1.0	0.64
	DROUGHT	1.4	0.87	1.4	0.87	1.4	0.89	1.5	0.91	1.4	0.89	1.4	0.90	1.4	0.90	1.5	0.91	1.5	0.91	1.4	0.89	1.6	0.99	1.5	0.97	1.6	0.97	1.6	1.0

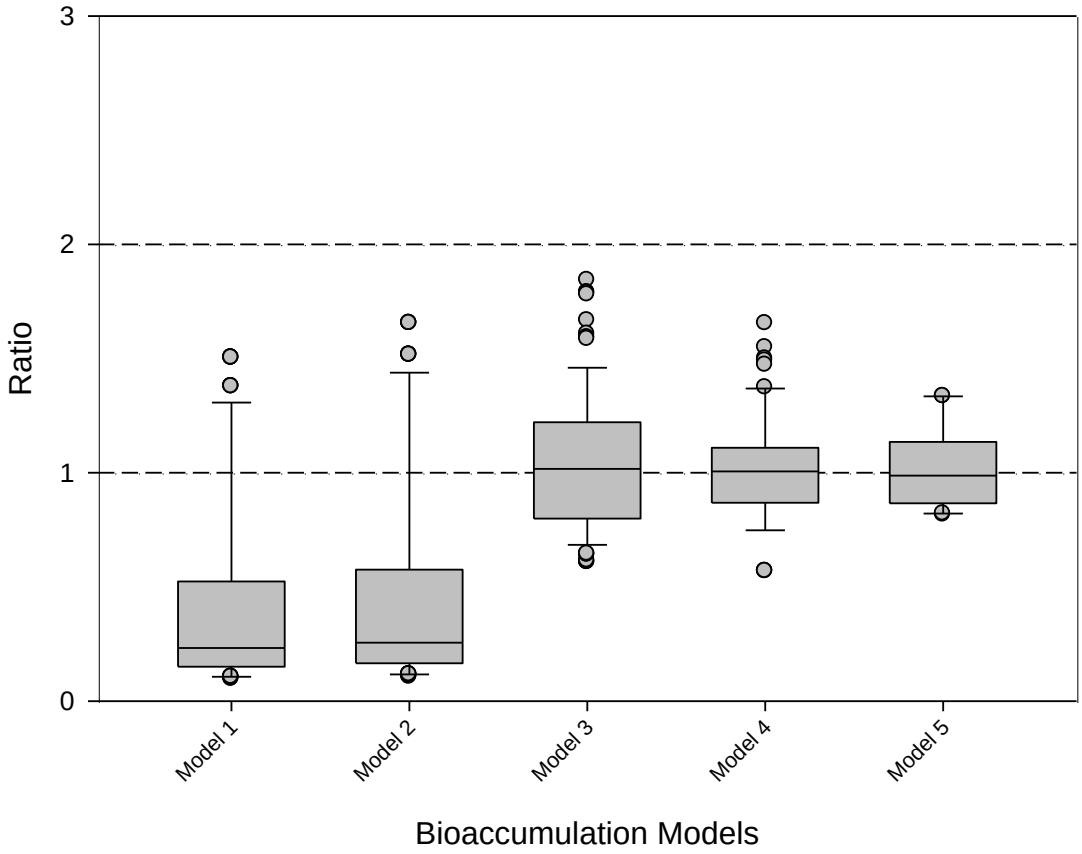
Notes:

[a] Toxicity thresholds are those reported in Presser and Luoma (2013): Low = 5 mg/kg, dw and High = 8 mg/kg, dw

[b] All: Water years 1975-1991 represent the 16-year period modeled using DSM2. Drought: Represents a 5-consecutive-year (Water Years 1987-1991) drought period consisting of dry and critical water-year types (as defined by the Sacramento Valley 40-30-30 water year hydrologic classification index).

FIGURES

Figure M-1. Ratios of Predicted Selenium Concentrations in Fish Models 1 through 5 to Observed Selenium Concentrations in Largemouth Bass



For Models 1 and 2, default values (K_d = 1000, TTF_{invert} = 2.8, TTF_{fish} = 1.1) were used in calculations as follows:

Model 1=Trophic level 3 (TL-3) fish eating invertebrates

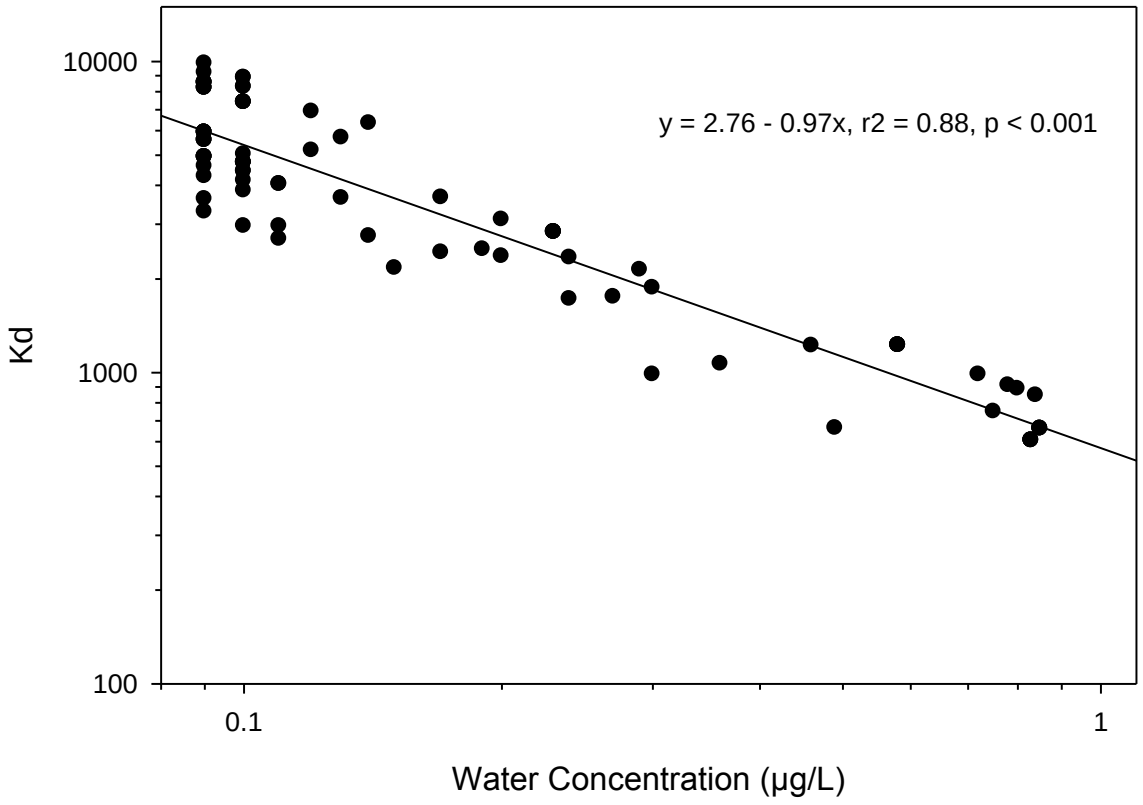
Model 2= TL-4 fish eating TL-3 fish

Model 3=Model 2 with K_d estimated using all years regression (log Kd = 2.76-0.97(logDSM2))

Model 4=Model 2 with K_d estimated using normal/wet years (2000/2005) regression (log Kd = 2.75-0.90(logDSM2))

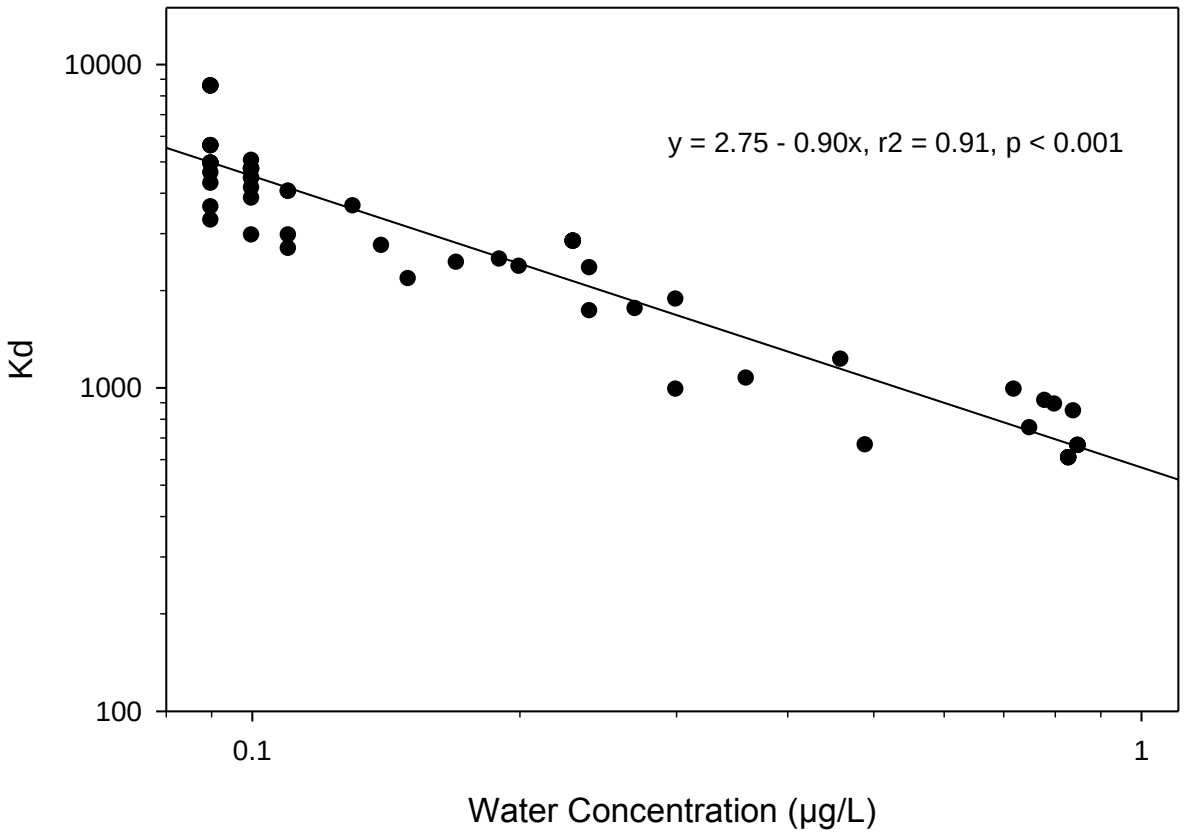
Model 5=Model 2 with K_d estimated using dry years (2007) regression (logKd = 2.84-1.02(logDSM2))

Figure M-2. Log-log Regression Relation of Estimated K_d to Waterborne Selenium Concentration for Model 3 in All Years (Based on Years 2000, 2005, and 2007)



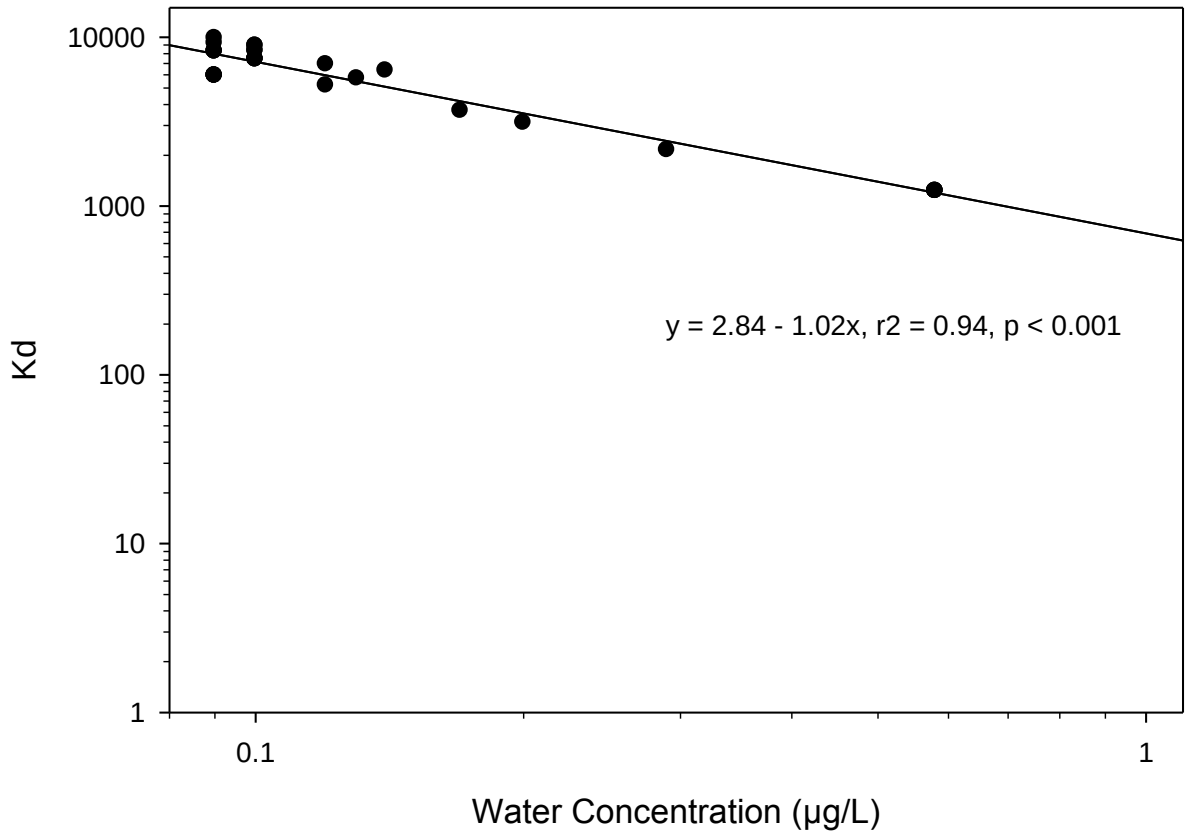
To predict the K_d (y) from water concentrations using the regression equation, take the log of the water concentration (x), multiply it by the slope (-0.97), which gives a positive number for x<1 (i.e., waterborne selenium concentrations less than 1 µg/L); then add this number to the intercept (2.76) and take the antilog.

Figure M-3. Log-log Regression Relation of Estimated K_d to Waterborne Selenium Concentration for Model 4 in Normal/Wet Years (Based on Years 2000 and 2005)



To predict the K_d (y) from water concentrations using the regression equation, take the log of the water concentration (x), multiply it by the slope (-0.90), which gives a positive number for x<1 (i.e., waterborne selenium concentrations less than 1 µg/L); then add this number to the intercept (2.75) and take the antilog.

Figure M-4. Log-log Regression Relation of Estimated K_d to Waterborne Selenium Concentration for Model 5 in Dry Years (Based on Year 2007)



To predict the K_d (y) from water concentrations using the regression equation, take the log of the water concentration (x), multiply it by the slope (-1.02), which gives a positive number for x<1 (i.e., waterborne selenium concentrations less than 1 µg/L); then add this number to the intercept (2.84) and take the antilog.

Figure M-5. Distribution of Data for Selenium Concentrations in Largemouth Bass Relative to Waterborne Selenium for Model 3

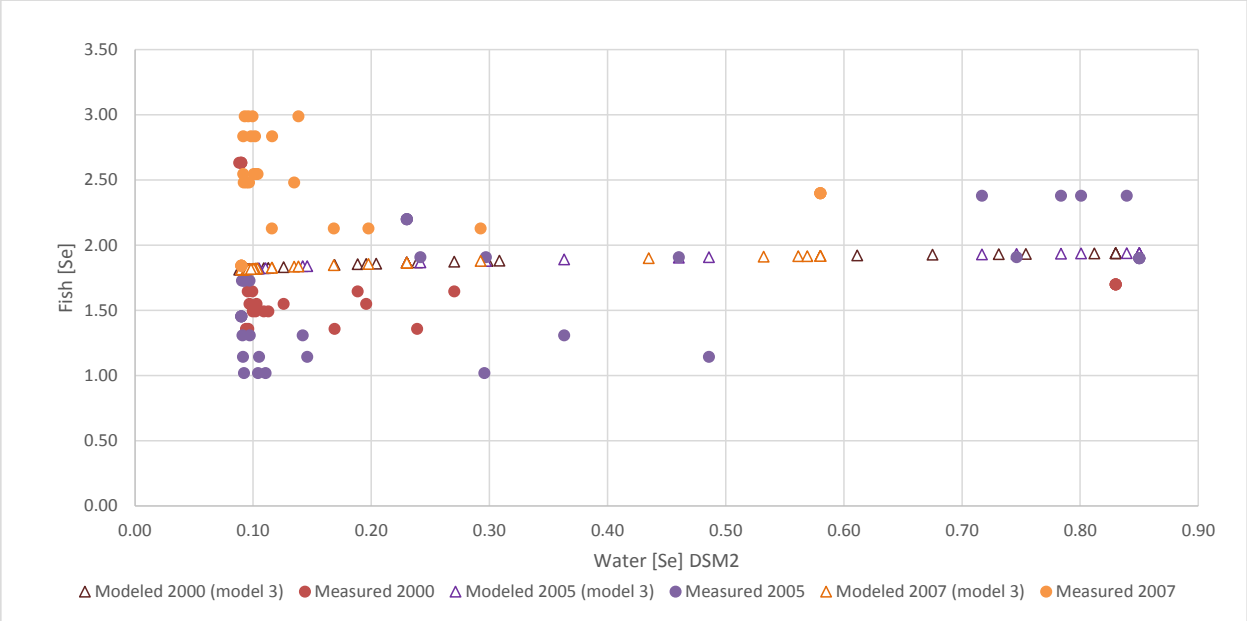


Figure M-6. Distribution of Data for Selenium Concentrations in Largemouth Bass Relative to Waterborne Selenium for Model 4 and Model 5

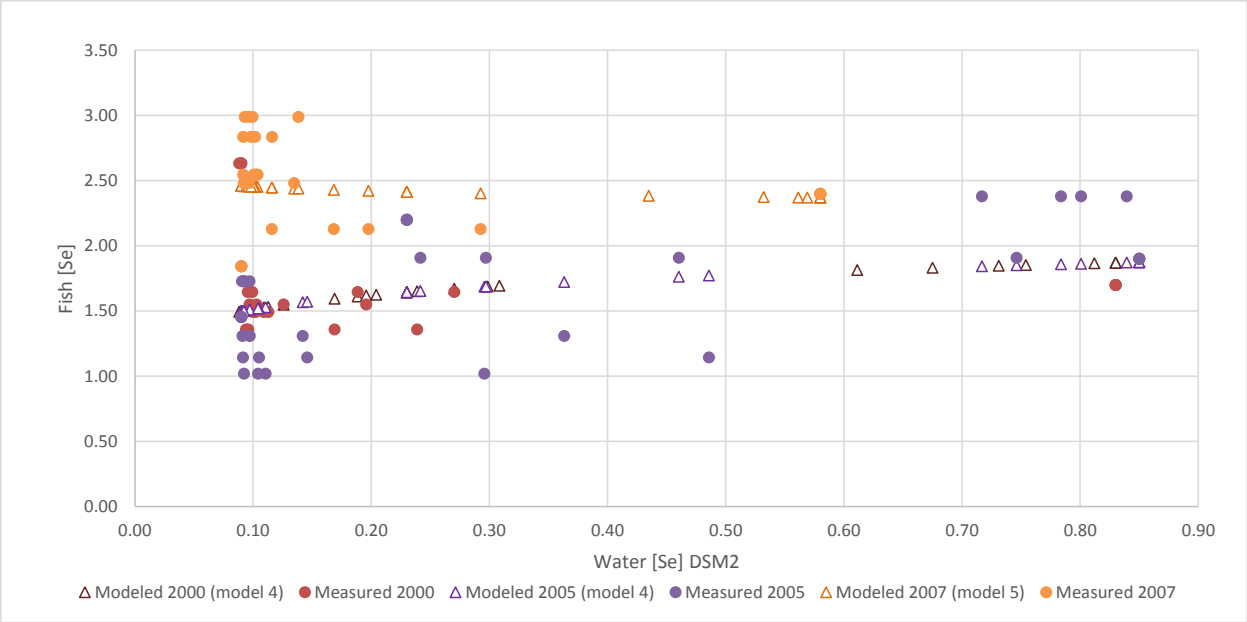


Figure M-7. Yearly Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

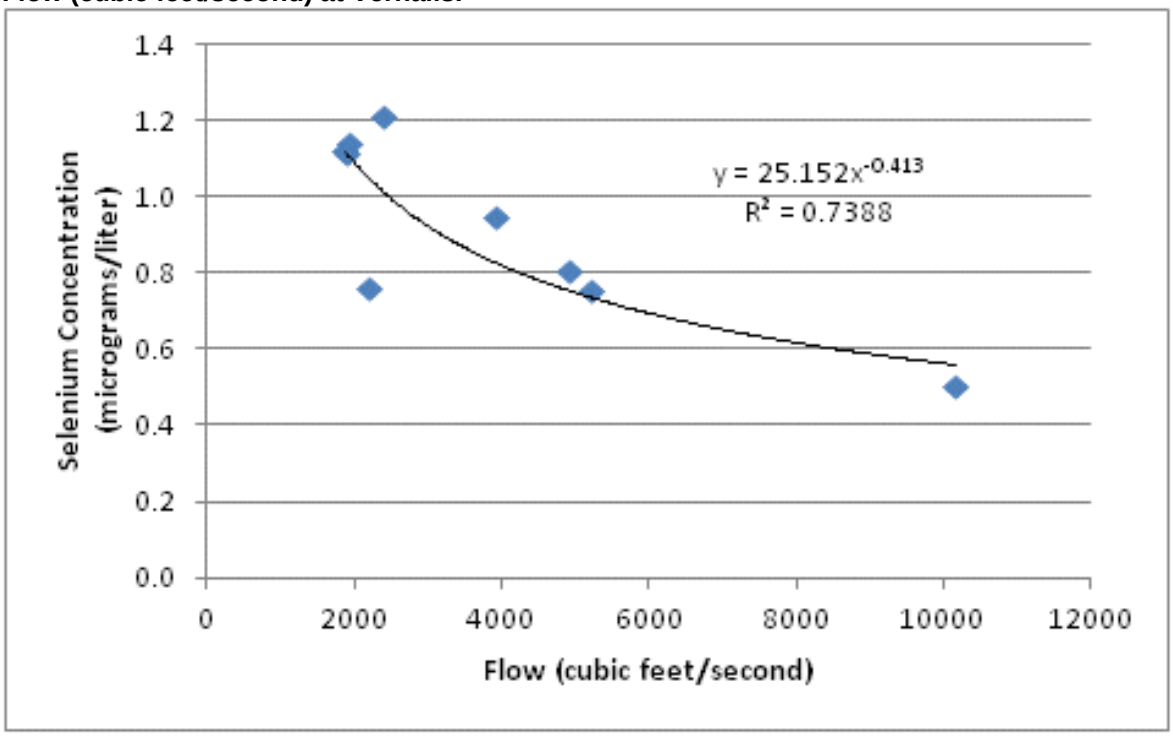


Figure M-8. Monthly Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

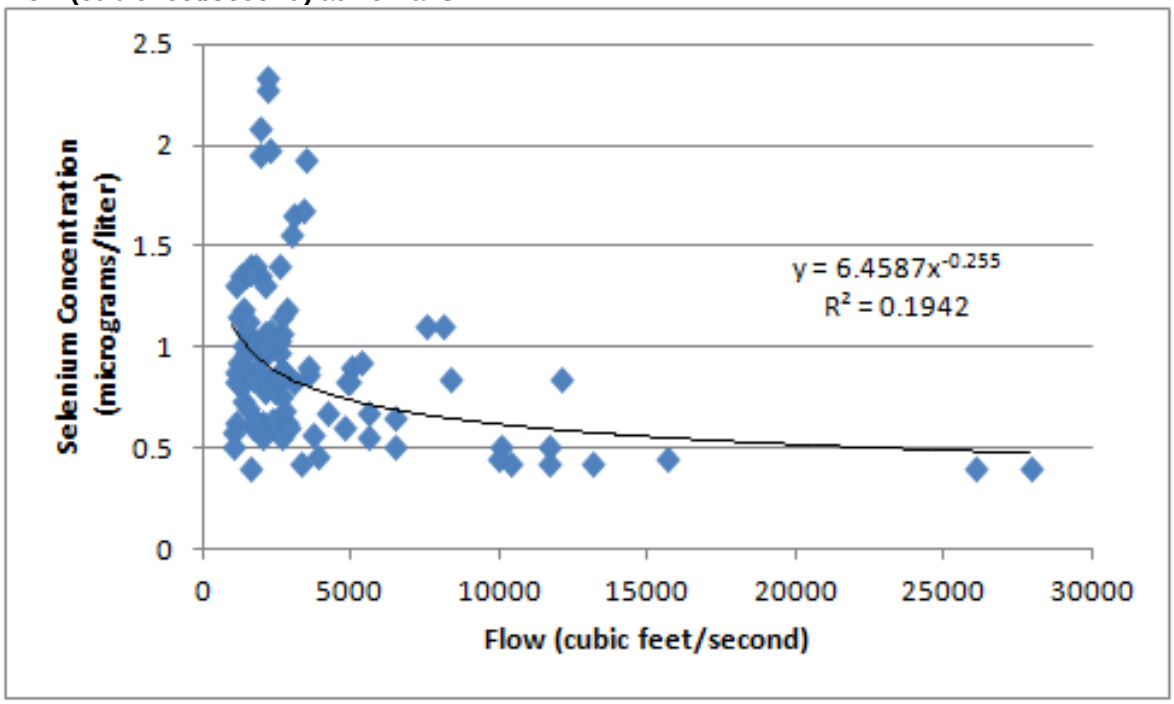


Figure M-9. January Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

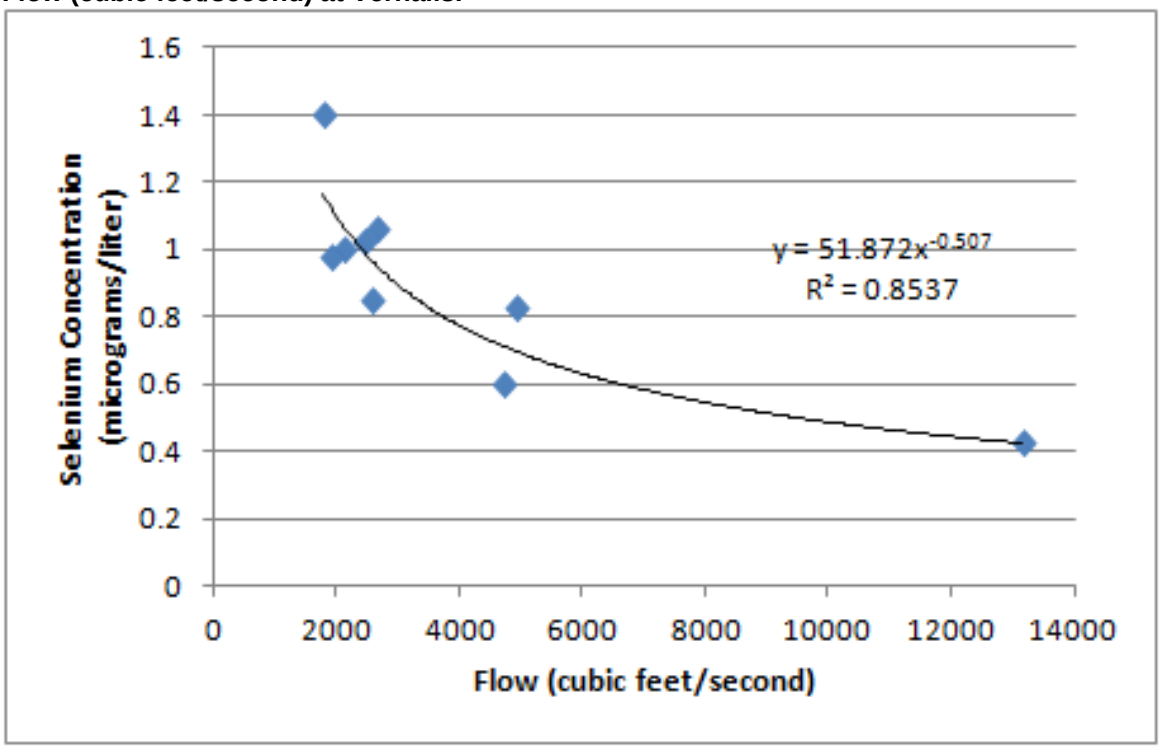


Figure M-10. February Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

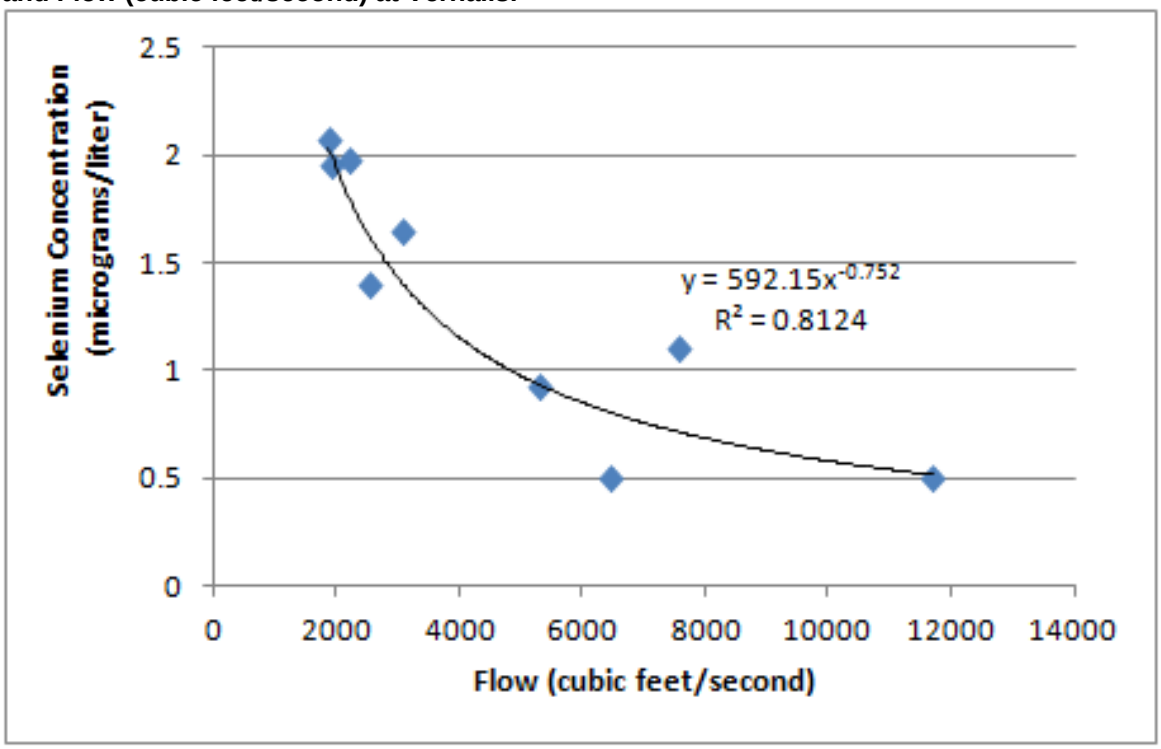


Figure M-11. March Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

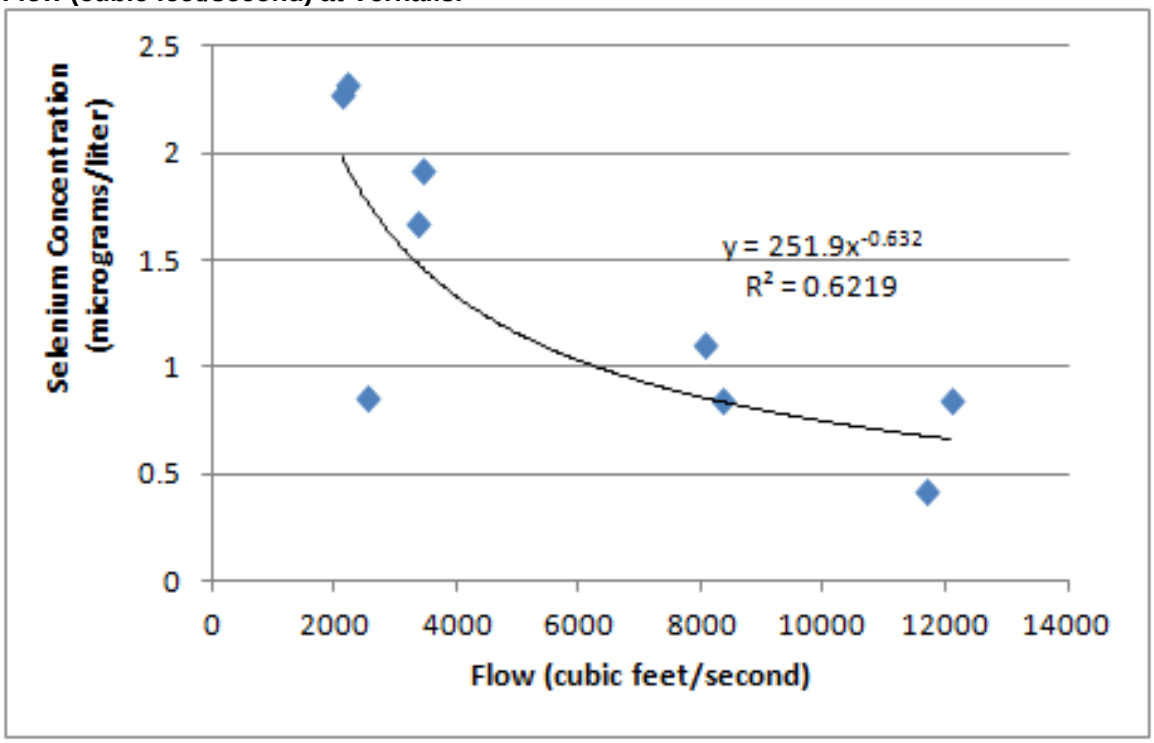


Figure M-12. April Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

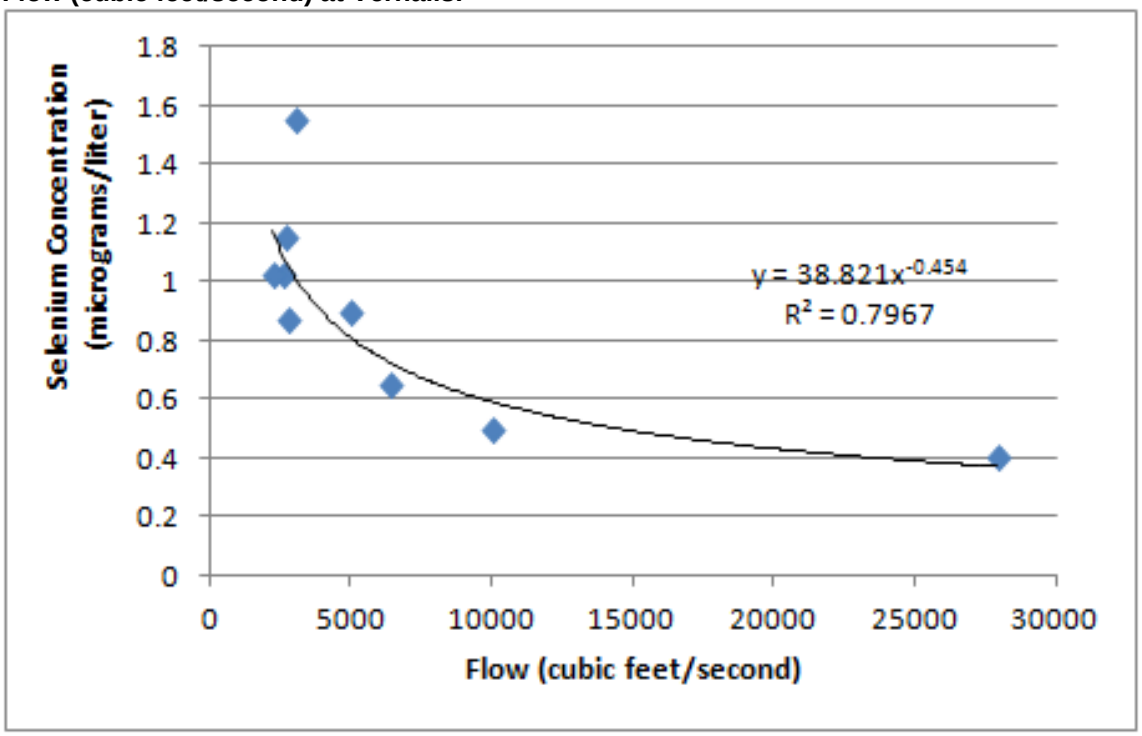


Figure M-13. May Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

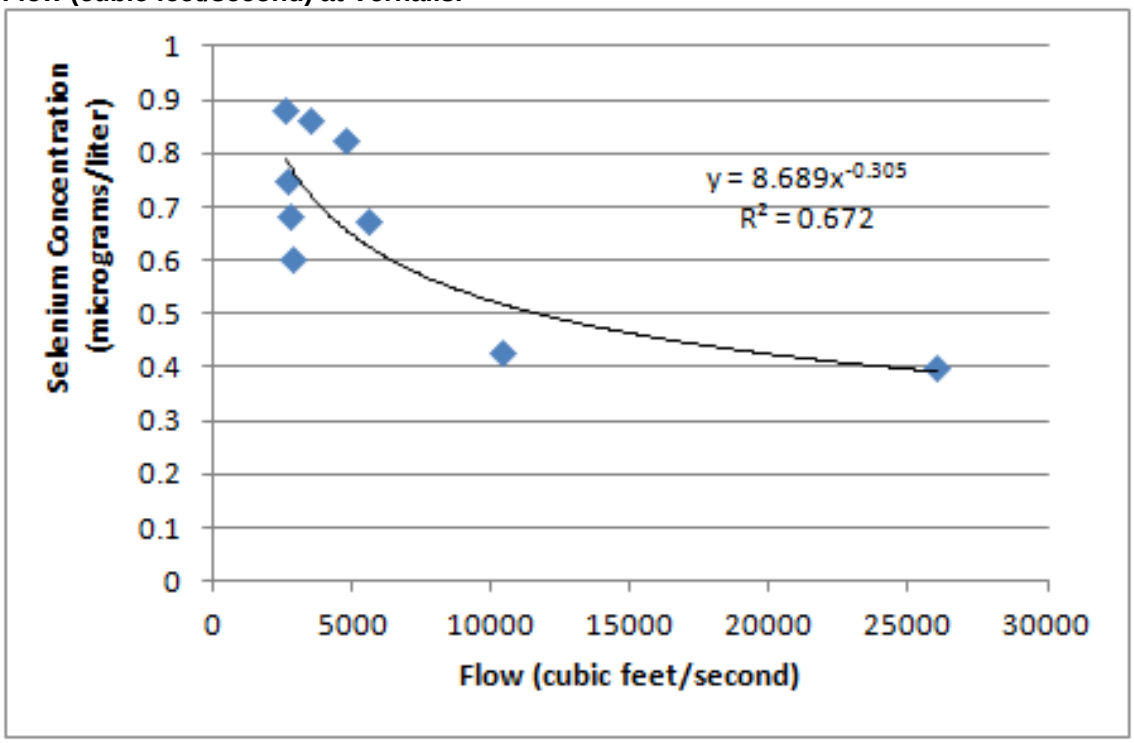


Figure M-14. June Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

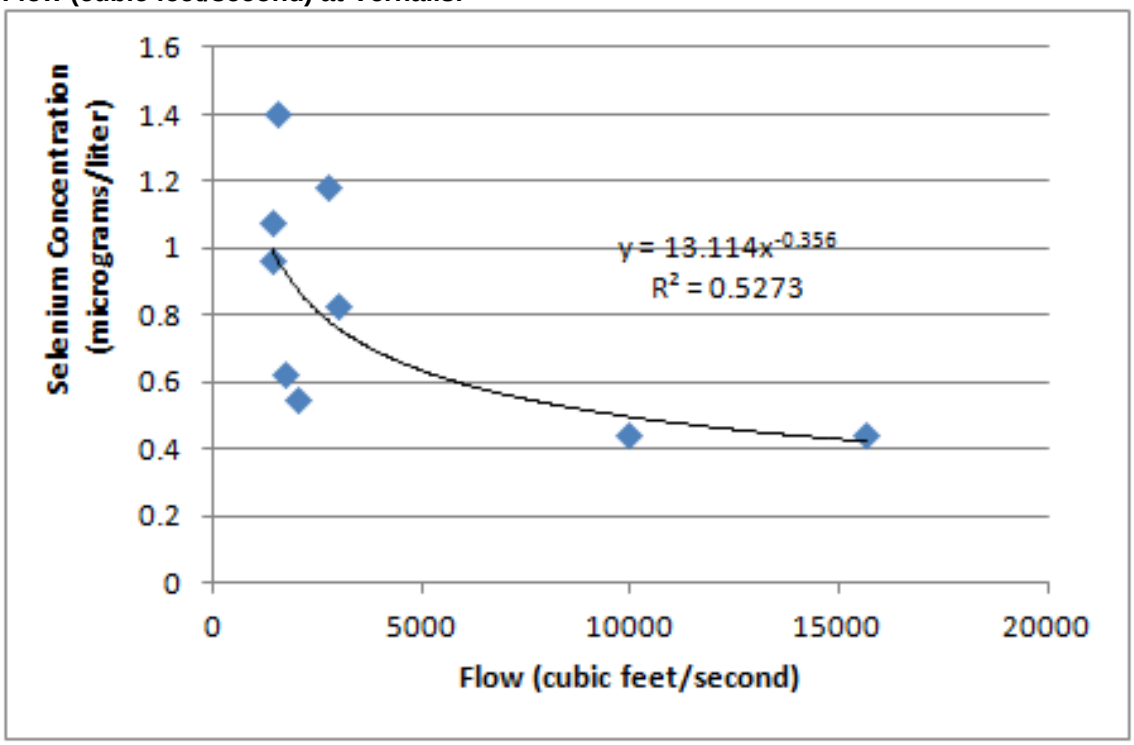


Figure M-15. July Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

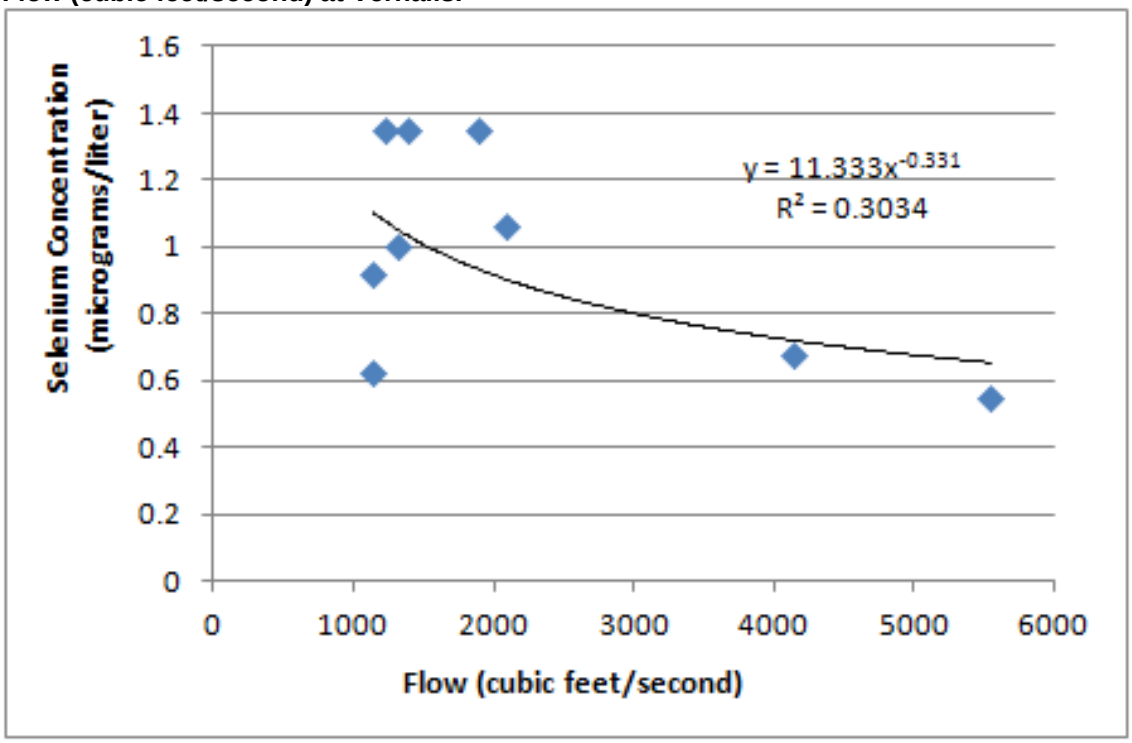


Figure M-16. August Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

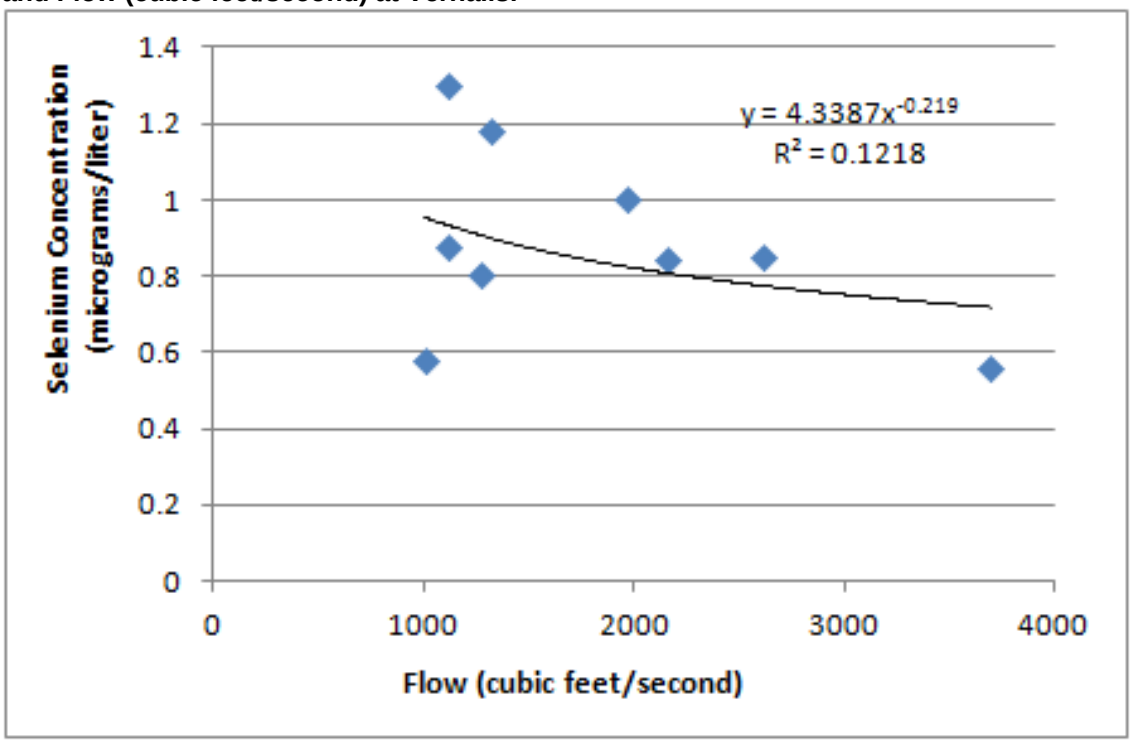


Figure M-17. September Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

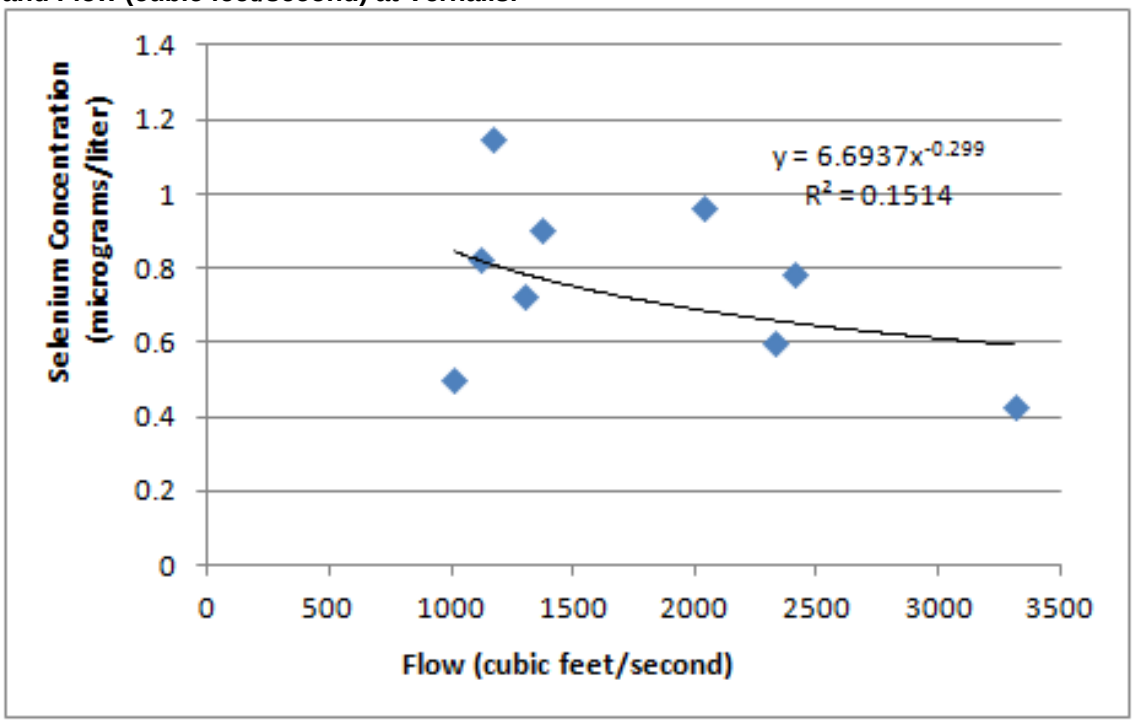


Figure M-18. October Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

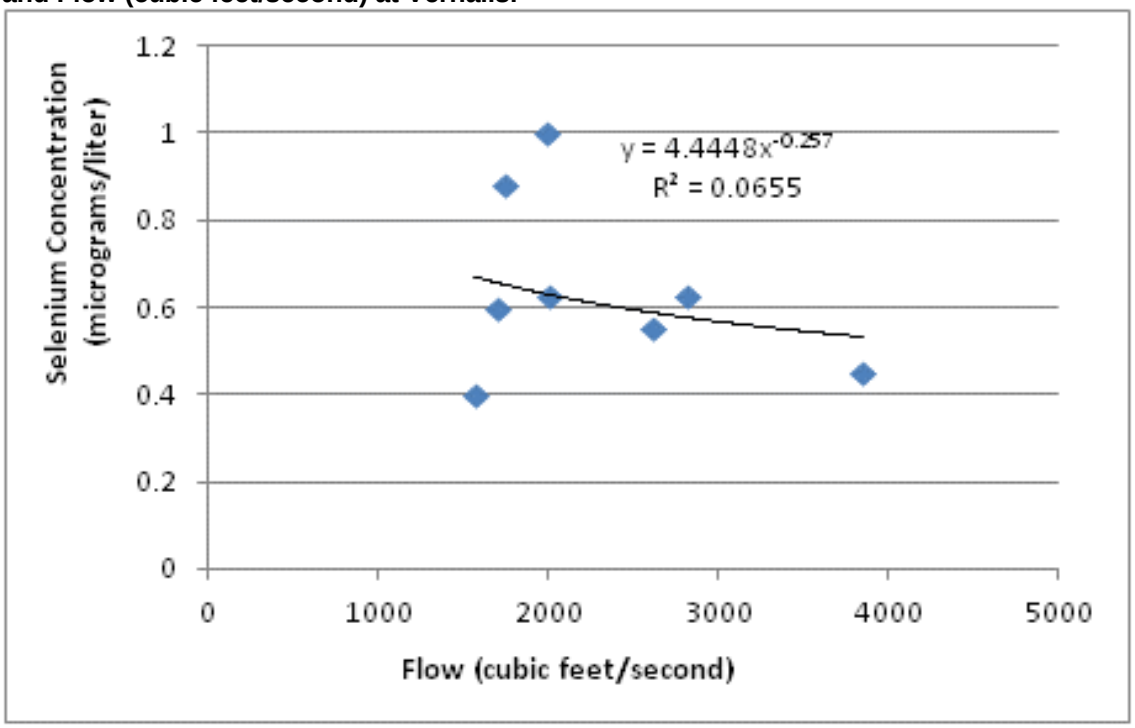


Figure M-19. November Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

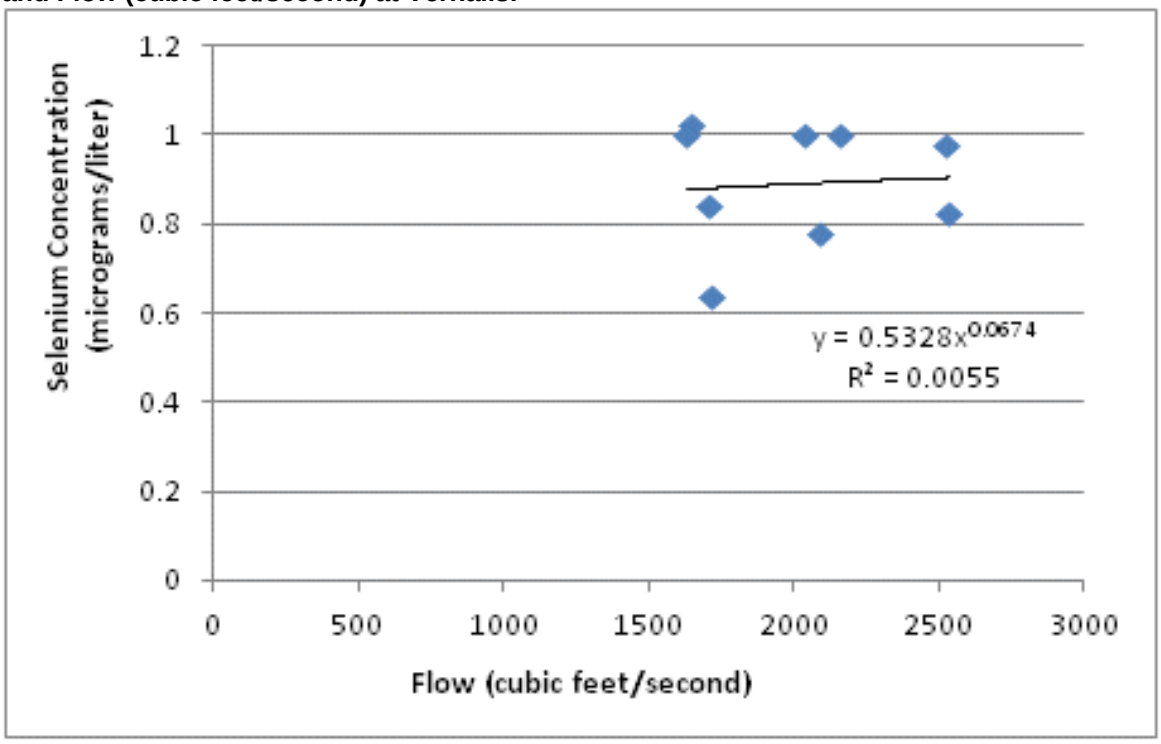


Figure M-20. December Averages of Selenium Concentrations in Surface Water (micrograms/liter) and Flow (cubic feet/second) at Vernalis.

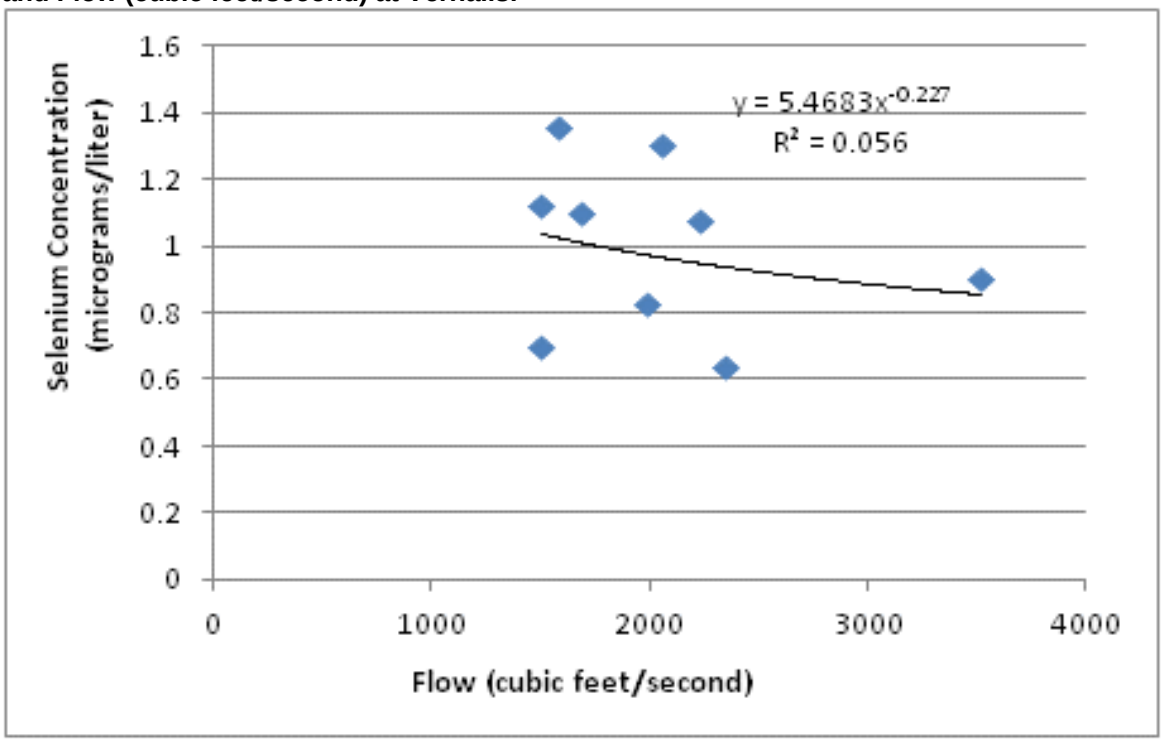


Figure M-21. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 1, 2, and 3.

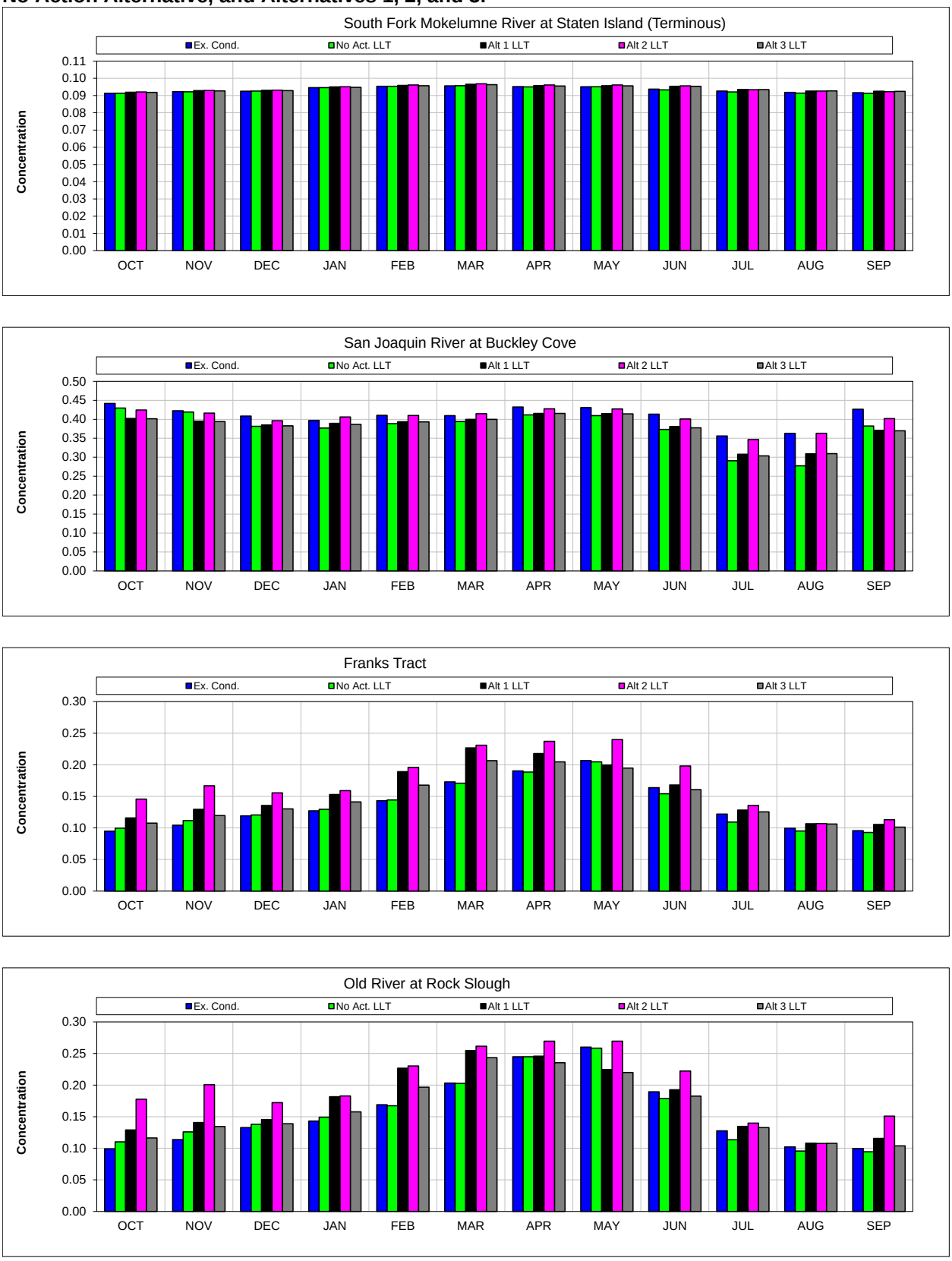
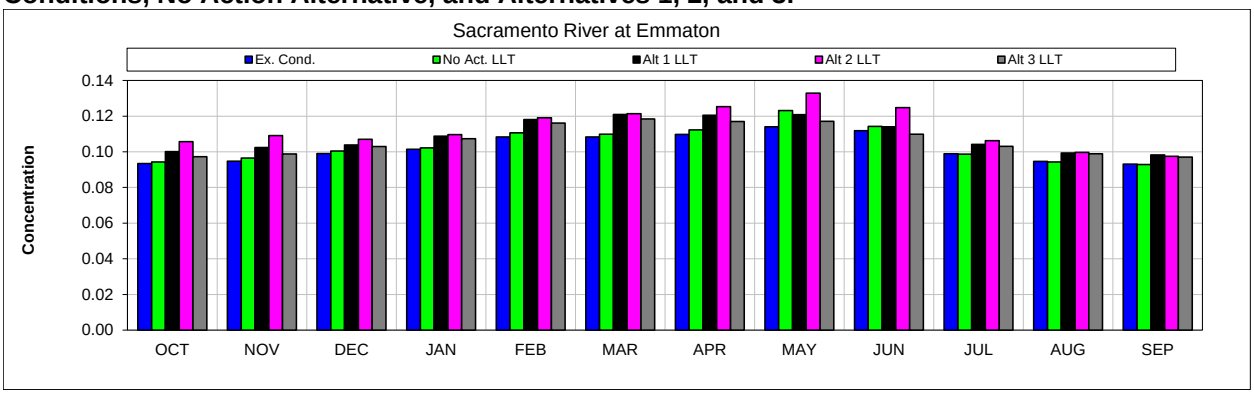
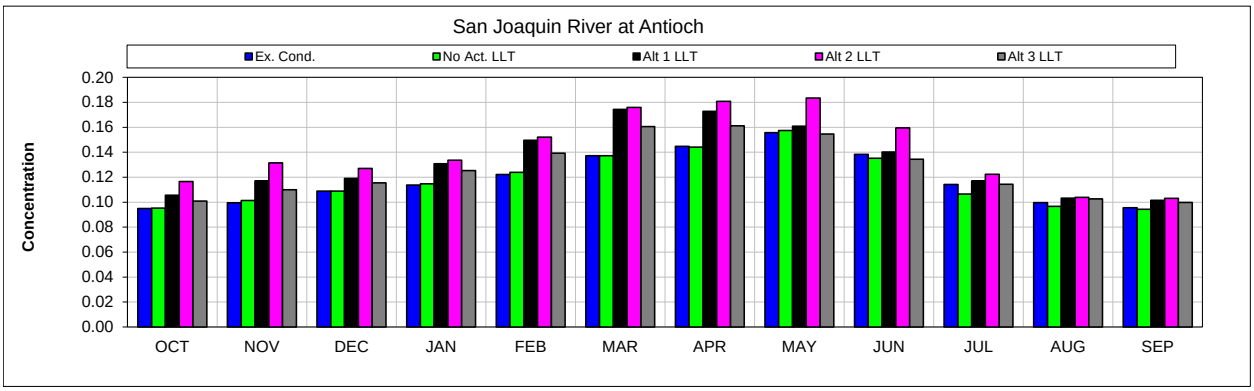
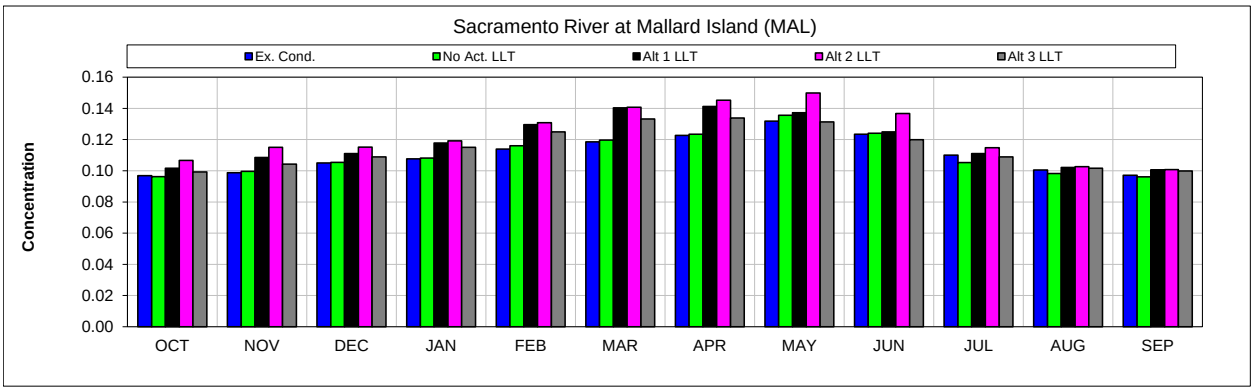


Figure M-21 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 1, 2, and 3.







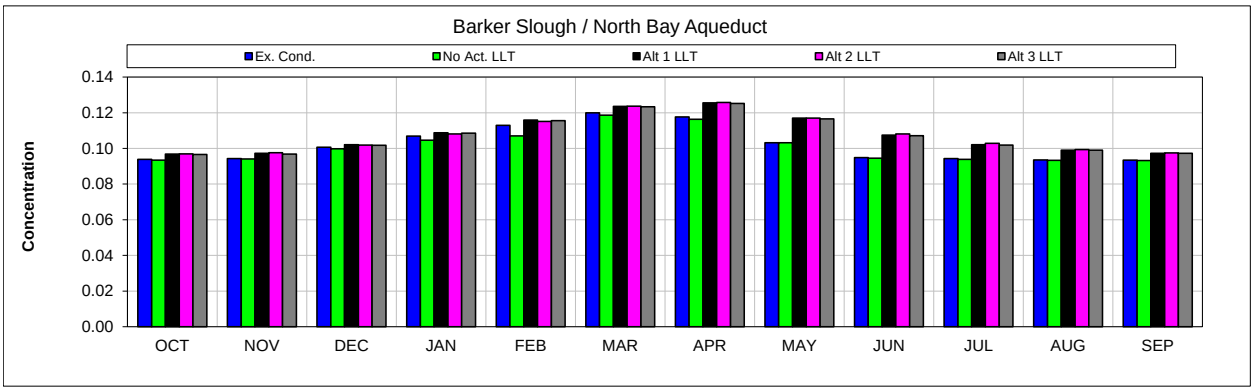
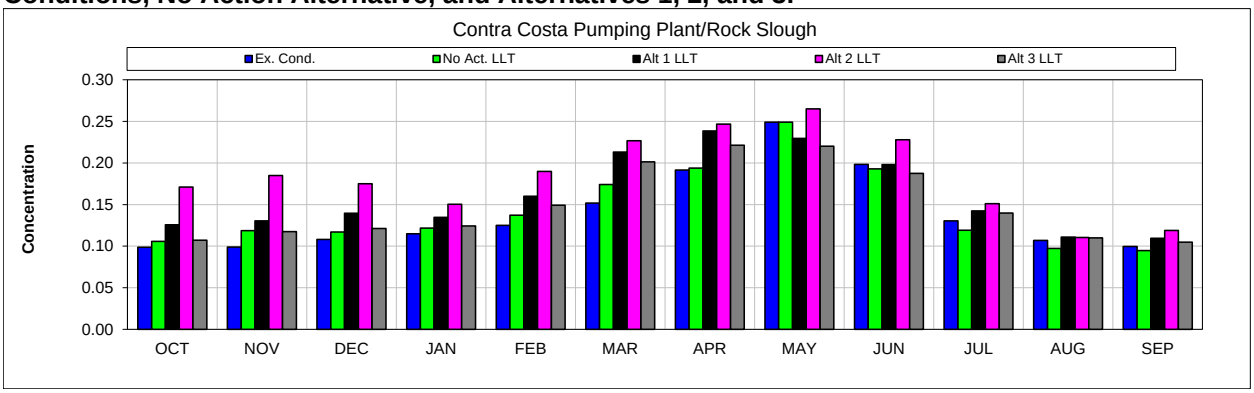
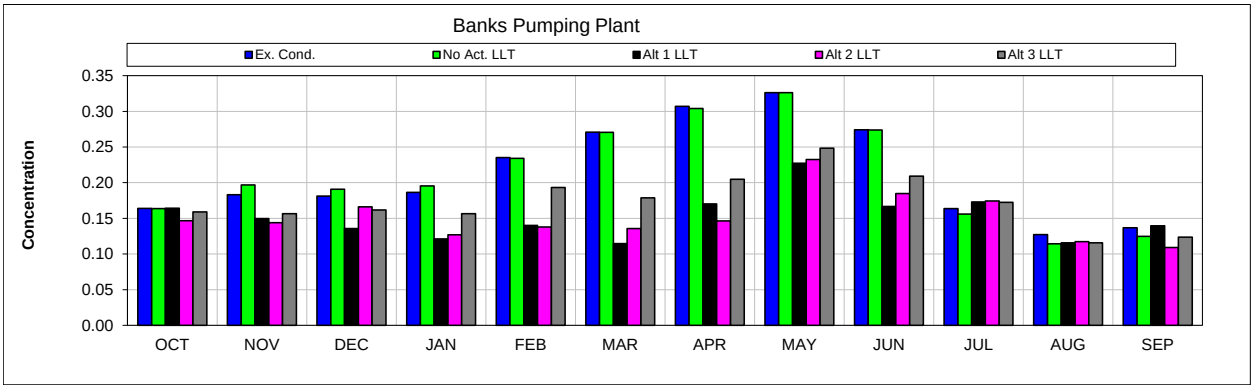


Figure M-21 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 1, 2, and 3.





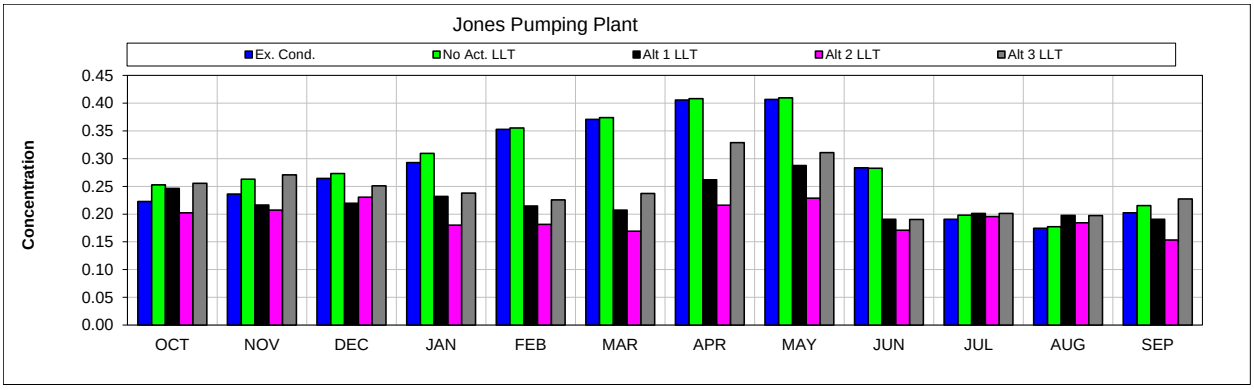
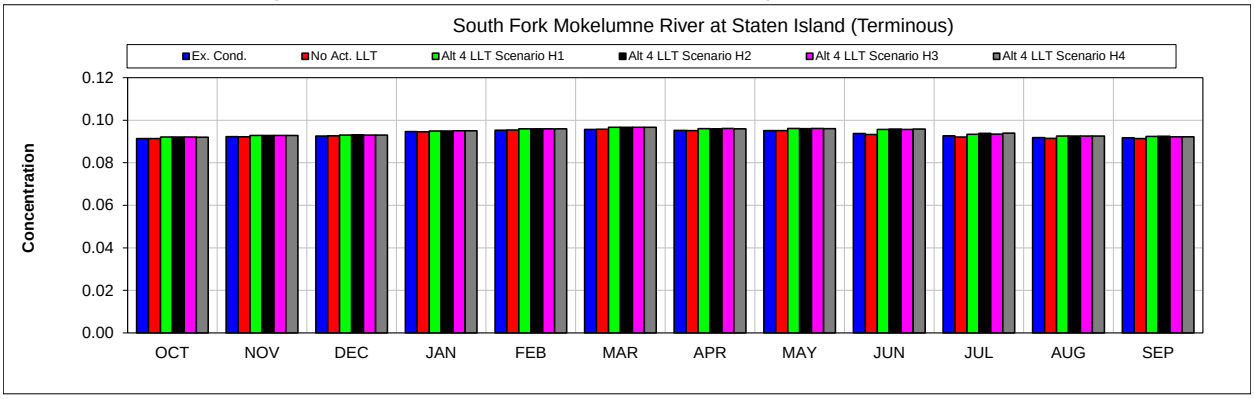
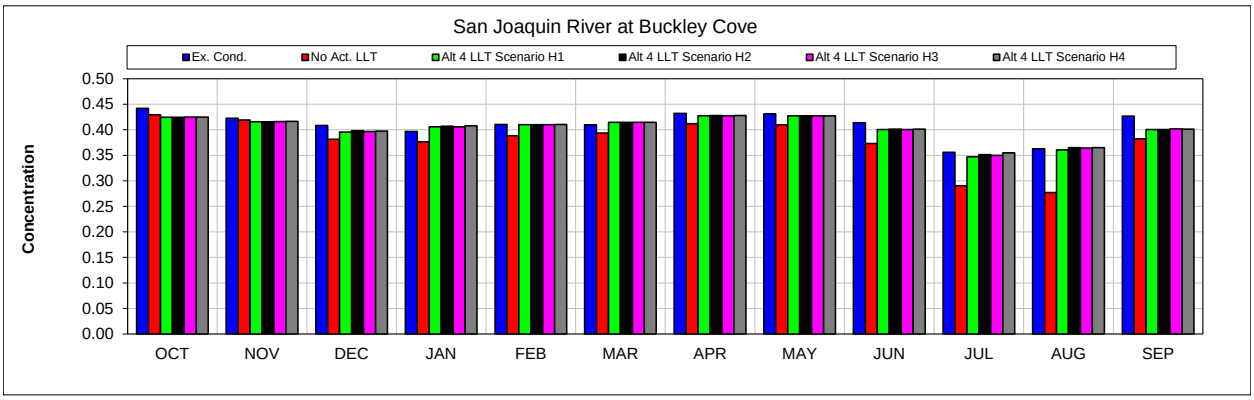
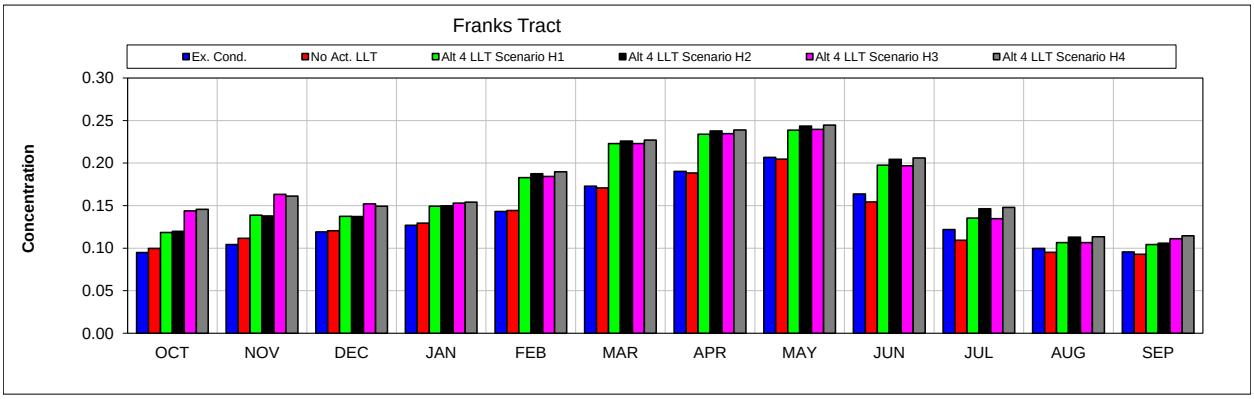


Figure M-22. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and All Scenarios Under Alternative 4, Scenarios H1–H4.







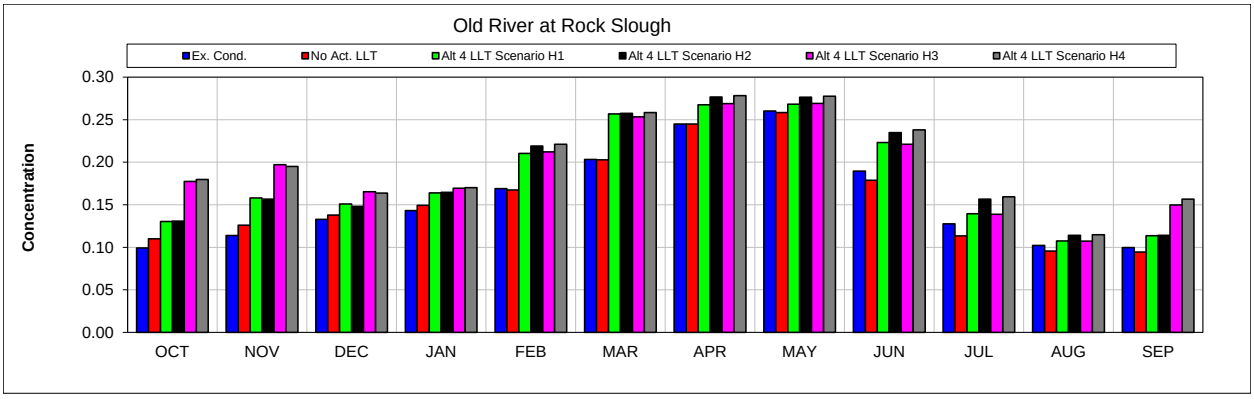
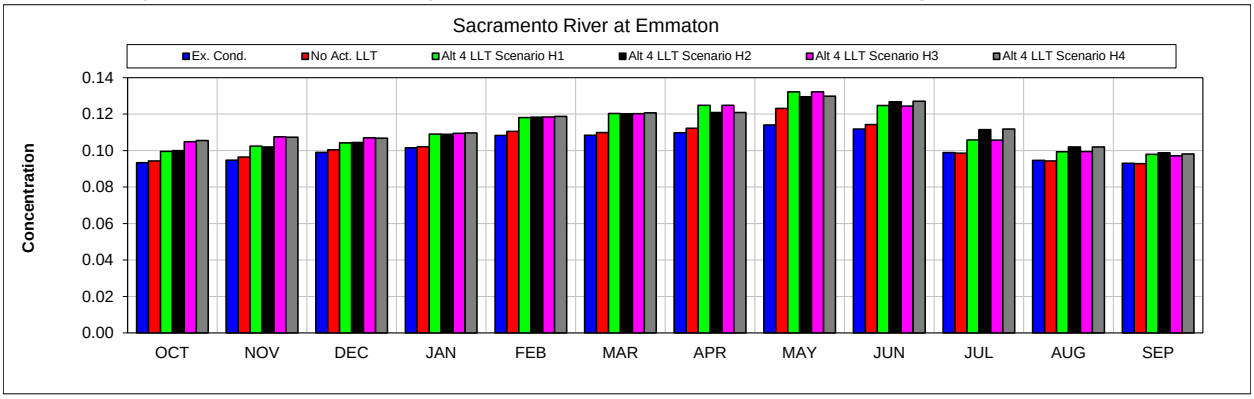
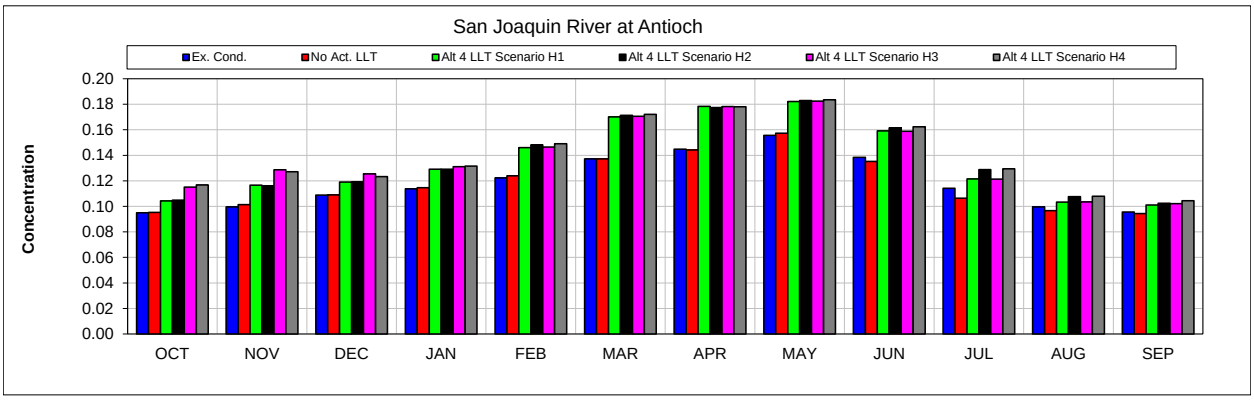
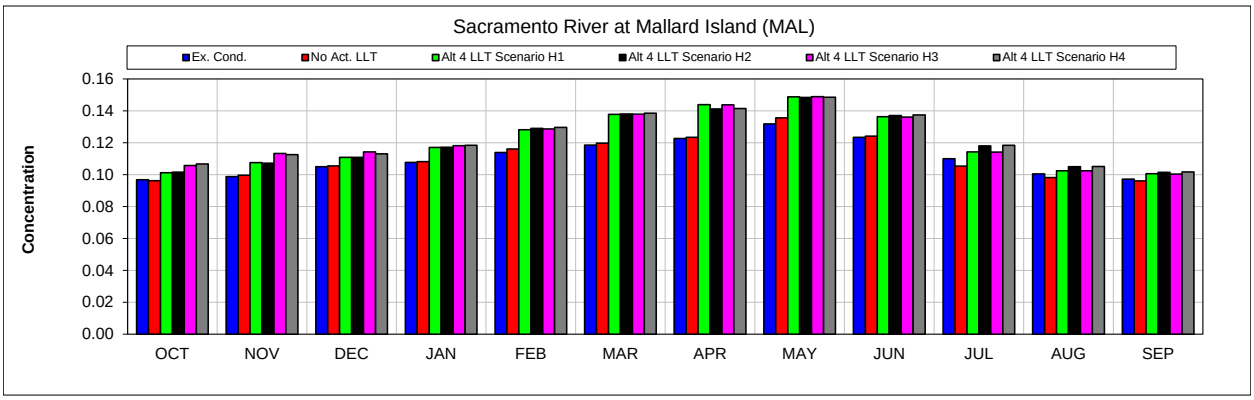
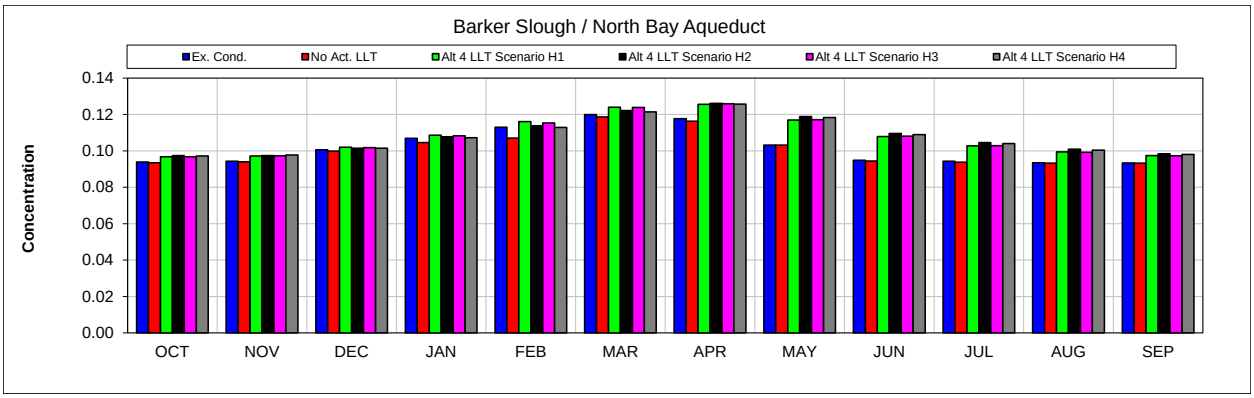


Figure M-22 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and All Scenarios Under Alternative 4, Scenarios H1–H4.



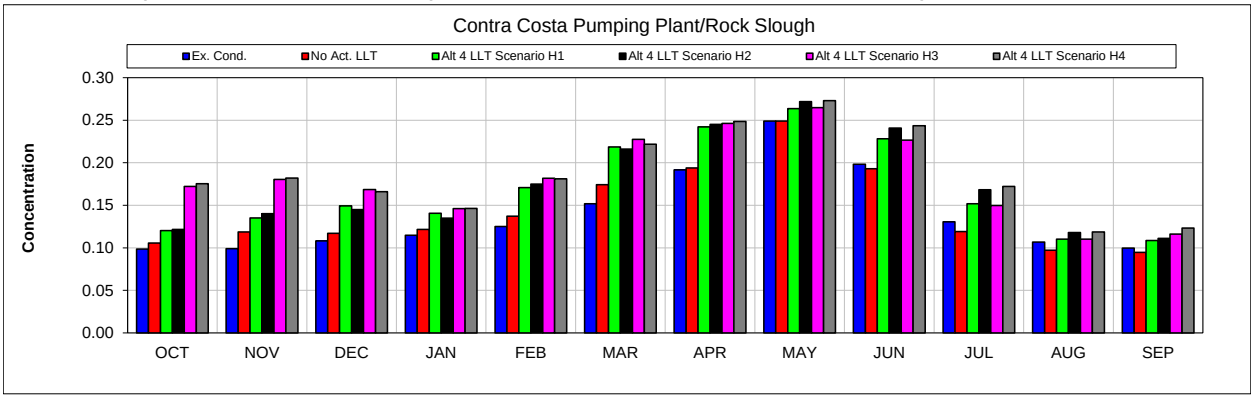


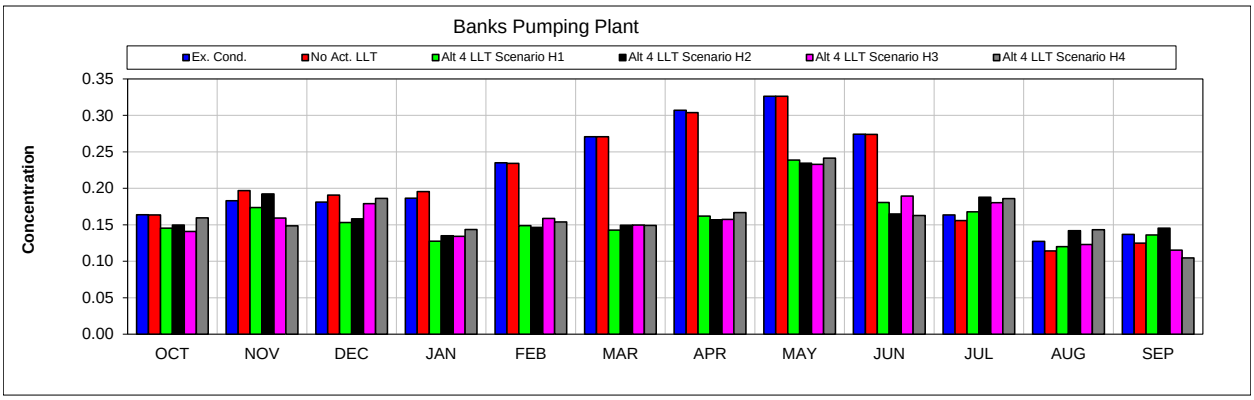



Barker Slough / North Bay Aqueduct
Ex. Cond.
No Act. LLT
Alt 4 LLT Scenario H1
Alt 4 LLT Scenario H2
Alt 4 LLT Scenario H3
Alt 4 LLT Scenario H4
Concentration
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP

1

Figure M-22 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and All Scenarios Under Alternative 4, Scenarios H1–H4.





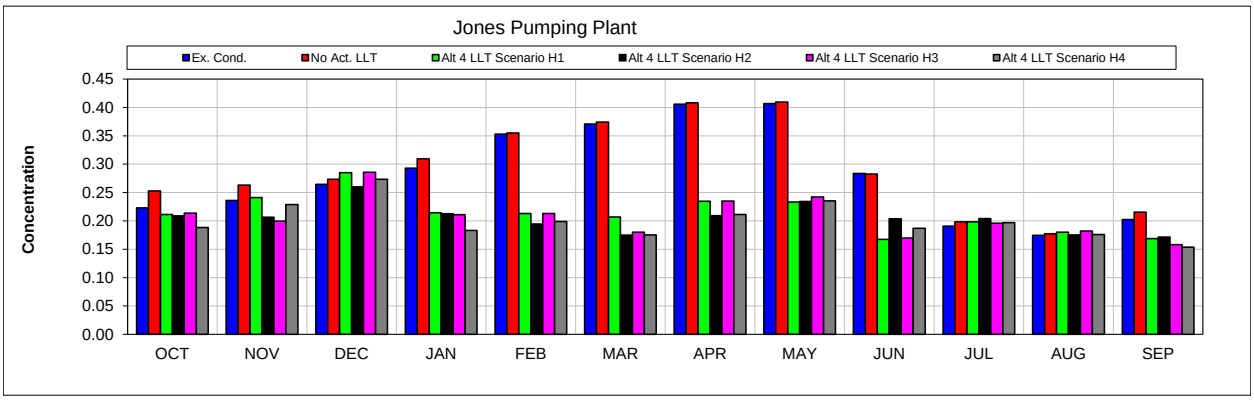
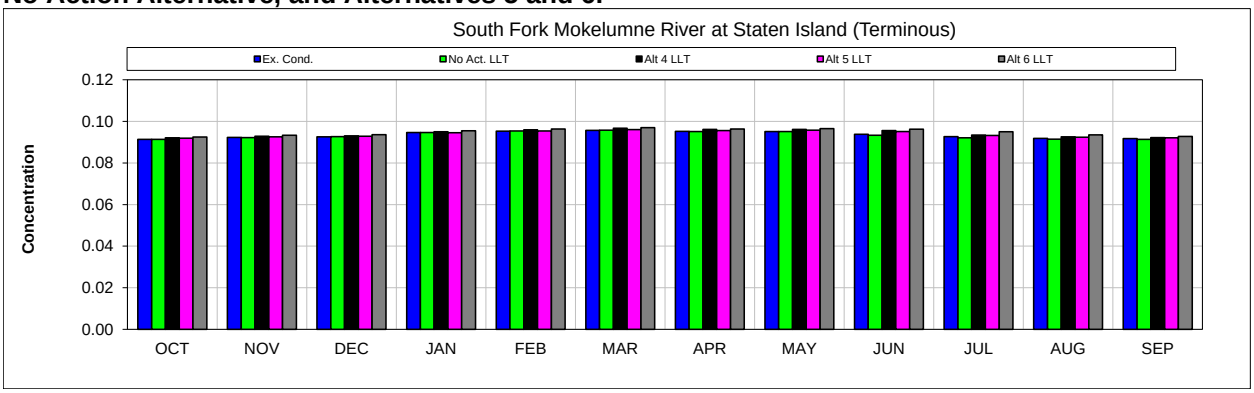
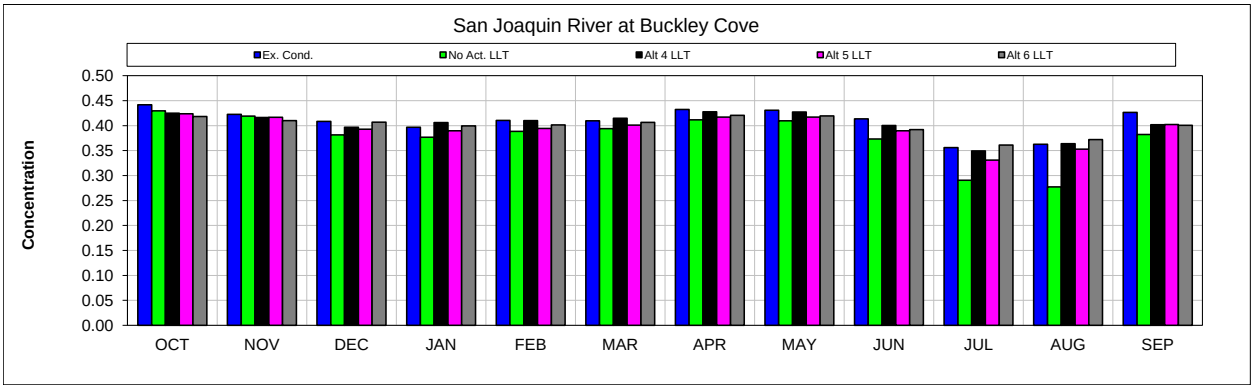
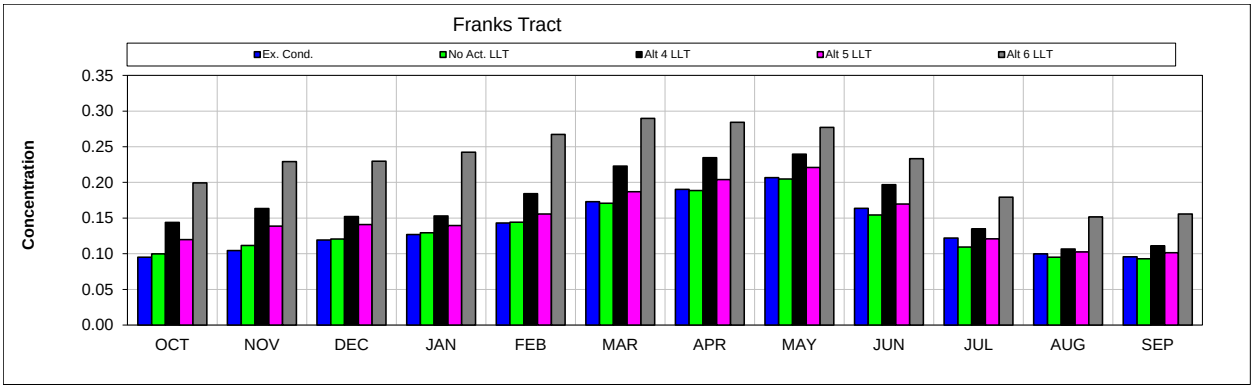


Figure M-23. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 5 and 6.







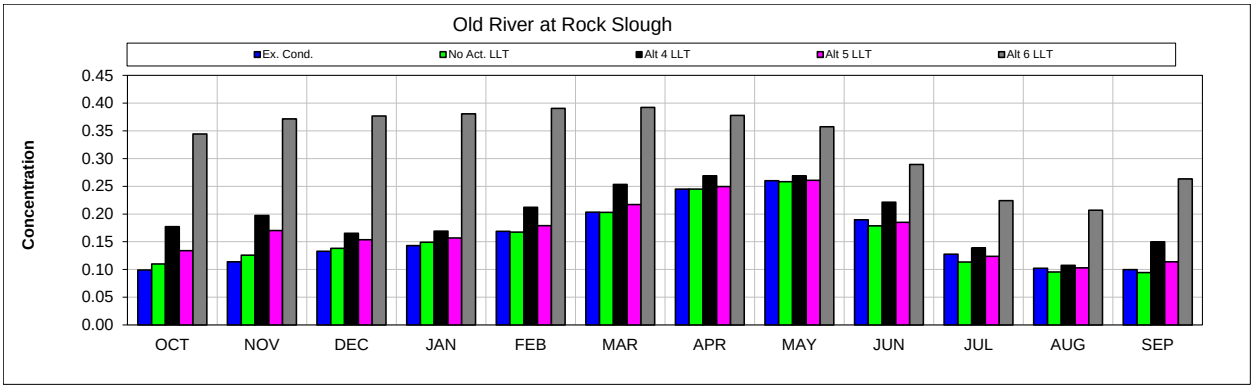
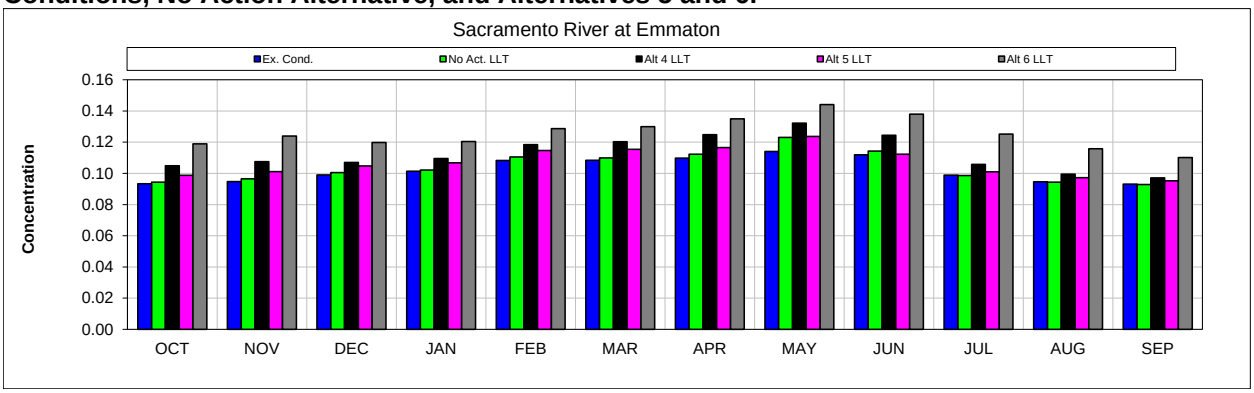
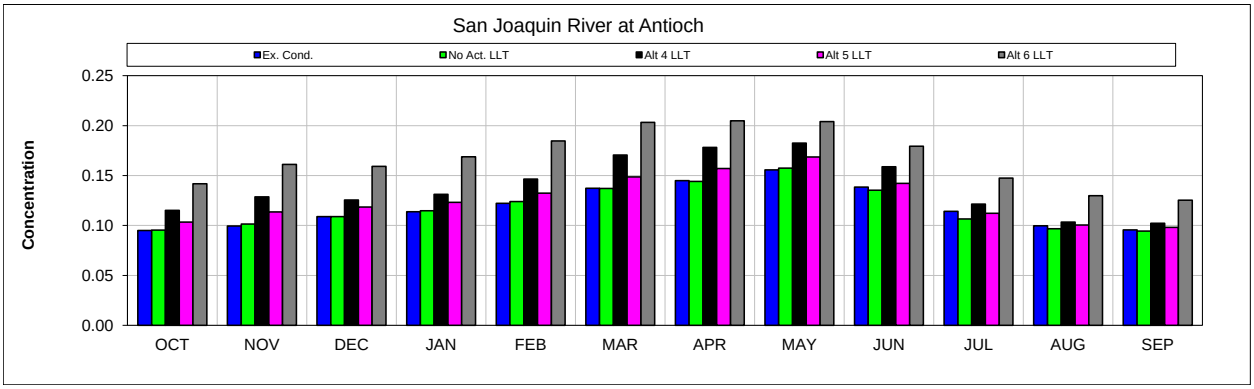
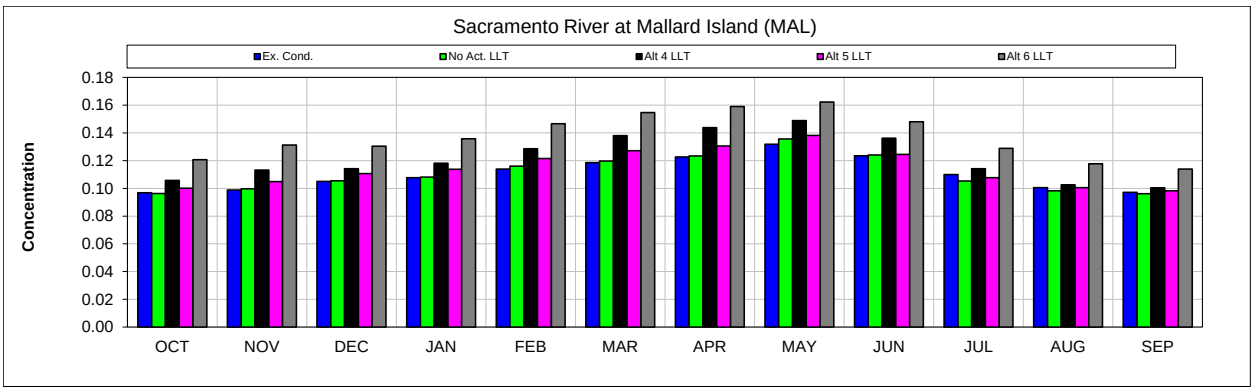


Figure M-23 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 5 and 6.







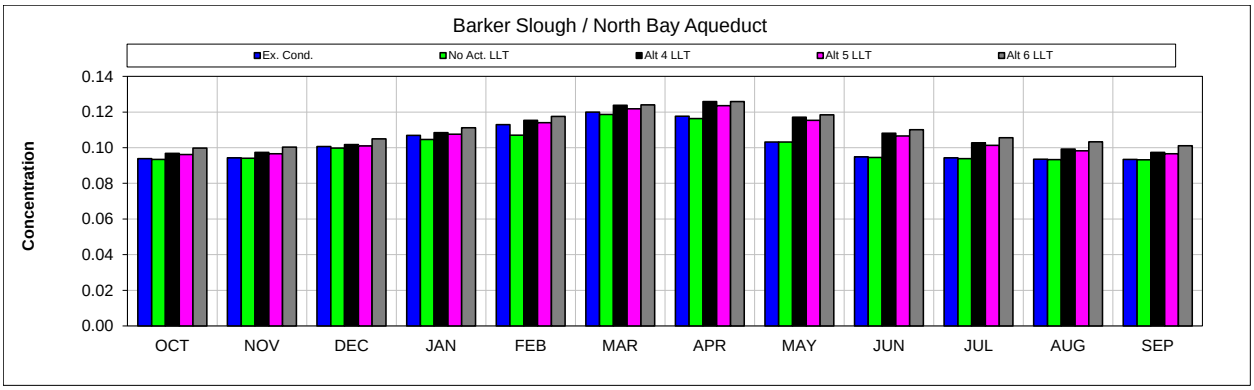
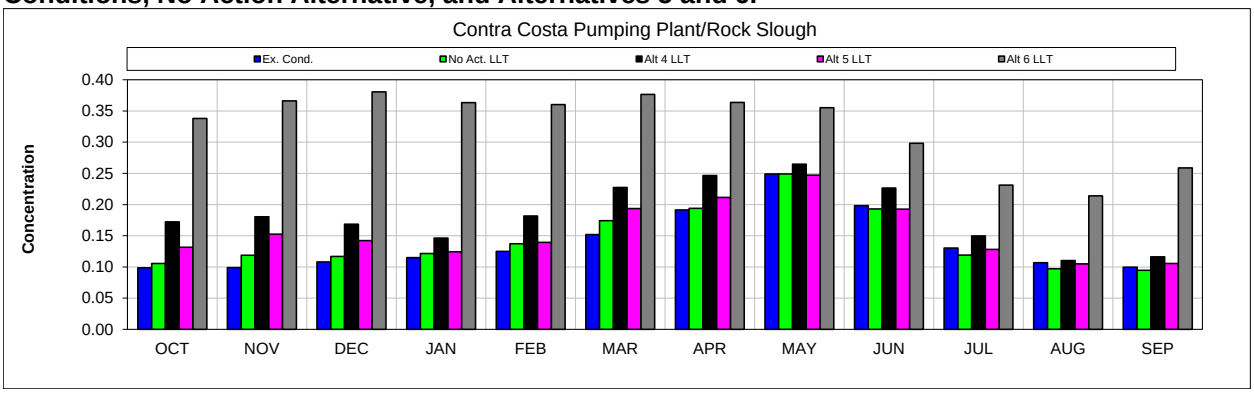
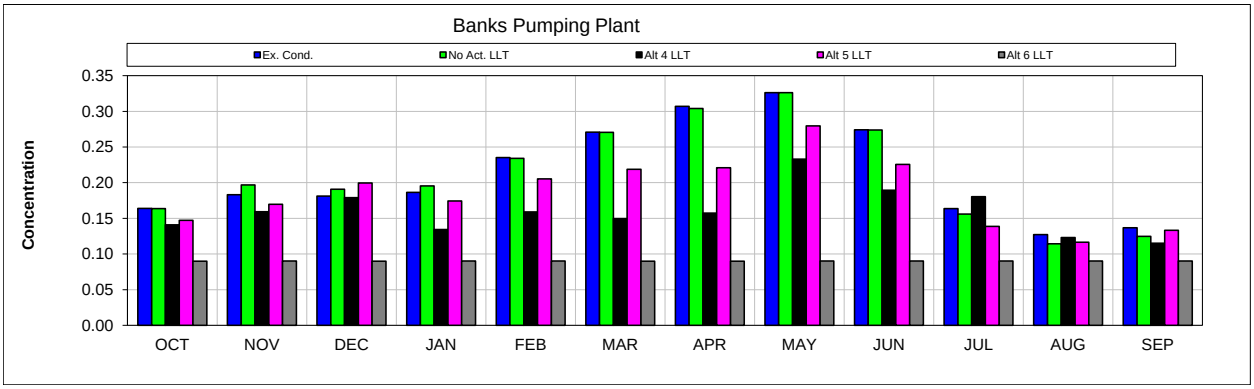


Figure M-23 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 5 and 6.





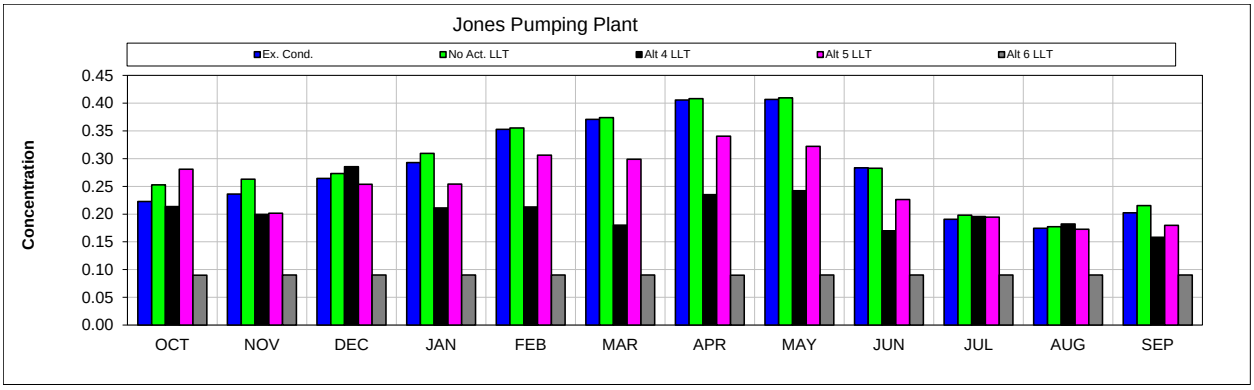
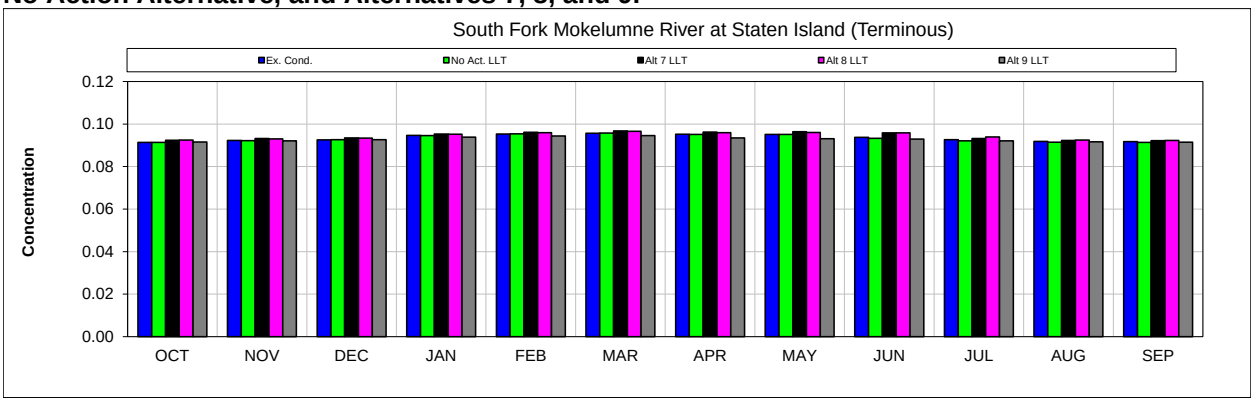
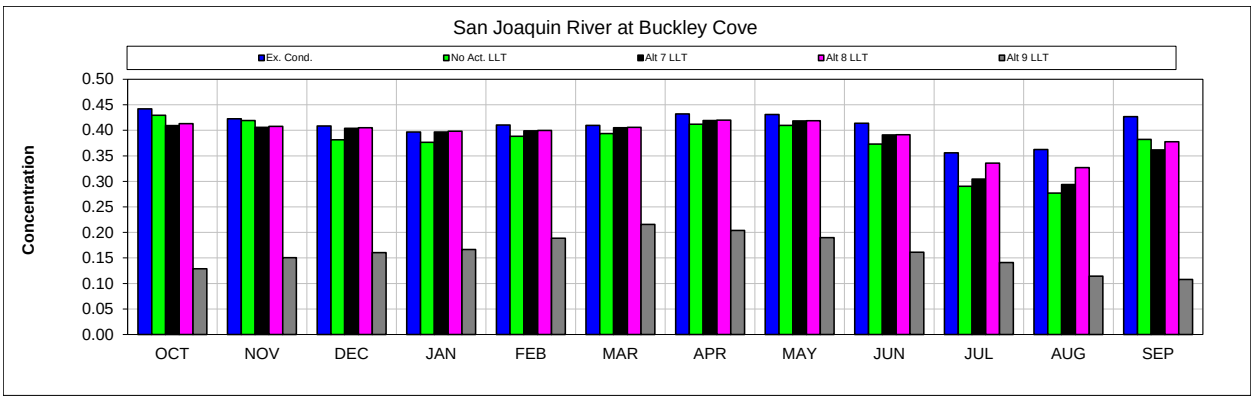
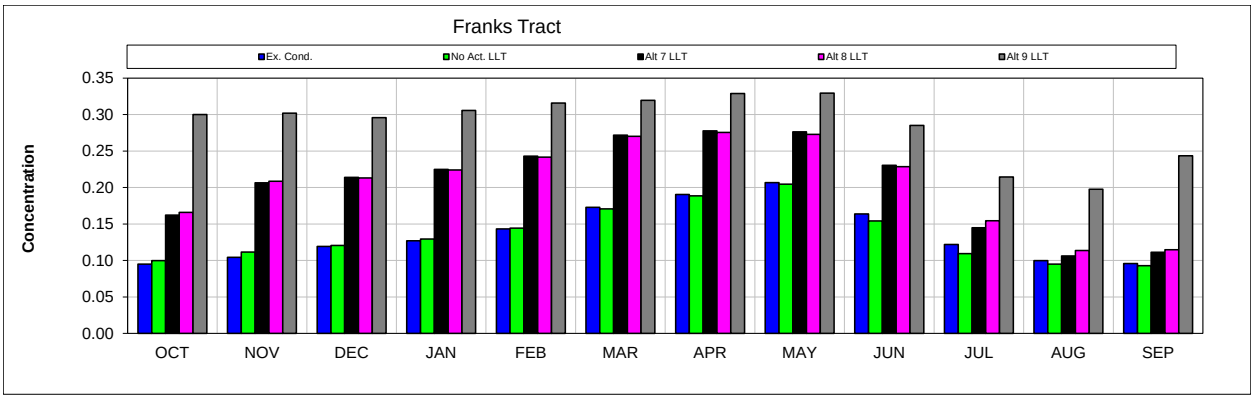


Figure M-24. Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 7, 8, and 9.







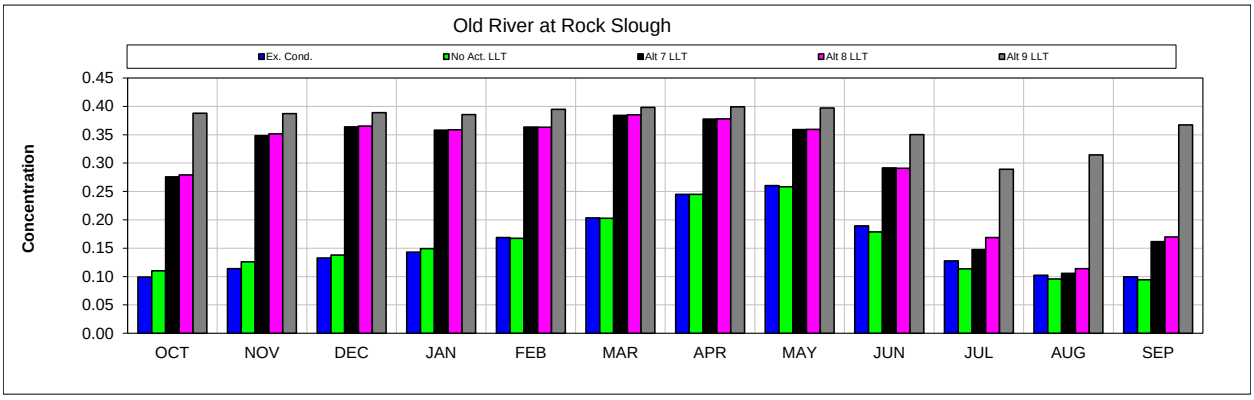
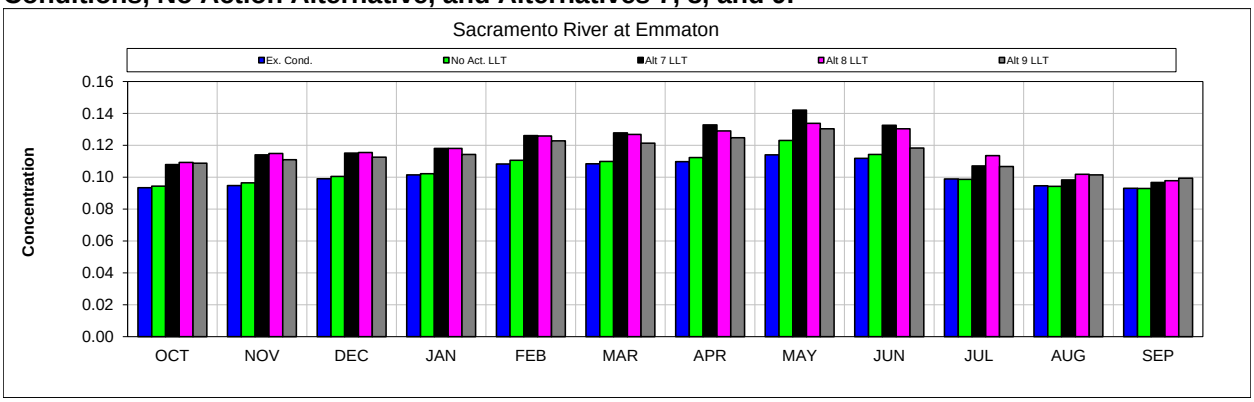
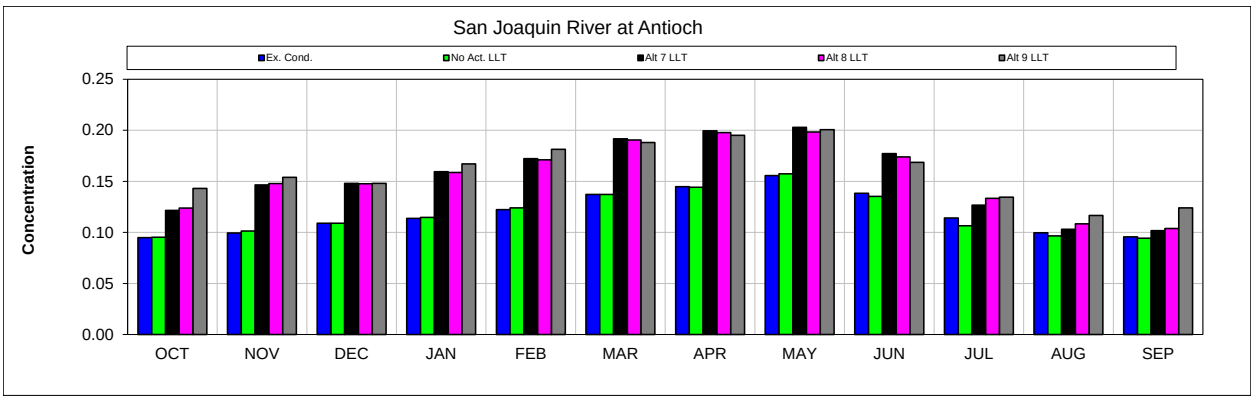
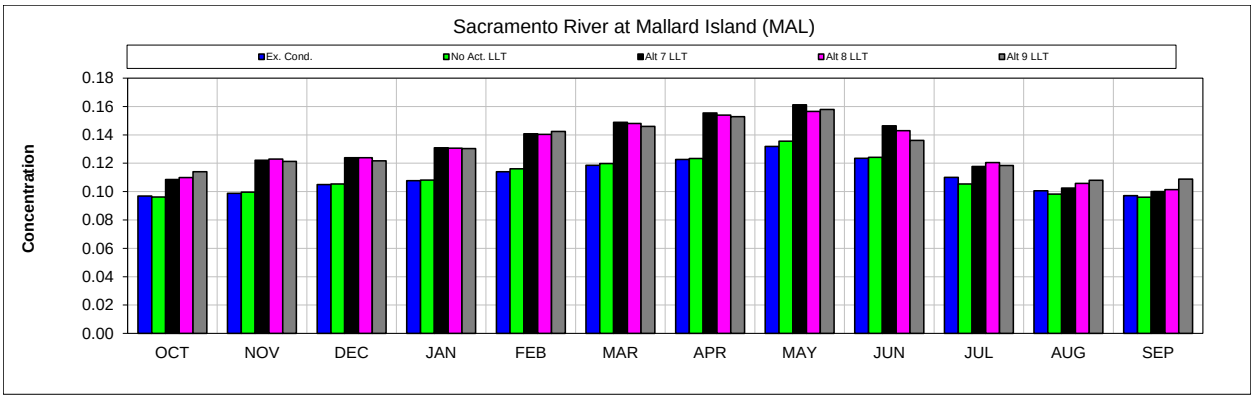


Figure M-24 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 7, 8, and 9.







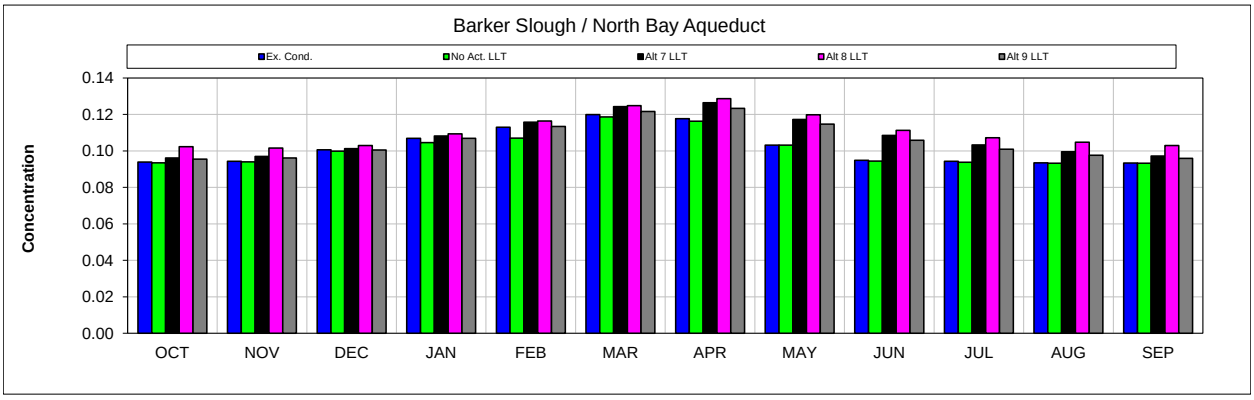


Figure M-24 (continued). Modeled Monthly Concentrations of Selenium (µg/L) in Water for Existing Conditions, No Action Alternative, and Alternatives 7, 8, and 9.