Pajaro Freshwater Wetlands Mitigation Project
Ecological Risk Assessment

Submitted to:

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Executive Summary

The Santa Clara Valley Water District proposes to restore an approximately nine-acre seasonal wetland for use as a District mitigation project at the southern end of its Carnadero Preserve near the confluence of Uvas-Carnadero Creek and the Pajaro River. Since legacy pesticides have been measured in the existing agricultural soils, the District wanted to determine whether restoration of the seasonal wetland would increase the potential risk to wildlife over the existing conditions. The goal for this assessment is to use measured soil pesticide concentrations to determine the potential for increased risk over existing conditions, if any, to terrestrial and aquatic wildlife that might be attracted to the wetland project planned for the eastern border of the 38-acre study field.

The available contaminant data included soil concentrations and a limited number of groundwater concentrations. The soil concentration values were used to model the potential concentrations in surface water, plants, or prey consumed by both terrestrial and aquatic wildlife. The Adaptive Risk Assessment Modeling System (ARAMS) is a computer-based, modeling- and database-driven analysis system for estimating human and ecological health impacts and risks and is based on a widely accepted risk paradigm that integrates exposure and effects assessments to characterize risk. ARAMS was used as the principal risk assessment software for this assessment.

Three fish species, two frogs, and a crayfish were assessed for potential risk to aquatic wildlife. Eight bird species, six mammal species, and a turtle were selected to assess potential risk to terrestrial wildlife. Whenever assumptions regarding the toxicity or the extent of exposure to pesticides needed to be made, the assumptions used were always conservative. This means the assessment might be overly protective of the species assessed. Because of the conservative nature of the assessment, when soil/sediment or water concentrations are provided indicating a less than significant impact is indicated, we are confident that is the case.

Anadromous fish such as steelhead are unlikely to experience any increase in risk caused by the creation of a wetland since they would be unlikely to enter the wetland or remain for long periods in the stream adjacent to the wetland. Tissue accumulation of DDD, and Toxaphene in warm-water fish, represented by bluegill sunfish, and bottom-feeding fish represented by the white sucker, might exceed concentrations known to indicate toxic effects. If warm-water fish represented by bluegill use the seasonal wetland when it is inundated, mitigation to less than significant impacts would result from soil concentrations of Toxaphene of approximately 325 ppb or less. For suckers, mitigation to less than significant impacts would result from soil concentrations of DDD of approximately 7 ppb or less and Toxaphene of approximately 40 ppb or less. Warm-water fish and bottom-feeding fish have the potential for exposure to water concentrations of Endrin and Toxaphene leading to an increase in acute risk. This risk could be mitigated to less than significant impacts with water concentrations of 0.019 ppb Endrin and 0.24 ppb Toxaphene. However, since the wetland will be seasonal, no chronic risk from exposure to pesticides in water is anticipated. If the planned mitigation seasonal wetland proves to be attractive to warm-water fish, the impacts indicated would be an increase over the existing condition since little cover would be present when the current crop field floods.

For crayfish, mitigation to less than significant impacts would result from soil concentrations of DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene of approximately 12, 16, 5, 0.9, 0.34 and 390 ppb or less, respectively. Acute or chronic exposure to dissolved DDE could be harmful to crayfish, but water concentrations less than 0.166 ppb and 0.017 ppb would mitigate this to less than a significant acute and chronic impact, respectively. The crayfish would be more likely to use the planned mitigation seasonal wetland than a flooded, bare crop field, so the potential impacts indicated would be an increase over the existing conditions.

Frogs could accumulate harmful levels of DDD, DDE, DDT, Dieldrin, Endosulfan, Endrin and Toxaphene in tissues. For frogs, mitigation to less than significant impacts would result from soil concentrations of DDD, DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene of approximately 5.5, 1.4, 0.011, 1.1, 3.8, 1.4 and 370 ppb or less, respectively. Acute or chronic exposures to water concentrations present from DDE, Endrin, and Toxaphene could be harmful to amphibians. Actual measurements of surface water concentrations for the pesticides and observations to determine the extent to which aquatic species use the seasonal wetland would confirm whether the calculated risks are accurate. If frogs use the planned mitigation seasonal wetland, it will likely be to a greater extent than the current conditions, so the potential impacts indicated would be an increase over the existing conditions.

Birds that consume large numbers of ground-dwelling small mammals could be at risk from pesticide concentrations found in the soil from the study field, but since creation of a wetland will not increase the existing risk, no increased risk is anticipated from the project. The only bird that might experience increased risk would be red-winged blackbirds. The actual degree of risk depends on whether the creation of the wetland leads to any noticeable increase in the availability of benthic invertebrates for red-winged blackbirds consumption and the extent to which the red-winged blackbirds focus on benthic invertebrates in their diets. Reductions of soil/sediment concentrations of DDD, DDE, DDT to 20, 18, 18 ppb, respectively could mitigate for this potential impact under the most conservative scenario assuming the red-winged blackbird diet consists of 85% benthic invertebrates and their entire diet is acquired on-site. Since the planned mitigation seasonal wetland will likely increase the amount of food present for red-winged blackbirds, any potential for impacts to blackbirds will be an increase over the existing conditions.

No substantial increase in risk is anticipated for mammals. Prairie vole is the only species for which there was potential risk. Since creation of a wetland is not anticipated to alter their exposure to soil pesticides, no increased risk to mammals is anticipated.

Turtles that use the wetland could experience significant impacts from exposure to Dieldrin. However, since the turtles are likely to have already selected brumation (turtle hibernation) sites prior to the wetland becoming inundated, there will likely be a less than significant impact on turtles.

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Introduction

Project Background

The Santa Clara Valley Water District (the District) proposes to restore an approximately nine-acre seasonal wetland for use as a District mitigation project at the southern end of its Carnadero Preserve near the confluence of Uvas-Carnadero Creek and the Pajaro River. Prior to restoring the wetland, the District hired Ardea Consulting to perform an ecological risk assessment to evaluate whether the conversion from current agricultural use to a less-disturbed wetland habitat in the proposed location would lead to a potentially significant impact. The lower level of human disturbance and increase in permanent vegetation within the seasonal wetland could create more attractive habitat for certain wildlife. Since legacy pesticides have been measured in the existing agricultural soils, the District wanted to determine whether restoration of the seasonal wetland would increase the potential risk to wildlife over the existing conditions.

Site Description

The Carnadero Preserve consists of approximately 480 acres of mostly actively-cultivated agricultural cropland. It is located in southern Santa Clara County and is bounded on the east by Uvas-Carnadero Creek, on the west by Highway 101, on the north by agricultural lands, and by the Pajaro River along a short section of the southern boundary. The Preserve is located in the southwestern portion of a highly cultivated valley near grass-dominated pasturelands and foothills to the west (see Figure 1). The Project Site is a 38-acre, roughly triangular crop field (here-in referred to as study field) located at the south end of the Preserve (see Figure 2). The planned wetland would be located along the eastern boundary of the field (see Figure 3) adjacent to Uvas-Carnadero Creek and the Pajaro River and would range from approximately 80 to 400 feet (25 to 120 m) wide.

The riparian corridor along the eastern border of the study field that has developed surrounding Uvas-Carnadero Creek and the Pajaro River is dominated by willow trees and willow shrubs (*Salix* spp.). The riparian corridors along Tick and Tar creeks (see Figure 2) have similar vegetation, but also include stretches without willows. In general, the corridors along these creeks are narrower than that along Uvas-Carnadero Creek (SCVWD 2003).

The District has identified a number of small wetlands on or near the Carnadero Preserve that can act as sources for native plants and animals to populate the planned wetland. These same wetlands can be used as models for a local seasonal wetland during the development of the mitigation wetland (see SCVWD 2003). The eastern portion of the study field, where the seasonal wetland project will be located, is estimated to flood for short durations every 2 to 4 years during the winter months. This area also has shallow seasonal groundwater levels, and some locations have surface water present for approximately four to five months (December/January to March/April) each year. Areas within and adjacent to the planned wetland have ground water levels that are approximately one foot or less below the ground surface (SCVWD unpubl. data) during this same time period.

In December 2004, the District collected soil samples for contaminant analysis from throughout the 38-acre study field. Eight pesticides were identified in those samples including DDD, DDE, DDT, Delta-BHC, Dieldrin, Endosulfan II, Endrin, and Toxaphene (see Table 1). Cadmium also was found in measurable amounts in the field. Only a few samples from below the upper one-foot stratum contained measurable contamination.

Assessment Goal

The goal for this assessment is to use measured soil pesticide concentrations to determine the potential for increased risk over existing conditions, if any, to terrestrial and aquatic wildlife that might be attracted to the wetland project planned for the eastern border of the 38-acre study field. To achieve this goal the potential risk to wildlife from direct exposure to soil, sediments, and surface water and consumption of prey or plant matter that have accumulated contaminants from the soil has been modeled.

Methods

Data Selection

The available contaminant data included soil concentrations and limited groundwater concentrations. The District provided data from 13 sample locations throughout the 38-acre study field (see Table 1). These locations were separated into those that fell within (including within 100 feet (30 m) of the planned wetland boundary) and outside the planned mitigation seasonal wetland. Wildlife exposure typically results from contact to soil within the upper foot, so values from the upper foot are used in the assessment. The maximum value and geometric mean values were identified for the entire study field, the area outside the wetland, and the portion intended for the wetland (see Table 2). These values were used to model the potential concentrations in either plants or prey consumed by both terrestrial and aquatic wildlife. When measured concentrations were reported as less than the limit of detection, mean values were calculated using ½ the limit of detection.

The geometric means of concentrations for soil contaminants of concern (COC) for the entire 38-acre study field were used as model inputs because during some portion of the year, the entire study field can be dry, and terrestrial wildlife could be directly exposed to soil. Similarly, terrestrial prey consumed by wildlife also could accumulate body burdens from direct exposure to soil concentrations from the entire field. Where model inputs called for sediment concentrations, the geometric means from sample locations within the planned seasonal wetland or within 100 feet (30 m) of the wetland boundary were used. Since these portions of the field can have standing water for a portion of the year, aquatic wildlife could use those areas and be exposed directly or indirectly from consumption of prey and plants that are directly exposed to the soil/sediment. For clarity, in this assessment, the term soil will refer to soil that is not inundated by surface water, and sediment will refer to soil that is inundated with surface water.

Risk Assessment Modeling

The Adaptive Risk Assessment Modeling System (ARAMS™, version 1.3), developed by the U.S. Army Engineer Research and Development Center (ERDC) and the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), is available for download from http://el.erdc.usace.army.mil/arams/. ARAMS is a computer-based, modeling- and database-driven analysis system for estimating human and ecological health impacts and risks associated with military relevant compounds and other potential COCs. ARAMS is based on a widely accepted risk paradigm that integrates exposure and effects assessments to characterize risk.

The required contaminant inputs for ARAMS are soil, sediment, and water pesticide concentrations. For this assessment, water entering the site was assumed to be uncontaminated since the primary sources for water in the wetland are groundwater and rainfall. The groundwater has been tested for contaminants with no contaminants detected (Sequoia Analytical Work Order Report MNL0610, Dated January 6, 2005). To model the amount of each pesticide potentially released into surface water after flowing over contaminated sediments, the model RECOVERY (version 4.3.1) was used. RECOVERY is a screening-level model used to assess the long-term impacts of contaminated bottom sediments on surface waters. RECOVERY is available from the Environmental Laboratory (EL) of the U.S. Army Engineer Research and Development Center (ERDC), Waterways Experiment Station (WES) (http://el.erdc.usace.army.mil/products.cfm? Topic=model&Type=drgmat). RECOVERY uses soil/sediment pesticide concentrations as well as total carbon content and pesticide characteristics to calculate the amount of pesticide released to surface water from the sediment. The geometric mean values for the concentration of the Pesticides in the planned seasonal wetland were used to calculate the water concentrations (see Table 3). Because of the water will only be a few inches deep, it will require only a few days for steady state concentrations of the pesticides to be reached. Therefore, the flushing rate will play only a minor role in determining the water concentrations.

This risk assessment uses ecological hazard quotients (EHQ) to screen for potentially unacceptable risk (a potentially significant impact). An EHQ is calculated by dividing an estimate of exposure by a toxic reference value (TRV). The exposure estimates can be based on the pesticide concentration in water, the pesticide quantity ingested daily, or the accumulated pesticide tissue concentration in the species of concern. A TRV is based on either laboratory toxicity tests or observed field effects and can reflect short-term (acute, *e.g.* measured in hours or days) or long-term (chronic impacts, *e.g.* measured in months). The potential for unacceptable risk is assumed to exist whenever the EHQ exceeds one. When the EHQ exceeds one, it might be possible to mitigate the risk, so the impact could be classified as potentially significant unless mitigation is incorporated. When the EHQ is less than one, the impact would be considered less than significant. When a potentially significant effect to a particular species was identified, the same models were used to “back-calculate” a soil concentration that would produce an EHQ of one or less.

Input Selection

To assess risk to aquatic species, the EHQ is calculated by dividing the body burden or tissue concentration that would result from environmental exposure to a pesticide by the body burden that relates to a toxic impact (*e.g.*, mortality, impaired reproduction, etc.). Body burden is the concentration or quantity of the pesticide in the entire organism. The ARAMS software calculated the body burden that would result from the pesticide concentrations measured in the soils at the study field including the exposure via bioaccumulation in the food chain. To identify the body burden related to toxic impact or TRV, a TRV provided by ARAMS was used, if available. Alternatively, a value was identified from the literature. If no TRVs were available from the literature, the TRVs were calculated by multiplying water concentrations known to be toxic by a published bioconcentration factor to provide tissue concentrations. Data from a related species was used when no data for a specific pesticide was available for the selected species.

For terrestrial species, the standard accepted approach is slightly different from that described for aquatic species. The degree of exposure resulting from environmental pesticides, measured in milligrams pesticide/kilogram of body weight/day is divided by a daily intake known to be toxic. The ARAMS software used the measured soil concentrations to calculate the daily exposure including exposure via the diet for each species based on dietary and caloric requirements. Uptake values from soils to plants or soil invertebrates could be used as well as food-chain multipliers to develop pesticide concentrations in various categories of dietary items. The EHQ for terrestrial species was determined by dividing the calculated daily intake by a TRV. The TRVs were either available directly from ARAMS or were identified from the literature. When necessary, data from related species were used.

Very little toxicological testing has been performed with reptiles, so there are no data available for most pesticides. When this was the case, a mammalian TRV multiplied by a safety factor of 0.01 was used. While applying a safety factor of 0.01 is a common practice in risk assessment when sufficient data are unavailable, no such specific instructions are available from a regulatory or published source. The sources for all TRVs and how each was determined have been recorded in the data files and are available in the supporting documentation.

Risk Modeling

The ARAMS software uses Biotic/Sediment Accumulation Factors (BSAFs) to evaluate the risk to aquatic organisms. The BSAF expresses the steady-state difference between the concentration of a bioaccumulating organic chemical normalized on the organic carbon content of a sediment, and the concentration measured in the total extractable lipids of an organism for which that sediment represents the source of contamination in its habitat. The BSAF incorporates all routes of exposure including absorption across the gill, direct contact with contaminated sediments, and dietary. Since the source for exposure to pesticides is the soil/sediment, it is appropriate to use BSAFs in this assessment. To assess the risk to aquatic organisms, ARAMS determines the tissue concentrations associated with specific sediment concentrations, and then compares those tissue concentrations to those tissue concentrations known to represent toxic impacts.

The tissue concentration approach is best when used under conditions where organisms are present and feeding in the area for a long enough period to reach a steady state between the sediment concentration and tissue concentration. However in this assessment of a seasonal wetland adjacent to a stream, organisms might be present for shorter periods of time. Therefore, the more traditional approach of comparing the water concentrations known to produce acute or chronic toxicity is also assessed.

The ARAMS software focuses on dietary exposure for terrestrial species. The concentrations of pesticides in food items is calculated using uptake factors from soil/sediments or water to plants or invertebrates, and then up to the higher trophic levels. The total daily exposure by using the species specific diets is then compared to the daily consumption known to cause toxic impacts.

For both terrestrial and aquatic species, the soil/sediment concentration that would lead to a less than significant impact was "back-calculated" by inserting a range of soil/sediment concentrations into the ARAMS model and then selecting that concentration that would be lead to a dietary intake or tissue concentrations approximately equal to the TRV. Also, for aquatic species, the acute or chronic limit is the water concentration expected to produce a less than significant impact.

Species Selection

Terrestrial and aquatic species were selected based on previous survey work conducted by SCVWD at the Carnadero Preserve (SCVWD 2003). Selected species were either those found on-site, or had similar habits to those on-site. Surrogate species with sufficient toxicological or life history data also were selected to represent species known to be present or likely present on or near the project site.

Aquatic

Six aquatic species were selected: rainbow trout (steelhead) (*Oncorhynchus mykiss*), bluegill sunfish (*Lepomis macrochirus*), white sucker (*Catostomus commersoni*) bullfrog (*Rana catesbeiana*), Pacific treefrog (*Pseudacris regilla*) and red swamp crayfish (*Procambarus clarkii*). These species were selected to represent a coldwater anadromous fish, a warmwater fish, a bottom-feeding fish, a principally aquatic amphibian, a partially terrestrial amphibian, and a benthic invertebrate, respectively. White suckers are not present in the watershed, but were selected as a surrogate for the Sacramento sucker (*Catostomus occidentalis*).

Terrestrial

Fifteen species were selected to represent species with terrestrial or aquatic carnivorous, omnivorous, and herbivorous diets. These include eight bird species: red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), belted kingfisher (*Ceryle alcyon*), mallard duck (*Anas platyrhynchos*), cliff swallow (*Petrochelidon pyrrhonota*), and red-winged blackbird (*Agelaius phoeniceus*); six mammals: coyote (*Canis latrans*), black-tailed jackrabbit (*Lepus californicus*), mule deer (*Odocoileus hemionus*), prairie vole (*Microtus ochrogaster*), muskrat (*Ondatra zibethica*), and raccoon (*Procyon lotor*); and a single reptile: painted turtle (*Chrysemys picta*). The bird species were selected to represent those species that focus on terrestrial vertebrate prey, aquatic prey, insects, and omnivorous diets. The mammals represented large, medium and small mammals with carnivorous, herbivorous or omnivorous diets. Prairie voles and painted turtles are not native to the area, but there was sufficient data to use them as surrogates for other small mammals and reptiles, respectively.

Risk Assessment

Contaminant Distribution

The distribution of the pesticides measured across the 38-acre study field was not uniform (see Figures 4 – 11). An insufficient number of samples were available for Cadmium collected from the project site to produce an appropriate distribution map. The Cadmium soil concentrations found on the project site are similar to those found elsewhere on the Carnadero Preserve (Shaw Environmental, Inc. 2003). Also, the soil concentrations presented in Table 1 fall within the range considered background levels (up to 0.5 ppm) in California agricultural soils (CDFA 2004, Hodel and Chang unpubl.). Cadmium shows a more consistent concentration profile from the surface down to 10 feet, including below the plow zone, supporting that these concentrations are likely natural. Therefore, no ecological risk assessment on Cadmium will be performed.

Generally, the areas of highest concentrations fell outside the area of the planned mitigation wetland. Two exceptions to this were Delta-BHC and Endosulfan II (Figures 7 & 9). The regions of highest concentrations depicted in Figures 4 – 11 do not always clearly demonstrate the where the actual highest concentration was found. The highest concentrations of DDT (Figure 6) and of Cadmium were also within or near the proposed wetland (Table 2).

Aquatic Risk

One critical factor that will determine acute or chronic risk to aquatic species is the accuracy of the models predicting the concentrations of pesticides released from the soils/sediments into surface waters. These models assume that equilibrium between the soils/sediments and the overlying water is reached. Because the water will be quite shallow, equilibrium will likely be reached within a few days. A second factor that is currently unknown is the extent to which fish, benthic invertebrates, and amphibians will utilize the flooded wetland during the period while overlying water is present. Previous observations by District staff indicate the depth of water will likely be only a few inches. Such shallow water will greatly limit the use of the wetland by most fish or other large aquatic species.

Based on models run using tissue concentrations, all aquatic species had EHQs that exceeded 1.0 for at least one pesticide (see Table 4) with the bullfrog and Pacific treefrog exhibiting exceedances for the greatest number of pesticides (8). Of the pesticides, Delta-BHC posed only less than significant impacts to the selected species based on tissue concentrations.

Using tissue concentrations to assess risk works well when individuals are restricted to the contaminated site, such as for lakes and ponds. Constant exposure to the contaminated sediment, water and food resources allows the pesticides to accumulate to their maximum extent. However, in the current assessment, water flows across the soil/sediments and will only occur during the rainy season in winter and early spring. Aquatic species will only come in contact with soil/sediment when water is present. Since water and prey concentrations might not reach equilibrium, exposure could be lower than projected.

Species such as steelhead are unlikely to enter the flooded wetland because they prefer faster flowing waters (Moyle 2002). So a steelhead's only contact with the pesticides is from food items or water that moved back into the main channel from the seasonal wetland. Even this exposure is likely minimal since steelhead will spend little time in the vicinity of the wetland when it is inundated. The steelhead in the Pajaro River watershed are winter-run steelhead (Moyle 2002) which means they enter the streams once sufficient water exists from late fall winter rains. They move up the streams to their headwater spawning areas. Adults are unlikely to remain in the vicinity of the study site for extended periods. Steelhead spawning and juvenile rearing typically occurs well upstream, off of the valley floor in this system. This occurs along the Uvas main stem and tributary reaches that are permanently wetted either naturally or from summer-augmented flows from the reservoir releases, well upstream of this wetland area. Out-migration of smolts and possibly a few adults may occur from February through May or early June depending on annual hydrology and stream connectivity. The out-migrants may pass the constructed wetland but are not expected to occupy the site as a rearing area. Exposure risk to the steelhead is limited to in- or out- migration past the site (pers. comm. J. Abel, Santa Clara Valley Water District Fisheries Biologist).

The water concentrations of Endrin and Toxaphene calculated to be possible in water in the flooded seasonal wetland are sufficient to lead to potential acute risk to species such as the steelhead (see Table 5), but since steelhead will not routinely enter the flooded wetland, the dilution effect of water flowing down the channel should be sufficient for the impact to be less than significant. In addition to the two previously named pesticides, Endosulfan also exceeds the chronic water concentration limit. Since steelhead do not remain for long periods in the stretch of the Uvas-Carnadero Creek or Pajaro River adjacent to the seasonal wetland, the potential for chronic risk is less than significant. Site occupation potential is very limited. Reduced entrainment is intentionally factored in the design by the limited connection to the main stem in order to specifically minimize the potential for impacts to a Federal ESA-listed species (pers. comm. J. Abel, Santa Clara Valley Water District Fisheries Biologist).

Other small fish that spend time in the shallow water within portions of the seasonal mitigation wetland could be at risk from accumulation in tissues of Toxaphene from the sediments (see Table 4). Depending on the density of emergent vegetation that becomes established, few fish may find sufficient water at a depth of only a few inches to remain in the wetland for long. The bottom-feeding white sucker, representing the native Sacramento sucker also exhibited exceedances for Toxaphene as well as DDD. During the cooler winter period when the wetland will be inundated, suckers greatly reduce their feeding activity (Moyle 2002). However, they focus on invertebrates during winter, so their potential for exposure will depend on the degree to which they are able to enter the wetland, and the availability of invertebrates. Additional observations will be necessary once the wetland is established to determine the potential for adverse impacts to suckers from the establishment of a seasonal wetland. Mitigation for warm-water fish represented by bluegill that use the seasonal wetland when it is inundated would be achieved if soil concentrations of Toxaphene were reduced to approximately 325 ppb or less (see

Table 8). For suckers, adequate mitigation would result from soil concentrations of DDD of approximately 7 ppb or less and Toxaphene of approximately 40 ppb or less (See Table 8).

Acute exposure to water concentrations of Endrin and Toxaphene, as demonstrated by the representative warm-water fish (bluegill sunfish) analyzed in this assessment, or exposure of the white sucker to Endrin (see Table 5) could lead to a potentially significant impact unless mitigation is incorporated. Whether any acute impacts will eventually occur will depend on actual water concentrations and whether fish actually enter the wetland. Water concentrations of ≤ 0.019 ppb Endrin and 0.24 ppb Toxaphene would be sufficiently low to mitigate impacts in warm-water fish (see Table 8). Because of the seasonal nature of the planned wetland, chronic exposures are not likely, so chronic risk is expected to be less than significant.

Benthic invertebrates such as crayfish might be expected to exhibit adverse effects from accumulation in their tissues of some of the pesticides in the sediments (see Table 4). The extent to which crayfish or other benthic invertebrates use the seasonal wetland will determine whether any such impacts could occur. However, the simple acute and chronic toxicity from exposure to anticipated water concentrations was also considered. For crayfish, sufficient mitigation would result from soil concentrations of DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene of approximately 12, 16, 5, 0.9, 0.34 and 390 ppb or less, respectively (See Table 8).

Acute or chronic exposures of crayfish to water concentrations of DDE could be toxic and lead to a potentially significant impact unless mitigated (see Table 5). Since the seasonal wetland might not remain continuously inundated for the entire rainy season, and will differ among years, it is unclear to what extent crayfish will use the planned seasonal wetland. If use is intermittent, chronic impacts might not manifest, however since shorter exposure could produce acute impacts, there is likely to be a potentially significant impact from DDE unless mitigated. Water concentrations of ≤ 0.166 ppb DDE would be sufficiently low to mitigate significant impacts in crayfish (see Table 8).

Bullfrogs and Pacific treefrogs, representing amphibians, could experience harmful effects from accumulation of pesticides in tissues from all pesticides in the sediments except Delta-BHC (see Table 4). Depending on the species, acute impacts from pesticides dissolved in water are possible from DDE and Endrin, whereas, chronic impacts are possible from DDE, Endrin and Toxaphene (Table 5). Both bullfrogs and Pacific treefrogs spend months as tadpoles with bullfrogs often overwintering as tadpoles and metamorphosing the following year (NatureServe 2006). So either species could experience chronic impacts, if they remain within the wetland for the full season. However if their use is intermittent because of dry periods, their potential for significant impacts will be determined by how long they actually spend in the wetland. Since Pacific treefrogs lay eggs on submerged plant stems, creation of a wetland with emergent vegetation could increase the exposure of these treefrogs to the pesticides. Bullfrog larvae develop in permanent waterbodies, so the seasonal nature of the wetland should preclude long-term exposure to tadpoles. Both species are likely to be inactive for at least part of the period when the wetland is inundated, so would not move into the seasonally wet areas. The duration of exposure will likely change from year to year depending on the amount of water and air temperatures. For frogs, impacts could be mitigated to be less than significant soil concentrations of DDD, DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene are reduced to approximately 5.5, 1.4, 0.011, 1.1, 3.8, 1.4 and 370 ppb or less, respectively (see Table 8).

Terrestrial Risk

Since most terrestrial species can move on and off a contaminated site, ecological risk assessments take into consideration an area use factor. For this assessment, the area use factor was determined by dividing the planned wetland size (9 acres) by the home range of the species as indicated by the ARAMS software or from published literature. All sources are included in the supporting documentation. The area use factor is simply the proportion of the home range that corresponds to the project site. All species except the red-winged blackbird, prairie vole, and painted turtle have home ranges greater than the size of the study field. Spending time and presumably gathering food items from off-site would diminish their exposure. The area use factors assume that the project site is used in proportion to its relative size compared to other areas within a species home range. The scope of this assessment did not provide the resources to perform a detailed landscape analysis for each species to determine the quality of habitat on or off the project site.

Risk to terrestrial species is assessed by comparing daily intake, primarily via oral ingestion, to the daily intake known to have an adverse effect, the TRV. Table 6 shows the exposure estimates of terrestrial species to pesticides from soil, sediment, water, air, and food resources. Table 7 shows the calculated EHQs for these species. The standard approach for TRV selection in terrestrial assessments is to use toxicity to the most sensitive species for a group, such as birds. The intake estimates are species specific and are based on diet composition, the estimated pesticide concentrations in those diet components, and the daily ingestion rates. In some cases, using the most sensitive species might be over protective, but when data is not available for each species; this has been accepted as the most conservative approach.

Red-tailed hawks and red-winged blackbirds showed the potential for risk from exposure to DDD, DDE, and/or DDT (see Table 7). The TRV for DDT and its metabolites is based on the eggshell thinning response observed in brown pelicans (*Pelecanus occidentalis*) (Anonymous 1999). Brown pelicans were highly sensitive to DDT and its metabolites, so basing the TRV on brown pelicans is a conservative approach. The dietary component for red-tailed hawks that drives the exposure estimate is small mammals. Creation of a seasonal wetland would have a limited impact on the number of small mammals exposed to DDT, DDE, or DDD residues, so although soil concentrations are sufficient to suggest the potential for risk, the development of a seasonal wetland would not attract any additional red-tailed hawks and would result in a less than significant impact.

Red-winged blackbirds eat both aquatic plants and benthic invertebrates. In this assessment, a diet focusing on benthic invertebrates (85%) was selected (McNicol *et al.* 1982) to stress the impact of creating a wetland in place of the existing farmland. The benthic invertebrate portion of their diet causes most of the exposure to DDT and its metabolites. McNicol *et al.* (1982) present an alternative diet that consists of 50% benthic invertebrates and 50% aquatic plants. There still existed risk from this diet from DDD, DDE, and DDT. A third possible diet minimizes benthic invertebrates (only 2%) with the remainder comprised of aquatic plants and seeds. When the diet minimizes the contribution of benthic invertebrates, EHQs for DDE and

DDT still exceed one indicating a potential for significant impact unless mitigated. To the extent that the seasonal wetland increases the availability of benthic invertebrates, restoration of a seasonal wetland could lead to a potentially significant impact over the current situation for red-winged blackbirds.

To reduce or mitigate the risk to red-winged blackbirds the concentration in the soil/sediment of DDD, DDE, and DDT would need to be reduced to approximately 20 ppb, 18 ppb, and 18 ppb, respectively, if the red-winged blackbird maximizes the benthic invertebrate portion of its diet (see Table 8). To mitigate the potentially significant impact should the diet include 50% benthic invertebrates and 50% aquatic vegetation, the concentrations of DDD, DDE, and DDT in sediments would need to be reduced to 20 ppb, 19 ppb, and 19 ppb, respectively. Even minimum consumption of benthic invertebrates consumed with the rest of the diet comprised of plant matter from the same wetland would require a reduction of the concentrations of DDE, and DDT to 65 ppb, and 60 ppb, respectively to mitigate a potentially significant impact.

The only mammal with potential risk from exposure to pesticides is the prairie vole, a surrogate for other ground-dwelling small mammals. Since their primary habitat is outside the seasonal wetland, there would be a less than significant impact to voles or other ground-dwelling mammals from the restoration of a seasonal wetland.

The single reptile considered is the painted turtle used as a surrogate for the western pond turtle. There is a potential for risk from exposure to Dieldrin, but the true extent of the risk is not known. Because no TRVs are available for reptiles, mammalian TRVs/100 were used. Up to 47 mg Dieldrin/kg tissue concentrations (Pauli and Money 2000) have been measured in field collected turtles. It is not known whether there were long-term detrimental impacts from these field-observed tissue concentrations. Another complicating factor in evaluating the impacts of the pesticides on turtles is the fact that western pond turtles are primarily inactive from November to April (Ernst *et al.* 1994), but western pond turtles could be attracted to the vegetated areas of the planned wetland if it becomes a suitable brumation[1] site and an adequate food chain is established (pers. comm. J. Abel, Santa Clara Valley Water District Fisheries Biologist). The majority of the modeled exposure for turtles is from dietary intake, and uptake of pesticides is largely restricted to when the active season for turtles overlaps the inundation season for the wetland. Inactivity during the wet period will greatly reduce any exposure. Western pond turtles brumate underwater often in the bottom of stream pools (Ernst *et al.* 1994); however, local western pond turtles often brumate under vegetation in upland site rather than risk being washed away during high, flashy flows (pers. comm. J. Abel, Santa Clara Valley Water District Fisheries Biologist). Since the wetland might not be fully inundated at the time turtles are searching for brumation sites, it is possible that any additional exposure from the restoration of a seasonal wetland will be minimal because western pond turtles are likely to brumate away from the planned seasonal wetland. Therefore, the impact from the restoration of a seasonal wetland on the project site will be less than significant.

[1] Brumation in turtles is similar to hibernation in mammals in that they become inactive for long periods in the winter.

Conclusions

The restoration of a seasonal wetland near the confluence of Uvas-Carnadero Creek and the Pajaro River poses the potential for risk to aquatic and terrestrial species by directly or indirectly increasing the exposure of these species to existing pesticides. Eight pesticides and one metal were identified in soil samples collected from the agricultural field where the seasonal wetland is planned. These contaminants are not evenly distributed throughout the study field. Except for Delta-BHC and Endosulfan, the highest concentrations of the pesticides are located mostly outside the planned seasonal wetland area. Although Cadmium was found in measurable amounts in the project site soils, the concentrations are within background levels and no risk assessment on Cadmium was performed.

Three fish species, two frogs, and a crayfish were assessed for potential risk to aquatic wildlife. Eight bird species, six mammal species, and a turtle were selected to assess potential risk to terrestrial wildlife. Whenever assumptions regarding the toxicity or the extent of exposure to pesticides needed to be made, the assumptions used were always conservative. This means the assessment might be overly protective of the species assessed. For example, no good estimates of the toxicity to turtles were available, so a conservative safety factor was applied to mammalian toxicity values to assess the risk to turtles. Also, red-winged blackbirds were assumed to acquire all their food from the project site, when this might not be the case. The true use of the seasonally inundated wetland by warm-water fish is not known. Until additional information is available to indicate warm-water fish level of use in the wetland, we assume the use is sufficient for there to be potentially significant impacts. Because of the conservative nature of the assessment, when soil/sediment or water concentrations are provided indicating a less than significant impact is indicated, we are confident that is the case.

Anadromous fish such as steelhead are unlikely to experience any increase in risk caused by the creation of a wetland since they would be unlikely to enter the wetland or remain for long periods in the stream adjacent to the wetland. Tissue accumulation of DDD, and Toxaphene in warm-water fish, represented by bluegill sunfish, and bottom-feeding fish represented by the white sucker, might exceed concentrations known to indicate toxic effects. If warm-water fish represented by bluegill use the seasonal wetland when it is inundated, mitigation to less than significant impacts would result from soil concentrations of Toxaphene of approximately 325 ppb or less. For suckers, mitigation to less than significant impacts would result from soil concentrations of DDD of approximately 7 ppb or less and Toxaphene of approximately 40 ppb or less. Warm-water fish and bottom-feeding fish have the potential for exposure to water concentrations of Endrin and Toxaphene leading to an increase in acute risk. This risk could be mitigated to less than significant impacts with water concentrations of 0.019 ppb Endrin and 0.24 ppb Toxaphene. However, since the wetland will be seasonal, no chronic risk from exposure to pesticides in water is anticipated. If the planned mitigation seasonal wetland proves to be attractive to warm-water fish, the impacts indicated would be an increase over the existing condition since little cover would be present when the current crop field floods.

For crayfish, mitigation to less than significant impacts would result from soil concentrations of DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene of approximately 12, 16, 5, 0.9, 0.34 and 390 ppb or less, respectively. Acute or chronic exposure to dissolved DDE could be harmful to crayfish, but water concentrations less than 0.166 ppb and 0.017 ppb would mitigate this to less than a significant acute and chronic impact, respectively. The crayfish would be more likely to use the planned mitigation seasonal wetland than a flooded, bare crop field, so the potential impacts indicated would be an increase over the existing conditions.

Frogs could accumulate harmful levels of DDD, DDE, DDT, Dieldrin, Endosulfan, Endrin and Toxaphene in tissues. For frogs, mitigation to less than significant impacts would result from soil concentrations of DDD, DDE, DDT, Dieldrin, Endosulfan, Endrin, Toxaphene of approximately 5.5, 1.4, 0.011, 1.1, 3.8, 1.4 and 370 ppb or less, respectively. Acute or chronic exposures to water concentrations present from DDE, Endrin, and Toxaphene could be harmful to amphibians. Actual measurements of surface water concentrations for the pesticides and observations to determine the extent to which aquatic species use the seasonal wetland would confirm whether the calculated risks are accurate. If frogs use the planned mitigation seasonal wetland, it will likely be to a greater extent than the current conditions, so the potential impacts indicated would be an increase over the existing conditions.

Birds that consume large numbers of ground-dwelling small mammals could be at risk from pesticide concentrations found in the soil from the study field, but since creation of a wetland will not increase the existing risk, no increased risk is anticipated from the project. The only bird that might experience increased risk would be red-winged blackbirds. The actual degree of risk depends on whether the creation of the wetland leads to any noticeable increase in the availability of benthic invertebrates for red-winged blackbirds consumption and the extent to which the red-winged blackbirds focus on benthic invertebrates in their diets. Reductions of soil/sediment concentrations of DDD, DDE, DDT to 20, 18, 18 ppb, respectively could mitigate for this potential impact under the most conservative scenario assuming the red-winged blackbird diet consists of 85% benthic invertebrates and their entire diet is acquired on-site. Since the planned mitigation seasonal wetland will likely increase the amount of food present for red-winged blackbirds, any potential for impacts to blackbirds will be an increase over the existing conditions.

No substantial increase in risk is anticipated for mammals. Prairie vole is the only species for which there was potential risk. Since creation of a wetland is not anticipated to alter their exposure to soil pesticides, no increased risk to mammals is anticipated.

Turtles that use the wetland could experience significant impacts from exposure to Dieldrin. However, since the turtles are likely to have already selected brumation sites prior to the wetland becoming inundated, there will likely be a less than significant impact on turtles.

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Table 1. Measured soil contaminant concentrations (µg/kg) in 38-acre study field.

		Non-wetland Sample Points							Proposed Wetland Sample Points[1]					
Depth	**Compounds**	**B2**	**B5**	**B8**	**P21**	**MW 17**	**MW 18**	**MW 19**	**B3**	**B6**	**B9**	**MW 15**	**MW 16**	**P20**
1 ft*	alpha-BHC	<5.0	<2.0	<1	<1	<1	<1	<1	<2.0	<4	<1	<1	<1	<1
	beta-BHC	<5.0	<2.0	<1	<1	<1	<1	<1	<2.0	<4	<1	<1	<1	<1
	delta-BHC	<5.0	<2.0	1.7	<1	<1	<1	<1	**3.4**	<4	1.7	2.8	3.3	3.3
	gamma-BHC	<5.0	<2.0	<1	<1	<1	<1	<1	<2.0	<4	<1	<1	<1	<1
	DDD	**110**	31	9.5	<6	<6	<6	<6	53	42	8.7	44	13	19
	DDE	**320**	130	33	3.4	16	<2	<2	170	160	9.4	290	34	90
	DDT	150	52	40	<6	14	<6	<6	90	89	17	**200**	42	64
	Dieldrin	**35**	12	7.6	<2	<2	<2	<2	25	11	5.6	28	8.2	10
	Endosulfan II	<10	5.6	<2	<2	<2	<2	<2	<4.0	<8	5.6	4.8	3.9	**6**
	Endrin	<10	**14**	3.5	<2	<2	<2	<2	5.8	4.1	5.5	8.5	4.4	8.6
	Toxaphene	**2000**	1800	550	<80	<80	<80	<80	1500	1700	470	660	280	520
	Cadmium	430						450	370	**480**				
3 ft*	alpha-BHC	<1	<1	<1	<1	<1	<1	<1	<2.0	<1	<4	<1	<1	<1
	beta-BHC	<1	<1	<1	<1	<1	<1	<1	<2.0	<1	<4	<1	<1	<1
	delta-BHC	<1	<1	<1	<1	<1	<1	<1	2.2	<1	6.2	<1	<1	<1
	gamma-BHC	<1	<1	<1	<1	<1	<1	<1	<2.0	<1	<4	<1	<1	<1
	DDD	<6	<6	<6	<6	<6	<6	<6	31	<6	78	<6	<6	<6
	DDE	<2	<2	<2	<2	<2	<2	11	99	<2	160	<2	6.3	6
	DDT	<6	<6	<6	<6	<6	<6	8.8	53	<6	150	<6	9.5	<6
	Dieldrin	<2	<2	<2	<2	<2	<2	<2	14	<2	17	<2	<2	<2
	Endosulfan II	<2	<2	<2	<2	<2	<2	<2	<4.0	<2	<8	<2	<2	<2
	Endrin	<2	<2	<2	<2	<2	<2	<2	<4.0	<2	27	<2	<2	<2
	Toxaphene	<80	<80	<80	<80	<80	<80	<80	810	<80	1900	<80	<80	<80
	Cadmium	310						300	390	340				
5 ft**	alpha-BHC	<1	< 1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	beta-BHC	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	delta-BHC	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	gamma-BHC	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDD	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
	DDE	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	6.7
	DDT	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
	Dieldrin	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Endosulfan II	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Endrin	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Toxaphene	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80	<80
	Cadmium	240						270	200	<200				
10 ft***	alpha-BHC				<1	<1	<1	<1				<1	<1	
	beta-BHC				<1	<1	<1	<1				<1	<1	
	delta-BHC				<1	<1	<1	<1				<1	<1	
	gamma-BHC				<1	<1	<1	<1				<1	<1	
	DDD				<6	<6	<6	<6				<6	<6	
	DDE				<2	<2	<2	<2				<2	<2	
	DDT				<6	<6	<6	<6				<6	<6	
	Dieldrin				<2	<2	<2	<2				<2	<2	
	Endosulfan II				<2	<2	<2	<2				<2	<2	
	Endrin				<2	<2	<2	<2				<2	<2	
	Toxaphene				<80	<80	<80	<80				<80	<80	
	Cadmium													

[1] Those sample sites within the proposed boundaries or within 100 feet of the proposed wetland boundaries were considered to represent the wetland.

Table 2. Maximum and geometric mean concentrations (µg/kg) of pesticides in the upper 1-ft (0.3-m) soil samples.

	Entire Site		Outside Wetland		Created Wetland	
Compound	Maximum	Geometric Mean	Maximum	Geometric Mean	Maximum	Geometric Mean
delta-BHC	3.4	1.42	2.5	0.83	3.4	2.66
DDD	110	13.61	110	8.26	53	24.39
DDE	320	30.14	320	13.33	290	78.10
DDT	200	28.62	150	14.23	200	64.68
Dieldrin	35	5.93	35	39.68	28	12.34
Endosulfan II	6	2.49	5.6	3.17	6	4.14
Endrin	14	3.46	14	1.61	8.6	5.90
Toxaphene	2000	331.50	2000	2.19	1700	697.52

Table 3. Estimated water concentrations (mg/mL) based on the geometric mean concentrations in the upper 1 ft (0.3 m) of soil using the Army Corp of Engineers' RECOVERY model.

Compound	Calculated water concentration
DDD	0.0000015
DDE	0.0002700
DDT	0.0000018
delta-BHC	0.0000019
Dieldrin	0.0000450
Endosulfan II	0.0000260
Endrin	0.0003500
Toxaphene	0.0017000

Table 4. Aquatic ecological hazard quotients (EHQs) based on estimated tissue concentrations accumulated from exposure to contaminated sediment, water and food resources.

CASID	Chemical Name	Tissue Conc.	Units	TRV[1]	EHQ[2]
Rainbow Trout (Steelhead)					
72548	DDD	0.046	mg/kg	5.000	0.009
72559	DDE	0.278	mg/kg	0.012	**23.167**
50293	DDT	0.027	mg/kg	1.160	0.023
319868	Delta-BHC	0.004	mg/kg	0.300	0.013
60571	Dieldrin	0.042	mg/kg	0.110	0.383
115297B	Endosulfan II (Beta)	0.007	mg/kg	0.008	0.933
72208	Endrin	0.009	mg/kg	0.220	0.041
8001352	Toxaphene	0.884	mg/kg	0.400	**2.210**
Bluegill Sunfish					
72548	DDD	0.027	mg/kg	0.060	0.450
72559	DDE	0.186	mg/kg	150.000	0.001
50293	DDT	0.120	mg/kg	0.420	0.286
319868	Delta-BHC	0.002	mg/kg	0.300	0.007
60571	Dieldrin	0.025	mg/kg	0.370	0.068
115297B	Endosulfan II (Beta)	0.004	mg/kg	0.195	0.021
72208	Endrin	0.005	mg/kg	0.080	0.063
8001352	Toxaphene	0.531	mg/kg	0.250	**2.124**
White Sucker					
72548	DDD	0.197	mg/kg	0.060	**3.283**
72559	DDE	2.399	mg/kg	6.700	0.358
50293	DDT	0.200	mg/kg	4.200	0.048
319868	Delta-BHC	0.015	mg/kg	0.300	0.050
60571	Dieldrin	0.087	mg/kg	0.380	0.229
115297B	Endosulfan II (Beta)	0.037	mg/kg	0.195	0.190
72208	Endrin	0.043	mg/kg	0.670	0.064
8001352	Toxaphene	4.418	mg/kg	0.250	**17.672**
Red Swamp Crayfish					
72548	DDD	0.108	mg/kg	0.110	0.981
72559	DDE	1.151	mg/kg	0.200	**5.755**
50293	DDT	0.191	mg/kg	0.047	**4.092**
319868	Delta-BHC	0.008	mg/kg	0.310	0.025
60571	Dieldrin	0.254	mg/kg	0.100	**2.538**
115297B	Endosulfan II (Beta)	0.030	mg/kg	0.007	**4.196**
72208	Endrin	0.018	mg/kg	0.001	**25.092**
8001352	Toxaphene	1.409	mg/kg	0.800	**1.762**

Table 4 (continued)

CASID	Chemical Name	Tissue Conc.	Units	TRV[1]	EHQ[2]
Bullfrog					
72548	DDD	1.365	mg/kg	0.403	**3.387**
72559	DDE	9.295	mg/kg	0.173	**53.728**
50293	DDT	5.976	mg/kg	0.001	**4819.355**
319868	Delta-BHC	0.115	mg/kg	2.640	0.044
60571	Dieldrin	1.250	mg/kg	0.110	**11.364**
115297B	Endosulfan II (Beta)	0.224	mg/kg	0.210	**1.067**
72208	Endrin	0.256	mg/kg	0.060	**4.267**
8001352	Toxaphene	26.533	mg/kg	14.000	**1.895**
Pacific Treefrog					
72548	DDD	1.682	mg/kg	0.403	**4.173**
72559	DDE	9.295	mg/kg	0.173	**53.727**
50293	DDT	3.149	mg/kg	0.001	**2539.488**
319868	Delta-BHC	0.092	mg/kg	2.640	0.035
60571	Dieldrin	1.184	mg/kg	0.110	**10.765**
115297B	Endosulfan II (Beta)	0.224	mg/kg	0.210	**1.068**
72208	Endrin	0.256	mg/kg	0.060	**4.262**
8001352	Toxaphene	26.533	mg/kg	14.000	**1.895**

[1] TRV = toxic reference value which is the body burden, which if exceeded, could produce adverse effects.
[2] EHQ = ecological hazard quotient (calculated as tissue concentration/TRV). Potential risk is indicated when the EHQ exceeds 1.

Table 5. Aquatic ecological hazard quotients (EHQs) based on estimated water concentrations.

CASID	Chemical Name	Water concentration (mg/L)	Acute Limit (mg/L)	Acute EHQ[1]	Chronic Limit (mg/L)	Chronic EHQ[1]
Rainbow Trout (Steelhead)						
72548	DDD	0.0000015	0.007000	0.000214	0.000700	0.0021429
72559	DDE	0.00027	0.003200	0.084375	0.000320	0.8437500
50293	DDT	0.0000017	0.000150	0.011333	0.000015	0.1133333
319868	Delta-BHC	0.0000019	0.040000	0.000048	0.004000	0.0004750
60571	Dieldrin	0.000045	0.000120	0.375000	0.000550	0.0818182
115297B	Endosulfan II (Beta)	0.000026	0.000030	0.866667	0.000001	**26.0000000**
72208	Endrin	0.00035	0.000033	**10.606061**	0.000003	**106.0606061**
8001352	Toxaphene	0.0017	0.000180	**9.444444**	0.000018	**94.4444444**
Bluegill Sunfish						
72548	DDD	0.0000015	0.004200	0.000357	0.000420	0.0035714
72559	DDE	0.00027	0.024000	0.011250	0.002400	0.1125000
50293	DDT	0.0000017	0.000120	0.014167	0.000012	0.1416667
319868	Delta-BHC	0.0000019	5.000000	0.000000	0.050000	0.0000380
60571	Dieldrin	0.000045	0.000280	0.160714	0.000028	**1.6071429**
115297B	Endosulfan II (Beta)	0.000026	0.001200	0.021667	0.000120	0.2166667
72208	Endrin	0.00035	0.000019	**18.421053**	0.000002	**184.2105263**
8001352	Toxaphene	0.0017	0.000240	**7.083333**	0.000024	**70.8333333**
White Sucker						
72548	DDD	0.0000015	0.440000	0.000003	0.044000	0.0000341
72559	DDE	0.00027	0.024000	0.011250	0.002400	0.1125000
50293	DDT	0.0000017	0.000740	0.002297	0.000074	0.0229730
319868	Delta-BHC	0.0000019	0.283000	0.000007	0.028300	0.0000671
60571	Dieldrin	0.000045	0.000380	0.118421	0.000038	**1.1842105**
115297B	Endosulfan II (Beta)	0.000026	0.000250	0.104000	0.000025	**1.0400000**
72208	Endrin	0.00035	0.000024	**14.583333**	0.000140	**2.5000000**
8001352	Toxaphene	0.0017	0.070000	0.024286	0.007000	0.2428571
Red Swamp Crayfish						
72548	DDD	0.0000015	0.000070	0.021429	0.000007	0.2142857
72559	DDE	0.00027	0.000166	**1.626506**	0.000017	**16.2650602**
50293	DDT	0.0000017	0.060000	0.000028	0.006000	0.0002833
319868	Delta-BHC	0.0000019	0.015000	0.000127	0.001500	0.0012667
60571	Dieldrin	0.000045	0.074000	0.000608	0.007400	0.0060811
115297B	Endosulfan II (Beta)	0.000026	0.002400	0.010833	0.000240	0.1083333
72208	Endrin	0.00035	0.030000	0.011667	0.003000	0.1166667
8001352	Toxaphene	0.0017	0.021000	0.080952	0.002100	0.8095238

Table 5 (continued)

CASID	Chemical Name	Water concentration (mg/L)	Acute Limit (mg/L)	Acute EHQ[1]	Chronic Limit (mg/L)	Chronic EHQ[1]
Bullfrog						
72548	DDD	0.0000015	0.040000	0.000038	0.004000	0.0003750
72559	DDE	0.00027	0.000100	**2.700000**	0.000010	**27.0000000**
50293	DDT	0.0000017	0.005000	0.000340	0.000500	0.0034000
319868	Delta-BHC	0.0000019	0.727000	0.000003	0.072700	0.0000261
60571	Dieldrin	0.000045	0.008700	0.005172	0.011000	0.0040909
115297B	Endosulfan II (Beta)	0.000026	0.000100	0.260000	0.000010	2.6000000
72208	Endrin	0.00035	0.000250	**1.400000**	0.000025	**14.0000000**
8001352	Toxaphene	0.0017	0.009900	0.171717	0.000990	**1.7171717**
Pacific Treefrog						
72548	DDD	0.0000015	0.040000	0.000038	0.004000	0.0003750
72559	DDE	0.00027	0.000100	**2.700000**	0.000010	**27.0000000**
50293	DDT	0.0000017	0.080000	0.000021	0.008000	0.0002125
319868	Delta-BHC	0.0000019	0.727000	0.000003	0.072700	0.0000261
60571	Dieldrin	0.000045	0.010000	0.004500	0.001000	0.0450000
115297B	Endosulfan II (Beta)	0.000026	0.068000	0.000382	0.006800	0.0038235
72208	Endrin	0.00035	0.018000	0.019444	0.001800	0.1944444
8001352	Toxaphene	0.0017	0.010000	0.170000	0.001000	**1.7000000**

[1] EHQ = ecological hazard quotient (calculated as tissue concentration/TRV). Potential risk is indicated when the EHQ exceeds 1.

Table 6. Exposure estimates of terrestrial species to pesticides from soil, sediment, water, air, and food sources reported as mg pesticide/kg body weight/day.

	CASID	Chemical Name	**Food**	**Water**	**Soil/Sed.**	**Air**	**Total**
Great Blue Heron							
	72548	DDD	0.000000	0.000000	0.000000	0.000000	0.000000
	72559	DDE	0.000000	0.000000	0.000000	0.000000	0.000000
	50293	DDT	0.000000	0.000000	0.000000	0.000000	0.000000
	319868	Delta-BHC	0.000000	0.000000	0.000000	0.000000	0.000000
	60571	Dieldrin	0.000045	0.000000	0.000000	0.000000	0.000045
	115297B	Endosulfan II (Beta)	0.000001	0.000000	0.000000	0.000000	0.000001
	72208	Endrin	0.000497	0.000000	0.000000	0.000000	0.000497
	8001352	Toxaphene	0.000043	0.000000	0.000000	0.000000	0.000043
Mallard Duck							
	72548	DDD	0.000033	0.000000	0.000001	0.000000	0.000034
	72559	DDE	0.000102	0.000000	0.000005	0.000000	0.000108
	50293	DDT	0.000085	0.000000	0.000004	0.000000	0.000089
	319868	Delta-BHC	0.000005	0.000000	0.000000	0.000000	0.000005
	60571	Dieldrin	0.000018	0.000000	0.000001	0.000000	0.000019
	115297B	Endosulfan II (Beta)	0.000010	0.000000	0.000000	0.000000	0.000010
	72208	Endrin	0.000008	0.000001	0.000000	0.000000	0.000009
	8001352	Toxaphene	0.001976	0.000003	0.000042	0.000000	0.002021
Red-Tailed Hawk							
	72548	DDD	0.002958	0.000000	0.000000	0.000000	0.002958
	72559	DDE	0.019010	0.000000	0.000000	0.000000	0.019010
	50293	DDT	0.001163	0.000000	0.000000	0.000000	0.001163
	319868	Delta-BHC	0.000007	0.000000	0.000000	0.000000	0.000007
	60571	Dieldrin	0.001477	0.000000	0.000000	0.000000	0.001477
	115297B	Endosulfan II (Beta)	0.000012	0.000000	0.000000	0.000000	0.000012
	72208	Endrin	0.000016	0.000000	0.000000	0.000000	0.000016
	8001352	Toxaphene	0.001560	0.000000	0.000000	0.000000	0.001560
Cooper's Hawk							
	72548	DDD	0.000190	0.000000	0.000000	0.000000	0.000190
	72559	DDE	0.001131	0.000000	0.000000	0.000000	0.001131
	50293	DDT	0.000110	0.000000	0.000000	0.000000	0.000110
	319868	Delta-BHC	0.000003	0.000000	0.000000	0.000000	0.000003
	60571	Dieldrin	0.000093	0.000000	0.000000	0.000000	0.000093
	115297B	Endosulfan II (Beta)	0.000004	0.000000	0.000000	0.000000	0.000005
	72208	Endrin	0.000006	0.000000	0.000000	0.000000	0.000007
	8001352	Toxaphene	0.000594	0.000001	0.000000	0.000000	0.000595

Table 6. Continued

	CASID	Chemical Name	**Food**	**Water**	**Soil/Sed.**	**Air**	**Total**
American Kestrel							
	72548	DDD	0.000007	0.000000	0.000000	0.000000	0.000007
	72559	DDE	0.000014	0.000000	0.000000	0.000000	0.000015
	50293	DDT	0.000014	0.000000	0.000000	0.000000	0.000014
	319868	Delta-BHC	0.000001	0.000000	0.000000	0.000000	0.000001
	60571	Dieldrin	0.000003	0.000000	0.000000	0.000000	0.000003
	115297B	Endosulfan II (Beta)	0.000001	0.000000	0.000000	0.000000	0.000001
	72208	Endrin	0.000002	0.000000	0.000000	0.000000	0.000002
	8001352	Toxaphene	0.000158	0.000001	0.000000	0.000000	0.000160
Belted Kingfisher							
	72548	DDD	0.000000	0.000000	0.000000	0.000000	0.000000
	72559	DDE	0.000000	0.000000	0.000000	0.000000	0.000000
	50293	DDT	0.000000	0.000000	0.000000	0.000000	0.000000
	319868	Delta-BHC	0.000000	0.000000	0.000000	0.000000	0.000000
	60571	Dieldrin	0.000081	0.000000	0.000000	0.000000	0.000081
	115297B	Endosulfan II (Beta)	0.000002	0.000000	0.000000	0.000000	0.000002
	72208	Endrin	0.000891	0.000000	0.000000	0.000000	0.000891
	8001352	Toxaphene	0.000077	0.000000	0.000000	0.000000	0.000078
Cliff Swallow							
	72548	DDD	0.000001	0.000000	0.000000	0.000000	0.000001
	72559	DDE	0.000002	0.000000	0.000000	0.000000	0.000002
	50293	DDT	0.000002	0.000000	0.000000	0.000000	0.000002
	319868	Delta-BHC	0.000000	0.000000	0.000000	0.000000	0.000000
	60571	Dieldrin	0.000000	0.000000	0.000000	0.000000	0.000000
	115297B	Endosulfan II (Beta)	0.000000	0.000000	0.000000	0.000000	0.000000
	72208	Endrin	0.000000	0.000000	0.000000	0.000000	0.000000
	8001352	Toxaphene	0.000020	0.000000	0.000000	0.000000	0.000020
Red-Winged Blackbird (85% Benthic Inverts)							
	72548	DDD	0.004297	0.000000	0.000253	0.000000	0.004550
	72559	DDE	0.013634	0.000076	0.000560	0.000000	0.014270
	50293	DDT	0.011309	0.000000	0.000532	0.000000	0.011842
	319868	Delta-BHC	0.000561	0.000001	0.000026	0.000000	0.000588
	60571	Dieldrin	0.002242	0.000013	0.000110	0.000000	0.002365
	115297B	Endosulfan II (Beta)	0.000949	0.000007	0.000046	0.000000	0.001003
	72208	Endrin	0.001060	0.000098	0.000065	0.000000	0.001223
	8001352	Toxaphene	0.176569	0.000476	0.006157	0.000000	0.183202

Table 6. Continued

	CASID	Chemical Name	**Food**	**Water**	**Soil/Sed.**	**Air**	**Total**
Red-Winged Blackbird (50% Benthic Inverts)							
	72548	DDD	0.002936	0.000000	0.000253	0.000000	0.003190
	72559	DDE	0.009001	0.000076	0.000560	0.000000	0.009636
	50293	DDT	0.007504	0.000000	0.000532	0.000000	0.008036
	319868	Delta-BHC	0.000611	0.000001	0.000026	0.000000	0.000638
	60571	Dieldrin	0.001734	0.000013	0.000110	0.000000	0.001857
	115297B	Endosulfan II (Beta)	0.001252	0.000007	0.000046	0.000000	0.001305
	72208	Endrin	0.000781	0.000098	0.000065	0.000000	0.000944
	8001352	Toxaphene	0.262831	0.000476	0.006157	0.000000	0.269464
Red-Winged Blackbird (2% Benthic Inverts)							
	72548	DDD	0.001070	0.000000	0.000253	0.000000	0.001324
	72559	DDE	0.002647	0.000076	0.000560	0.000000	0.003282
	50293	DDT	0.002285	0.000000	0.000532	0.000000	0.002817
	319868	Delta-BHC	0.000679	0.000001	0.000026	0.000000	0.000706
	60571	Dieldrin	0.001038	0.000013	0.000110	0.000000	0.001160
	115297B	Endosulfan II (Beta)	0.001666	0.000007	0.000046	0.000000	0.001720
	72208	Endrin	0.000397	0.000098	0.000065	0.000000	0.000560
	8001352	Toxaphene	0.381133	0.000476	0.006157	0.000000	0.387766
Coyote							
	72548	DDD	0.000013	0.000000	0.000000	0.000000	0.000013
	72559	DDE	0.000086	0.000000	0.000000	0.000000	0.000086
	50293	DDT	0.000005	0.000000	0.000000	0.000000	0.000005
	319868	Delta-BHC	0.000000	0.000000	0.000000	0.000000	0.000000
	60571	Dieldrin	0.000007	0.000000	0.000000	0.000000	0.000007
	115297B	Endosulfan II (Beta)	0.000000	0.000000	0.000000	0.000000	0.000000
	72208	Endrin	0.000000	0.000000	0.000000	0.000000	0.000000
	8001352	Toxaphene	0.000008	0.000000	0.000000	0.000000	0.000008
Mule Deer							
	72548	DDD	0.000008	0.000000	0.000001	0.000000	0.000009
	72559	DDE	0.000015	0.000002	0.000002	0.000000	0.000018
	50293	DDT	0.000014	0.000000	0.000002	0.000000	0.000016
	319868	Delta-BHC	0.000004	0.000000	0.000000	0.000000	0.000005
	60571	Dieldrin	0.000006	0.000000	0.000000	0.000000	0.000007
	115297B	Endosulfan II (Beta)	0.000013	0.000000	0.000000	0.000000	0.000013
	72208	Endrin	0.000003	0.000003	0.000000	0.000000	0.000006
	8001352	Toxaphene	0.002297	0.000014	0.000018	0.000000	0.002329
Prairie Vole							
	72548	DDD	0.000448	0.000001	0.000046	0.000000	0.000494
	72559	DDE	0.000814	0.000100	0.000101	0.000000	0.001015
	50293	DDT	0.000783	0.000001	0.000096	0.000000	0.000880
	319868	Delta-BHC	0.000248	0.000001	0.000005	0.000000	0.000253
	60571	Dieldrin	0.000339	0.000017	0.000020	0.000000	0.000375
	115297B	Endosulfan II (Beta)	0.000718	0.000010	0.000008	0.000000	0.000736
	72208	Endrin	0.000158	0.000129	0.000012	0.000000	0.000300
	8001352	Toxaphene	0.128153	0.000629	0.001112	0.000000	0.129894

Table 6. Continued

	CASID	Chemical Name	**Food**	**Water**	**Soil/Sed.**	**Air**	**Total**
Black-tailed Jackrabbit							
	72548	DDD	0.000044	0.000000	0.000012	0.000000	0.000056
	72559	DDE	0.000080	0.000000	0.000026	0.000000	0.000107
	50293	DDT	0.000077	0.000000	0.000025	0.000000	0.000102
	319868	Delta-BHC	0.000024	0.000000	0.000001	0.000000	0.000026
	60571	Dieldrin	0.000033	0.000000	0.000005	0.000000	0.000039
	115297B	Endosulfan II (Beta)	0.000071	0.000000	0.000002	0.000000	0.000073
	72208	Endrin	0.000016	0.000000	0.000003	0.000000	0.000019
	8001352	Toxaphene	0.012650	0.000000	0.000288	0.000000	0.012939
Muskrat							
	72548	DDD	0.000253	0.000000	0.000117	0.000000	0.000370
	72559	DDE	0.000607	0.000027	0.000374	0.000000	0.001008
	50293	DDT	0.000527	0.000000	0.000310	0.000000	0.000838
	319868	Delta-BHC	0.000174	0.000000	0.000013	0.000000	0.000187
	60571	Dieldrin	0.000257	0.000004	0.000059	0.000000	0.000321
	115297B	Endosulfan II (Beta)	0.000429	0.000003	0.000020	0.000000	0.000451
	72208	Endrin	0.000097	0.000035	0.000028	0.000000	0.000160
	8001352	Toxaphene	0.098446	0.000168	0.003346	0.000000	0.101960
Raccoon							
	72548	DDD	0.000008	0.000000	0.000003	0.000000	0.000012
	72559	DDE	0.000015	0.000001	0.000007	0.000000	0.000023
	50293	DDT	0.000014	0.000000	0.000007	0.000000	0.000021
	319868	Delta-BHC	0.000005	0.000000	0.000000	0.000000	0.000005
	60571	Dieldrin	0.000006	0.000000	0.000001	0.000000	0.000008
	115297B	Endosulfan II (Beta)	0.000013	0.000000	0.000001	0.000000	0.000014
	72208	Endrin	0.000003	0.000001	0.000001	0.000000	0.000005
	8001352	Toxaphene	0.002358	0.000007	0.000080	0.000000	0.002445
Painted Turtle							
	72548	DDD	0.000039	0.000000	0.000011	0.000000	0.000051
	72559	DDE	0.000095	0.000007	0.000037	0.000000	0.000138
	50293	DDT	0.000082	0.000000	0.000030	0.000000	0.000113
	319868	Delta-BHC	0.000027	0.000000	0.000001	0.000000	0.000028
	60571	Dieldrin	0.000040	0.000001	0.000006	0.000000	0.000047
	115297B	Endosulfan II (Beta)	0.000067	0.000001	0.000002	0.000000	0.000069
	72208	Endrin	0.000015	0.000009	0.000003	0.000000	0.000027
	8001352	Toxaphene	0.015344	0.000042	0.000327	0.000000	0.015714

Table 7. Ecological Hazard Quotients (EHQs) determined for terrestrial species based primarily on estimated oral ingestion from soil, sediments, water, and food resources.

CASID	Chemical Name	Total Pesticide Ingested	Units	TRV	EHQ
Great Blue Heron					
72548	DDD	0.000000	mg/kg/d	0.002800	0.000000
72559	DDE	0.000000	mg/kg/d	0.002800	0.000026
50293	DDT	0.000000	mg/kg/d	0.002800	0.000000
319868	Delta-BHC	0.000000	mg/kg/d	0.560000	0.000000
60571	Dieldrin	0.000045	mg/kg/d	0.077000	0.000584
115297B	Endosulfan II (Beta)	0.000001	mg/kg/d	10.000000	0.000000
72208	Endrin	0.000497	mg/kg/d	0.010000	0.049658
8001352	Toxaphene	0.000043	mg/kg/d	2.000000	0.000022
Mallard Duck					
72548	DDD	0.000034	mg/kg/d	0.002800	0.012213
72559	DDE	0.000108	mg/kg/d	0.002800	0.038440
50293	DDT	0.000089	mg/kg/d	0.002800	0.031797
319868	Delta-BHC	0.000005	mg/kg/d	0.560000	0.000010
60571	Dieldrin	0.000019	mg/kg/d	0.077000	0.000244
115297B	Endosulfan II (Beta)	0.000010	mg/kg/d	10.000000	0.000001
72208	Endrin	0.000009	mg/kg/d	0.010000	0.000932
8001352	Toxaphene	0.002021	mg/kg/d	2.000000	0.001010
Red-Tailed Hawk					
72548	DDD	0.002958	mg/kg/d	0.002800	**1.056272**
72559	DDE	0.019010	mg/kg/d	0.002800	**6.789252**
50293	DDT	0.001163	mg/kg/d	0.002800	0.415317
319868	Delta-BHC	0.000007	mg/kg/d	0.560000	0.000012
60571	Dieldrin	0.001477	mg/kg/d	0.077000	0.019180
115297B	Endosulfan II (Beta)	0.000012	mg/kg/d	10.000000	0.000001
72208	Endrin	0.000016	mg/kg/d	0.010000	0.001650
8001352	Toxaphene	0.001560	mg/kg/d	2.000000	0.000780
Cooper's Hawk					
72548	DDD	0.000190	mg/kg/d	0.002800	0.067704
72559	DDE	0.001131	mg/kg/d	0.002800	0.404036
50293	DDT	0.000110	mg/kg/d	0.002800	0.039283
319868	Delta-BHC	0.000003	mg/kg/d	0.560000	0.000004
60571	Dieldrin	0.000093	mg/kg/d	0.077000	0.001212
115297B	Endosulfan II (Beta)	0.000005	mg/kg/d	10.000000	0.000000
72208	Endrin	0.000007	mg/kg/d	0.010000	0.000657
8001352	Toxaphene	0.000595	mg/kg/d	2.000000	0.000298

Table 7. Continued

CASID	Chemical Name	Total Pesticide Ingested	Units	TRV	EHQ
American Kestrel					
72548	DDD	0.000007	mg/kg/d	0.002800	0.002326
72559	DDE	0.000015	mg/kg/d	0.002800	0.005212
50293	DDT	0.000014	mg/kg/d	0.002800	0.004890
319868	Delta-BHC	0.000001	mg/kg/d	0.560000	0.000001
60571	Dieldrin	0.000003	mg/kg/d	0.077000	0.000037
115297B	Endosulfan II (Beta)	0.000001	mg/kg/d	10.000000	0.000000
72208	Endrin	0.000002	mg/kg/d	0.010000	0.000191
8001352	Toxaphene	0.000160	mg/kg/d	2.000000	0.000080
Belted Kingfisher					
72548	DDD	0.000000	mg/kg/d	0.002800	0.000000
72559	DDE	0.000000	mg/kg/d	0.002800	0.000029
50293	DDT	0.000000	mg/kg/d	0.002800	0.000000
319868	Delta-BHC	0.000000	mg/kg/d	0.560000	0.000001
60571	Dieldrin	0.000081	mg/kg/d	0.077000	0.001048
115297B	Endosulfan II (Beta)	0.000002	mg/kg/d	10.000000	0.000000
72208	Endrin	0.000891	mg/kg/d	0.010000	0.089056
8001352	Toxaphene	0.000078	mg/kg/d	2.000000	0.000039
Cliff Swallow					
72548	DDD	0.000001	mg/kg/d	0.002800	0.000294
72559	DDE	0.000002	mg/kg/d	0.002800	0.000657
50293	DDT	0.000002	mg/kg/d	0.002800	0.000619
319868	Delta-BHC	0.000000	mg/kg/d	0.560000	0.000000
60571	Dieldrin	0.000000	mg/kg/d	0.077000	0.000005
115297B	Endosulfan II (Beta)	0.000000	mg/kg/d	10.000000	0.000000
72208	Endrin	0.000000	mg/kg/d	0.010000	0.000023
8001352	Toxaphene	0.000020	mg/kg/d	2.000000	0.000010
Red-Winged Blackbird (85% Benthic Inverts)					
72548	DDD	0.004550	mg/kg/d	0.002800	**1.625099**
72559	DDE	0.014270	mg/kg/d	0.002800	**5.096347**
50293	DDT	0.011842	mg/kg/d	0.002800	**4.229135**
319868	Delta-BHC	0.000588	mg/kg/d	0.560000	0.001050
60571	Dieldrin	0.002365	mg/kg/d	0.077000	0.030709
115297B	Endosulfan II (Beta)	0.001003	mg/kg/d	10.000000	0.000100
72208	Endrin	0.001223	mg/kg/d	0.010000	0.122326
8001352	Toxaphene	0.183202	mg/kg/d	2.000000	0.091601

Table 7. Continued

CASID	Chemical Name	Total Pesticide Ingested	Units	TRV	EHQ
Red-Winged Blackbird (50% Benthic Inverts)					
72548	DDD	0.003190	mg/kg/d	0.002800	**1.139181**
72559	DDE	0.009636	mg/kg/d	0.002800	**3.441607**
50293	DDT	0.008036	mg/kg/d	0.002800	**2.870075**
319868	Delta-BHC	0.000638	mg/kg/d	0.560000	0.001139
60571	Dieldrin	0.001857	mg/kg/d	0.077000	0.024112
115297B	Endosulfan II (Beta)	0.001305	mg/kg/d	10.000000	0.000131
72208	Endrin	0.000944	mg/kg/d	0.010000	0.094364
8001352	Toxaphene	0.269464	mg/kg/d	2.000000	0.134732
Red-Winged Blackbird (2% Benthic Inverts)					
72548	DDD	0.001324	mg/kg/d	0.002800	0.472779
72559	DDE	0.003282	mg/kg/d	0.002800	**1.172249**
50293	DDT	0.002817	mg/kg/d	0.002800	**1.006222**
319868	Delta-BHC	0.000706	mg/kg/d	0.560000	0.001260
60571	Dieldrin	0.001160	mg/kg/d	0.077000	0.015065
115297B	Endosulfan II (Beta)	0.001720	mg/kg/d	10.000000	0.000172
72208	Endrin	0.000560	mg/kg/d	0.010000	0.056015
8001352	Toxaphene	0.387766	mg/kg/d	2.000000	0.193883
Coyote					
72548	DDD	0.000013	mg/kg/d	0.080000	0.000168
72559	DDE	0.000086	mg/kg/d	0.080000	0.001077
50293	DDT	0.000005	mg/kg/d	0.080000	0.000066
319868	Delta-BHC	0.000000	mg/kg/d	0.400000	0.000000
60571	Dieldrin	0.000007	mg/kg/d	0.002000	0.003350
115297B	Endosulfan II (Beta)	0.000000	mg/kg/d	0.150000	0.000000
72208	Endrin	0.000000	mg/kg/d	0.092000	0.000001
8001352	Toxaphene	0.000008	mg/kg/d	8.000000	0.000001
Mule Deer					
72548	DDD	0.000009	mg/kg/d	0.080000	0.000110
72559	DDE	0.000018	mg/kg/d	0.080000	0.000231
50293	DDT	0.000016	mg/kg/d	0.080000	0.000195
319868	Delta-BHC	0.000005	mg/kg/d	0.400000	0.000011
60571	Dieldrin	0.000007	mg/kg/d	0.002000	0.003381
115297B	Endosulfan II (Beta)	0.000013	mg/kg/d	0.150000	0.000088
72208	Endrin	0.000006	mg/kg/d	0.092000	0.000064
8001352	Toxaphene	0.002329	mg/kg/d	8.000000	0.000291

Table 7. Continued

CASID	Chemical Name	Total Pesticide Ingested	Units	TRV	EHQ
Prairie Vole					
72548	DDD	0.000494	mg/kg/d	0.080000	0.006173
72559	DDE	0.001015	mg/kg/d	0.080000	0.012685
50293	DDT	0.000880	mg/kg/d	0.080000	0.010998
319868	Delta-BHC	0.000253	mg/kg/d	0.400000	0.000632
60571	Dieldrin	0.000375	mg/kg/d	0.002000	0.187567
115297B	Endosulfan II (Beta)	0.000736	mg/kg/d	0.150000	0.004910
72208	Endrin	0.000300	mg/kg/d	0.092000	0.003255
8001352	Toxaphene	0.129894	mg/kg/d	8.000000	0.016237
Black-tailed Jackrabbit					
72548	DDD	0.000056	mg/kg/d	0.080000	0.000700
72559	DDE	0.000107	mg/kg/d	0.080000	0.001332
50293	DDT	0.000102	mg/kg/d	0.080000	0.001277
319868	Delta-BHC	0.000026	mg/kg/d	0.400000	0.000064
60571	Dieldrin	0.000039	mg/kg/d	0.002000	0.019283
115297B	Endosulfan II (Beta)	0.000073	mg/kg/d	0.150000	0.000487
72208	Endrin	0.000019	mg/kg/d	0.092000	0.000203
8001352	Toxaphene	0.012939	mg/kg/d	8.000000	0.001617
Muskrat					
72548	DDD	0.000370	mg/kg/d	0.080000	0.004628
72559	DDE	0.001008	mg/kg/d	0.080000	0.012606
50293	DDT	0.000838	mg/kg/d	0.080000	0.010470
319868	Delta-BHC	0.000187	mg/kg/d	0.400000	0.000468
60571	Dieldrin	0.000321	mg/kg/d	0.002000	0.160298
115297B	Endosulfan II (Beta)	0.000451	mg/kg/d	0.150000	0.003009
72208	Endrin	0.000160	mg/kg/d	0.092000	0.001739
8001352	Toxaphene	0.101960	mg/kg/d	8.000000	0.012745
Raccoon					
72548	DDD	0.000012	mg/kg/d	0.080000	0.000144
72559	DDE	0.000023	mg/kg/d	0.080000	0.000293
50293	DDT	0.000021	mg/kg/d	0.080000	0.000267
319868	Delta-BHC	0.000005	mg/kg/d	0.400000	0.000012
60571	Dieldrin	0.000008	mg/kg/d	0.002000	0.003925
115297B	Endosulfan II (Beta)	0.000014	mg/kg/d	0.150000	0.000093
72208	Endrin	0.000005	mg/kg/d	0.092000	0.000057
8001352	Toxaphene	0.002445	mg/kg/d	8.000000	0.000306

Table 7. Continued

CASID	Chemical Name	Total Pesticide Ingested	Units	TRV	EHQ
Painted Turtle					
72548	DDD	0.000051	mg/kg/d	0.000800	0.063667
72559	DDE	0.000138	mg/kg/d	0.000800	0.172567
50293	DDT	0.000113	mg/kg/d	0.000800	0.140701
319868	Delta-BHC	0.000028	mg/kg/d	0.004000	0.007106
60571	Dieldrin	0.000047	mg/kg/d	0.000020	**2.349020**
115297B	Endosulfan II (Beta)	0.000069	mg/kg/d	0.001500	0.046313
72208	Endrin	0.000027	mg/kg/d	0.000920	0.028981
8001352	Toxaphene	0.015714	mg/kg/d	0.080000	0.196424

Table 8. Soil/Sediment and water concentrations calculated to mitigate to less than significant impacts.

	Mitigation Soil/Sediment Concentration					Mitigation Water Concentration	
Compound	Red-winged Blackbirds	Frogs	Crayfish	Warm-water fish	Bottom-feeding fish	Crayfish	Warm-water fish
DDD	20 ppb	5.5 ppb			7 ppb		
DDE	18 ppb	1.4 ppb	12 ppb			0.166 ppb	
DDT	18 ppb	0.011 ppb	16 ppb				
Dieldrin		1.1 ppb	5 ppb				
Endosulfan		3.8 ppb	0.9 ppb				
Endrin		1.4 ppb	0.34 ppb				0.019 ppb
Toxaphene		370 ppb	390 ppb	325 ppb	40 ppb		0.24 ppb

Figure 1. Location of Carnadero Preserve within the Pajaro River Valley.

Figure 2. Carnadero Preserve with the 38-acre project field indicated.

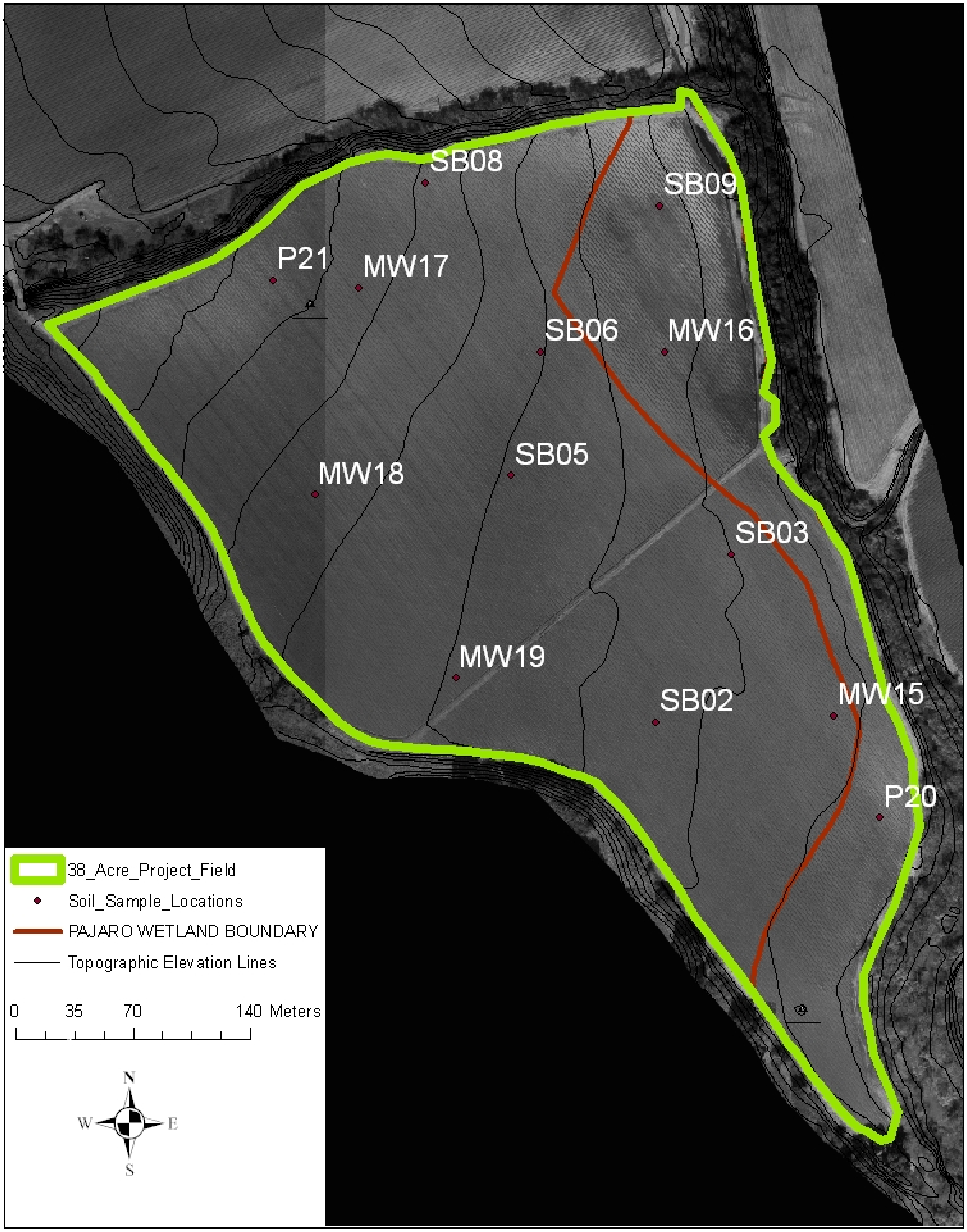

Figure 3. 38-Acre project field with the mitigation wetland and elevation lines depicted.

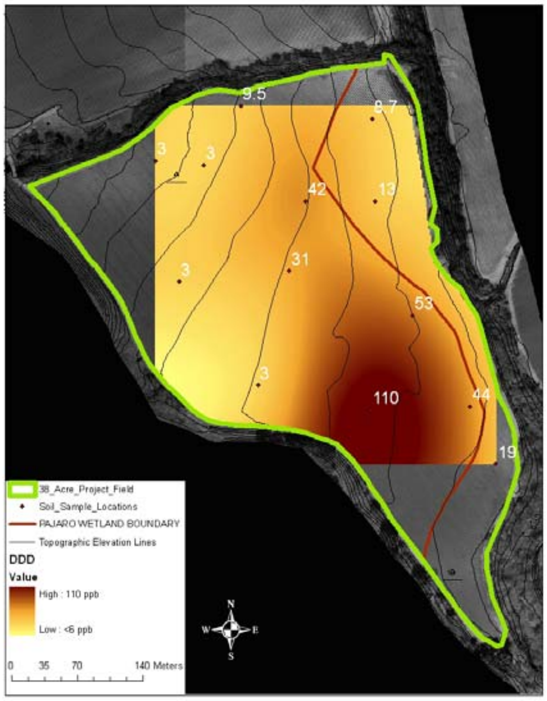

Figure 4. Distribution of DDD concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 4 displays concentrations of DDD in soil and does not in itself indicate the potential for toxicity or risk.

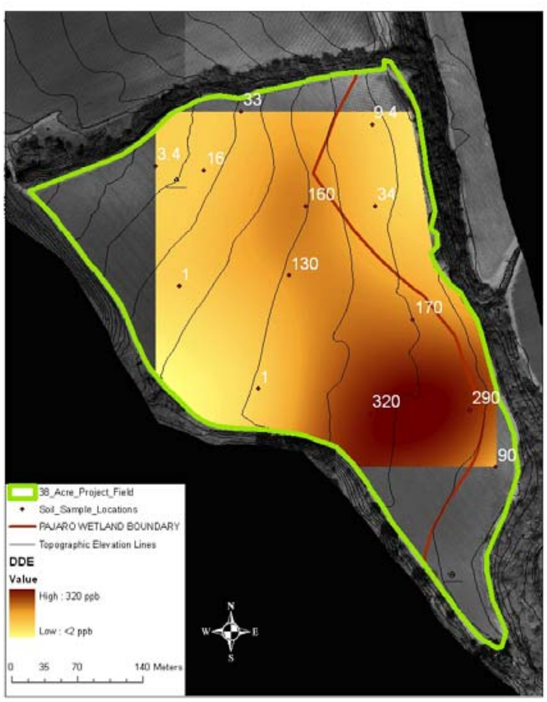

Figure 5. Distribution of DDE concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 5 displays concentrations of DDE in soil and does not in itself indicate the potential for toxicity or risk.

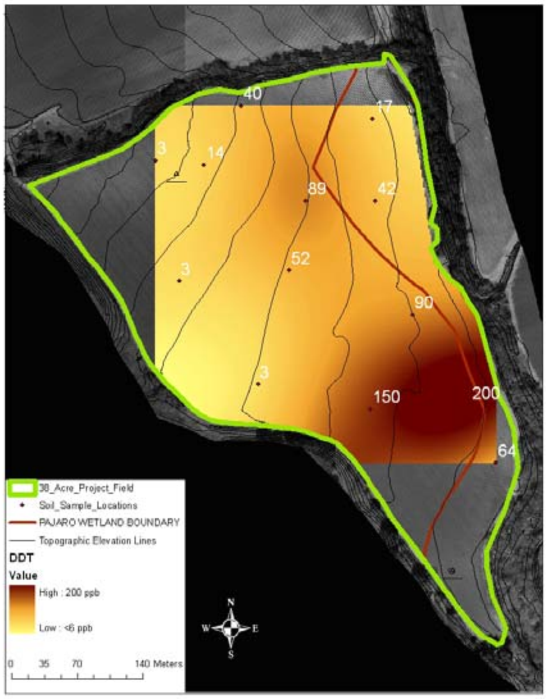

Figure 6. Distribution of DDT concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 6 displays concentrations of DDT in soil and does not in itself indicate the potential for toxicity or risk.

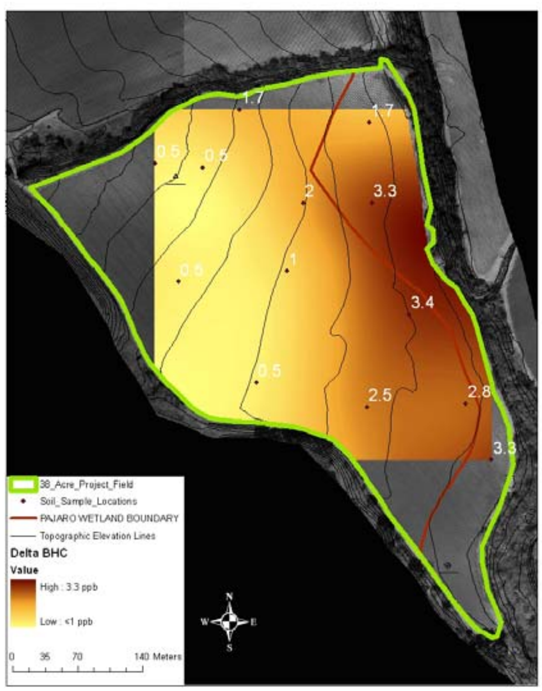

Figure 7. Distribution of Delta-BHC concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 7 displays concentrations of Delta-BHC in soil and does not in itself indicate the potential for toxicity or risk.

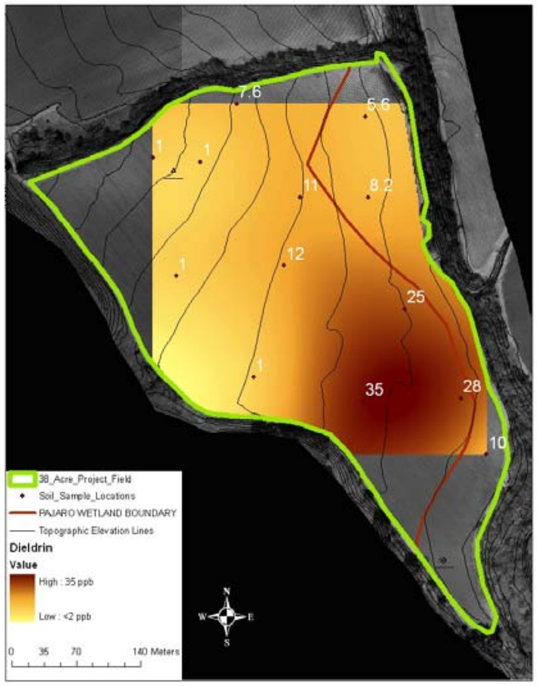

Figure 8. Distribution of Dieldrin concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 8 displays concentrations of Dieldrin in soil and does not in itself indicate the potential for toxicity or risk.

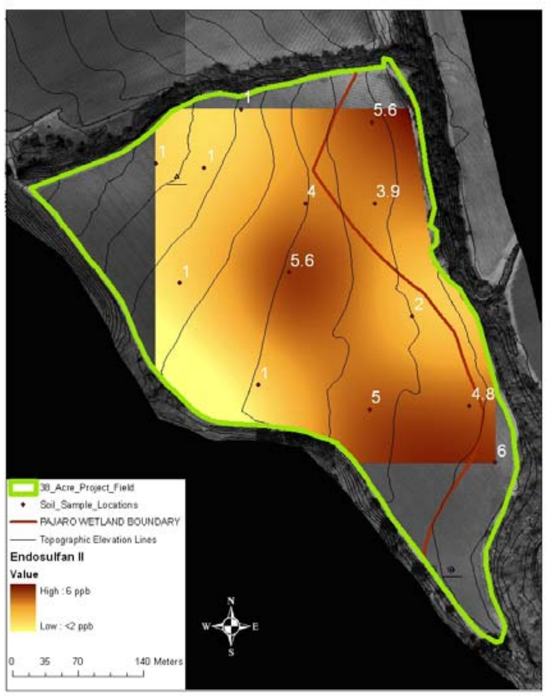

Figure 9. Distribution of Endosulfan concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 9 displays concentrations of Endosulfan in soil and does not in itself indicate the potential for toxicity or risk.

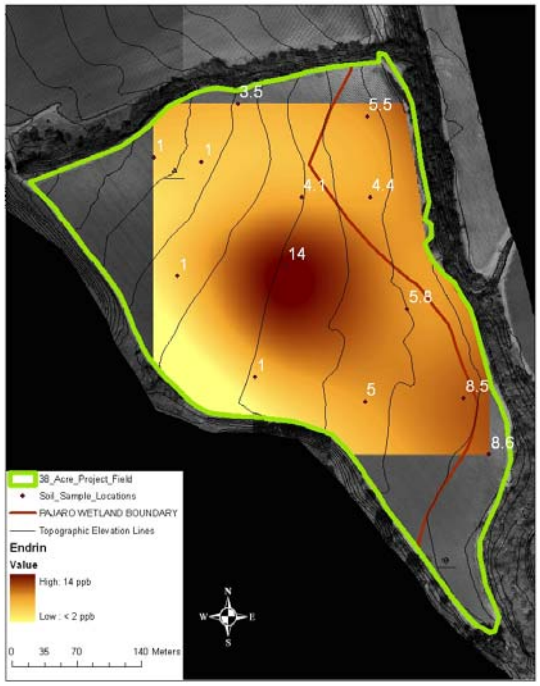

Figure 10. Distribution of Endrin concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 10 displays concentrations of Endrin in soil and does not in itself indicate the potential for toxicity or risk.

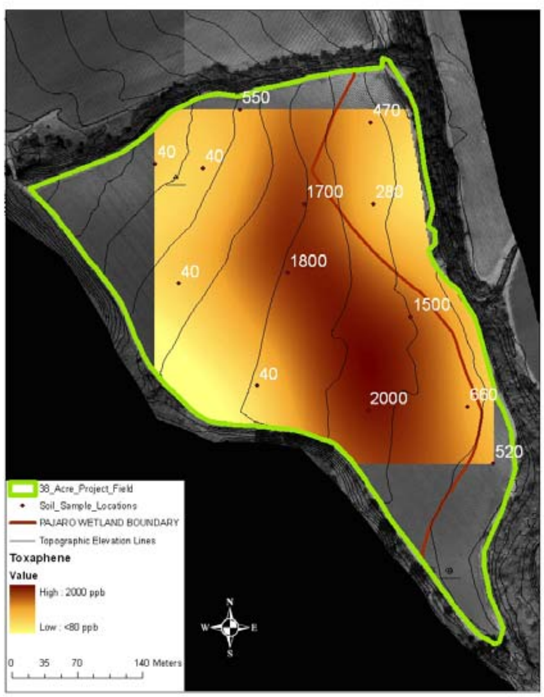

Figure 11. Distribution of Toxaphene concentrations as µg/kg (ppb) in the upper 1 foot of soil throughout 38-acre project site.

Figure 11 displays concentrations of Toxaphene in soil and does not in itself indicate the potential for toxicity or risk.