Attachment E-4 Response to Peer Review Comments

Issue 1: The effects of diazinon dissolved in the water column on the beneficial uses (i.e., aquatic life and wildlife) of Chollas Creek. This would include health, reproduction, survivability and diversity.

Dr. Daniel Schlenk, Issue #1 - Question #1: Health: It is difficult to make any health assessments without an Ecological Risk Assessment (ERA) in this system. Although it is likely this was already performed elsewhere, a summary of, at least the Risk Characterization for this system, should be provided in the document. Based upon the documentation provided, it was not possible to conduct any hazard identification analyses.

San Diego RWQCB Response**:** An Ecological Risk Assessment (ERA) in Chollas Creek has never been performed and there are no current plans to conduct an ERA.

Dr. Daniel Schlenk, Issue #1 - Question #2: A better description of "toxicity" should be provided. For example, what was the percentage of organisms that were killed by the water in the toxicity tests using Chollas Creek water. The only LC50 value provided was 0.5 ug/l as a 16 day LC50 for frogs. No mortality numbers or LC50 values were provided for any of the *Ceriodaphnid* acute toxicity tests. Provision of this data as it pertains to the target concentration of diazinon would strengthen the document. A revised document might also provide a table of acute and chronic toxicity values for *Ceriodaphnia dubia* as well as other invertebrates and vertebrates reported in the literature.

San Diego RWQCB Response**:** The *Ceriodaphnia dubia* 96-hour and 7-day toxicity data for monitoring stations in Chollas Creek are now included as an appendix to the TMDL. A copy of the report by S. Siepmann and Finlayson, B. (2000) entitled, *"Water quality criteria for diazinon and chlorpyrifos"* Administrative Report 00-3, by the California Department of Fish and Game is now available in the appendix of the TMDL. The report includes a summary of acute and chronic toxicity values reported in the literature for *Ceriodaphnia dubia* and other animals.

Dr. Daniel Schlenk Issue #1 – Question #3: The following are certain biological effects of diazinon on reproduction, survivability and diversity. Reproduction: 0.15-30 ug/L appears to be the NOEC for diazinon in Daphnids. (Fernandez-Cassalderrey et. al., 1995)

Survivability: Published 48 hour LC50s for Ceriodaphnids are approximately 0.5 ug/L, these are the most sensitive freshwater aquatic organism to the acute toxicity of diazinon. *Hyalella azteca* had 96-hour LC50 values around 4 ug/L.

Diversity: Cladoceran zooplankton (i.e., *Ceriodaphnids*) were the most sensitive organisms in a 70-d mesocosm experiments showing toxicity at 2 ug/L. Effects on other zooplankton and macroinvertebrates began at 9.2 ug/L, concentrations of 22 ug/L adversely affected fish biomass (survival was affected at 54 ug/L) (See Giddings et al. 1996).

San Diego RWQCB Response: Thank you for the biological effects information.

Dr. Daniel Schlenk Issue #1 – Question #4: A description of the fauna in Chollas Creek, which would be susceptible to toxicity should be provided.

San Diego RWQCB Response: Comment noted. A detailed survey of the aquatic fauna of Chollas Creek has not been found/done.

Dr. Daniel Schlenk Issue #1 – Question #5: Expected Environmental Concentrations (EEC) were not provided. EEC determinations are also critical to Ecological Risk Assessments (ERAs) and rely heavily upon the fate and transport of diazinon in environmental media. A discussion regarding the fate and half-life of diazinon or its metabolites should be provided (Issue 4). Half-lives appear to be about 50 d in water, but with enhanced UV light, heat (during summer months) and/or change of pH, values may be significantly less. Enhancement of environmental degradation will reduce the half-life and possibly increase the threshold value (i.e., target concentration).

San Diego RWQCB Response: Expected Environmental Concentrations are not known. The field dissipation half-life of diazinon ranges from 3 to 54 days (USDA Pesticide Properties Database, 2000). The environmental fate of diazinon was previously reported by Menconi and Cox (1994) and is reproduced here.

Half-Life of Diazinon

The persistence of a chemical in the environment is often determined by calculating the half-life of the chemical under field conditions. The half-life represents the amount of time needed for half of the applied chemical to decompose. The environmentally significant amount of diazinon is small (e.g., 50 parts per trillion). [Note: The chronic toxicity value for diazinon is 50 parts per trillion which is equivalent to 0.05 microgram per liter (µg/l) (Siepmann and Finlayson, 2000)]. Therefore, several half-lives may have to pass before the amount of diazinon remaining reaches a level that is no longer environmentally significant (Cooper, A. 1996).

Several studies have been done to demonstrate the half-life of diazinon under field conditions. Due to varying soil, weather, and other environmental conditions, the specific length of one half-life can not be defined precisely for diazinon under field conditions. Depending on the situation and the study, a wide range of half-lives have been found. Generally within the range of 7 to 80 days, half of the diazinon applied has disappeared (Cooper, A., 1996). In the environment, diazinon appears to degrade by hydrolysis in water and by photolysis and microbial metabolism (USEPA, 1999b). Hydrolysis is rapid under acidic conditions with a half-life of 12 days at pH 5 (USEPA, 1999b). Under neutral and alkaline conditions however, diazinon hydrolyzed more slowly with abiotic hydrolysis half-lives of 138 days at pH 7, and 77 days at pH 9 (USEPA, 1999b).

Table 1 below gives an indication of approximately how long significant amounts of diazinon may remain in the environment using certain half-lives. Since 1 percent of the applied diazinon appears to be a significant quantity, the number of half-lives that would have to pass before the amount of diazinon applied was reduced through decomposition to 1 percent of its initial amount was estimated. The following chart summarizes these numbers for a variety of half-lives.

Table 1. The Number of Days to Reduce Diazinon Concentrations to the Indicated Percentage Remaining Using Diazinon Half-Lives of 7, 12, 20, 40, 77, 80 or 138 days

Half-life	Percentage Remaining					
	50%	25%	12.5%	10%	5%	1%
7 days	7 days	14 days	21 days	23 days	30 days	47 days
12 days	12 days	24 days	36 days	39 days	52 days	80 days
20 days	20 days	40 days	60 days	66 days	86 days	133 days
40 days	40 days	80 days	120 days	133 days	173 days	266 days
77 days	77 days	154 days	231 days	256 days	333 days	512 days
80 days	80 days	160 days	240 days	266 days	346 days	532 days
138 days	138 days	276 days	414 days	459 days	597 days	918 days

It can be seen from this table, that even given a half-life of 7 days, diazinon may persist in the environment at potentially significant levels for over two months. Using a more typical half-life for diazinon of about 40 days, diazinon could remain at environmentally significant levels for almost a year (Cooper, A. 1996).

Runoff and Soil Persistence

Diazinon hydrolysis and soil half-life vary, diazinon appears to have quite a long residence time in soils (Cooper, A. 1996). Diazinon persists in soils for 10 to 12 weeks (Cox, C. 1992). First order aerobic soil half-lives were 37 and 39 days for a sandy loam soil with at pH of 5.4 and 7.8, respectively (USEPA, 1999b). Diazinon can also degrade under anaerobic conditions, having half-lives of 17 and 34 days when samples were amended with glucose (USEPA, 1999b). (It is not known how much longer the half-life of diazinon would be extended in anaerobic conditions when the soil is not amended with glucose.)

The long soil residence time of diazinon and the need for several half-lives to pass before diazinon falls below environmentally significant levels suggest that levels of diazinon high enough to cause toxicity may remain in the environment for several months (or longer) after an application. Diazinon has a moderate water solubility and low K_{oc} and thus has a potential to be carried in runoff water or leached into groundwater (Menconi and Cox, 1994). The tendency of diazinon to run off or leach would depend on field conditions. The major route of dissipation for diazinon appears to be soil metabolism (USEPA, 1999b).

The degradates of diazinon are diazoxon, oxyprimidine and GS-31144, and these degradates can be found in the water and/or soil environment (USEPA, 1999b). Toxicity is caused when diazinon is changed to its oxygen analogues within organisms (Menconi and Cox, 1994). Diazinon degrades by oxidation and/or hydrolysis first to diazoxon (USEPA, 1999b), then diazoxon rapidly degrades by oxidation and/or by hydrolysis to oxypyrimidine. Diazinon does not appear to bioconcentrate to a significant degree (Pait et. al., 1992), and is rapidly excreted after exposure (Kanazawa, 1978).

In one aerobic soil metabolism study, diazinon degraded in a sandy loam soil with a half-life of 37 days. The major degradate was oxyprimidine reaching 67% of the applied after 95 days and decreased to 37% at 195 days and further to 13% by 371 days post treatment (Das, Fiche ID 400287 in USEPA, 1999b). In a study of diazinon photodegradation on soil, the degradate, oxypyrimidine, was detected at levels of 23.7% of the original parent diazinon applied after 1.4 days of exposure to sunlight. Another degradate, GS-31144 was present at 3.6% (Martinson, MRID 00153229 in USEPA, 1999b).

There is concern with the environmental effects of diazinon and the degradates. For example, diazoxon is known to be a stronger cholinesterase inhibitor than parent diazinon (USEPA, 1999b). Another concern is that the degradate, oxyprimidine appears to be more persistent and mobile in soil than diazinon (USEPA, 1999b). Also, oxyprimidine is more stable than diazinon under aerobic conditions (USEPA, 1999b). Furthermore, oxyprimidine is also more stable under anaerobic than aerobic conditions (USEPA, 1999b).

The properties of diazinon and the degradates suggest that regular diazinon use can adversely affect storm water runoff months after an application of diazinon. Applications in the winter months, especially to control ants, are of special concern. Winter season applications likely have a higher probability of runoff since the diazinon is more likely to come in contact with rain during this season (Cooper, A., 1996).

A full discussion of the fate and effects of diazinon can be found in the technical paper by Daniel Larkin and Ronald Tjeerdema, which is included in the attachments.

***Dr. Daniel Schlenk Issue #1 – Question #6*:** Based upon the chemistry of this compound (Log Kow of 3.8), sediment contamination is also a very likely behavior and should be addressed.

- San Diego RWQCB Response: In order to provide an indication of the impact of urban runoff on sediments of San Diego Bay the stormwater monitoring program conducted sediment toxicity testing at the mouth of Chollas Creek. This information has been incorporated into the appendix of the TMDL. The burrowing amphipod, *Eohaustorius estuarius*, was utilized for this sediment toxicity testing. Order No. 95-76 specified the sampling configuration. The sampling configuration for the sediment toxicity testing consists of two transects diverging at a 90^{o} angle from the creek mouth. Along each transect, two locations were sampled approximately 100 feet apart (1A, 3A and 1B, 3B).

Station 1A/1B is situated closer to the mouth of Chollas Creek than 3A/3B. A total of four sediment samples were collected, and then each pair of samples were composited together (1A/1B and 3A/3B). Composite samples 1A/1B and 3A/3B were analyzed for sediment toxicity testing utilizing the burrowing amphipod, *Eohaustorius estuarius*.

Each round of sediment toxicity testing consisted of a test with samples, reference and control sediments, and an aquatic toxicant test using test organisms from the same batch.

Summary of *Eohaustorius estuarius*
Mean Percent (%) Survival and Reburial Success in Sediment
Collected from the Mouth of Chollas Creek

Sample ID	Date	San Diego Bay 1A/1B	San Diego Bay 3A/3B	Reference	Control
Mean Survival %	Sept 1996	92	95	97	98
Reburial (% of survivors)	Sept 1996	100	100	100	100
Mean Survival %	May 1997	84	81	54	100
Reburial (% of survivors)	May 1997	100	96	100	100
Mean Survival %	Sept 1997	95	94	97	100
Reburial (% of survivors)	Sept 1997	100	100	100	100
Mean Survival %	May 1998	42	60	94	98
Reburial (% of survivors)	May 1998	83	90	97	100
Mean Survival %	Sept 1998	94	98	98	98
Reburial (% of survivors)	Sept 1998	100	100	100	100
Mean Survival %	May 1999	85	92	97	99
Reburial (% of survivors)	May 1999	96	100	100	100
Mean Survival %	Sept 1999	83	75	78	92
Reburial (% of survivors)	Sept 1999	100	100	100	100
Mean Survival %	May 2000	67	42	100	100
Reburial (% of survivors)	May 2000	100	93	100	100

Dr. Ronald S. Tjeerdema, Issue #1 Question #7: In the Problem Statement it is stated that since 1994 almost all toxicity tests using the water flea *Ceriodaphnia dubia* have shown Chollas Creek storm waters to be toxic. Therefore, the conclusion is made that the creek has not met the applicable water quality objective for toxicity. However, the rationale for using *Ceriodaphnia dubia* as the test species is incomplete. While it is indeed a widely used and approved test organism for aquatic toxicity testing, no attempt was made in the document to determine its suitability as a surrogate for resident arthropods in the Chollas Creek. Is it a good model for resident species and their potential responses to pesticides? Without information on the native insects present, it is difficult to determine how closely *Ceriodaphnia dubia* might predict toxicity in them.

Therefore, it is suggested that a brief ecological survey of the creek be included in the TMDL to support the adequacy of using *Ceriodaphnia dubia* as a model insect in toxicity testing.

San Diego RWQCB Response: The water flea, *Ceriodaphnia dubia*, was utilized as an indicator organism for surface water toxicity. The rationale for using *Ceriodaphnia dubia* as the test species is as follows: (a) it is a small crustacean found in freshwater throughout the world and can be grown in “culture”, (b) response of *Ceriodaphnia dubia* to reference toxicants has been studied, and a characteristic range of concentrations that causes mortality has been established, (c) it is very sensitive to pesticides, heavy metals, and other toxic substances and (d) it is a widely used and approved test organism for aquatic toxicity testing.

Initial surveys of resident freshwater aquatic species [California Stream Bioassessment Procedure (CSBP)] in other San Diego Region (9) creeks are either being planned, and/or underway, and/or have recently become available. However, hydrologic conditions in the creek make CSBP sampling problematic. No comprehensive survey of resident freshwater aquatic species has been performed, nor is one being planned for Chollas Creek.

Dr. Ronald S. Tjeerdema, Issue #1 Question #8: It was indicated that a toxicity identification evaluation (TIE) was conducted to determine the cause of the toxicity in Chollas Creek stormwater, and that the results indicate diazinon as the cause. However, TIE information can be difficult to interpret at times, and the results not always as definitive as portrayed by this TMDL. The entire focus of the document is on diazinon, thus results of the TIE are paramount in determining the importance of this TMDL. Therefore, it is suggested that the results of the TIE be briefly summarized and included in the document to clearly strengthen the argument for focusing this TMDL on diazinon.

San Diego RWQCB Response: A summary of the TIE results are now included as an appendix to the TMDL.

Issue 2: Selection of the numeric target for diazinon.

Dr. Daniel Schlenk, Issue #2 Question #1: Selection of the target appears to be somewhat conservative, but since the level of uncertainty is high (i.e., no fauna data or sensitivity data for Chollas Creek fauna), a large margin of safety is probably warranted. This needs to be clarified in the text. The US EPA values (0.09 ug/L) which are also highly conservative, is a "one size fits all" type of number that needs to be justified in this particular system. Therefore, justification for the targeted concentrations should be mentioned in the revised document.

San Diego RWQCB Response: Comment noted. The rationale for the numeric target is explained.

Basin Plan water quality objectives adopted by the Regional Board must be approved by the State Board and US EPA before they become effective. State and Federal water quality control regulations contain guidance on how to develop water quality objectives that protect beneficial uses. In the TMDL program, it is essential that a water quality objective be developed that US EPA can approve. US EPA can approve TMDLs only if the numeric targets on which they are based are protective of beneficial uses, consistent with Basin Plan objectives and protective under the Clean Water Act.

This TMDL provides a recommendation for an acute and chronic numeric target for diazinon for the Regional Board to consider in adopting a water quality objective into the Basin Plan. There are lots of different reasons for identifying pesticide target values in surface waters and each reason has different objectives and constraints. In adopting water quality objectives, compliance with existing federal and state laws, regulations and policies is required.

The California Department of Fish and Game (DFG) methodology for selecting the acute and chronic criteria are based on US EPA methodology. The US EPA methodology of deriving water quality criteria for aquatic organisms involves the following steps:

- Review acute and chronic toxicity studies performed to document effects of a water quality constituent on aquatic organisms. Accept only those studies that followed procedures that conform with standard methods.
- Evaluate whether toxicity studies include toxicity information on species from eight taxonomic groups, specifically: (1) the family Salmonidae, (2) a second fish family, preferably one including commercially or recreationally important species, (3) a third family of vertebrates, (4) a planktonic crustacean, (5) a benthic crustacean, (6) an insect, (7) a family from a group that is not an arthropod or vertebrate, and (8) certain other taxonomic groups not already represented.
- The acute criterion is derived as follows: (1) identify acute toxicity values such as LC50 or EC50 values for each species studied, (2) acute toxicity values from species of the same genus are pooled and the geometric mean of their toxicity values is calculated to generate the genus mean acute value. (3) the four lowest genus mean acute values and the total number of genus mean acute values are used to calculate the final acute value. If the number of genus mean acute values is relatively low, the final acute value will be conservative to account for uncertainties associated with small data sets. (4) the acute criterion is equal to one half of the final acute value.
- The USEPA method has several approaches for developing a chronic criterion. In the case of diazinon, chronic toxicity data are inadequate to calculate a chronic criterion directly using procedures similar to those used to calculate an acute criterion. Instead, acute-to-chronic ratios are used, when available to calculate a chronic criterion using acute toxicity data. The chronic criterion is derived as follows: (1) For each chronic value for which at least one corresponding appropriate acute value is available, calculate an acute-to-chronic ratio. (2) Acute-to-chronic ratios for species in at least three different taxonomic families are derived provided that: at least one is a fish, at least one is an invertebrate, and at least one is an acutely sensitive freshwater species. (3) For each species, calculate the mean species acute-to-chronic ratio as the geometric mean of all acute-to-chronic ratios for that species. (4) Calculate the final chronic value by dividing the final acute value by the final acute-to-chronic ratio. (5) The chronic criterion is equal to the final chronic value.

The DFG acute and chronic criteria appear to be technically sound. The DFG methodology appears to be consistent with meeting existing federal and state laws, regulations and policies. The Clean Water Act Section 101(a)(3) prohibits the discharge of toxic pollutants in toxic amounts. A key provision of the Basin Plan is the narrative toxicity objective that states, in part, *"All waters shall be maintained free of toxic* *substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life…."*

The DFG chronic and acute criteria are designed to protect the full range of aquatic life beneficial uses. By maintaining concentrations of a constituent at or below these criteria, aquatic organisms should be provided with *"a reasonable level of protection"* and will not be *"unacceptably"* impacted. This is fundamentally different than assuming it is acceptable to cause mortality or otherwise adversely impact a small fraction of the aquatic species, given that such an interpretation would not appear to be consistent with the narrative toxicity objective.

While it is recognized that some physical and chemical factors present in surface waters mitigate the toxicity of contaminants, matrix potentiation of toxicity has also been demonstrated (e.g., Miller et al, 1998). Studies showing that diazinon is additive or interactive in toxicity when combined with other contaminants found in urban storm water follows. According to Bailey et al., (1997) diazinon and chlorpyrifos have been found to be additive in toxicity. Belden and Lydy (2000) found that atrazine at non-toxic concentrations potentiate chlorpyrifos and diazinon toxicity to invertebrates. Pape-Lenstrom and Lydy (1997) found that there is synergistic toxicity from OP pesticides and atrazine to invertebrates. Macek (1975) found that eleven combinations of pesticides were shown to have greater than additive toxicity in bluegill sunfish. Bocquene et al. (1995) found most combinations of OP and carbamate insecticides produced synergistic toxicity on invertebrates. Forget et al. (1999) found synergistic OP/metal toxicity on invertebrates.

Most efforts directed at prediction, protection, and remediation of damage inflicted on aquatic biota focus on one chemical at a time. Focus on one chemical at a time can lead to an underestimate of biotic effects when there is additive or interactive (e.g., synergism or greater than additive toxicity) toxicity.

With our current lack of understanding of the effects of multiple pollutants, the most common approach to dealing with the uncertainties of chemical additivity and synergism is to apply a safety factor when deriving a concentration of a single chemical deemed 'safe'.

According to SCCRWP (1999), chemical analyses in the TIE study indicated Chollas Creek runoff had concentrations of diazinon and chlorpyrifos in sufficient quantities to account for most of the toxicity to *Ceriodaphnia dubia.* The total predicted toxicity due to these pesticides is approximately double the observed toxicity, indicating that some fraction of one or both of these pesticides is not in a biologically available form. These results are consistent with recent studies indicating that the bioavailability of diazinon and chlorpyrifos can range from 15 to 90% in water samples (Miller et al., 1997).

The lowest acute 96-hr LC50 values were 0.26 for diazinon and 0.053 ug/L for chlorpyrifos. Converting the criteria values (0.08 for diazinon and 0.02 for chlorpyrifos) to TUs based on the LC50s gives values of 0.31 and 0.38 TUs for diazinon and chlorpyrifos respectively. Thus, if both pesticides were present at their respective acute and interim criteria levels, the total TUs would equal 0.69, giving a level of protection of less than a factor of two. Whether this is sufficient remains open to conjecture, but the empirical data obtained in this study provide some perspective. No mortalities were observed in concentrations of the mixtures that totaled between 0.47 and 0.58 TUs. Conversely, between 40 and 65% mortality occurred in concentrations that contained between 0.95 and 1.20 total TUs (Bailey, 1997).

CDFG Table 14. Joint toxicity of diazinon and chlorpyrifos (96-hr LC50 values in ug/L) to *Ceriodaphnia dubia*.

	Bailey et al (1997)	CDFG (1999a,c;1998b)
Chlorpyrifos alone	0.053, 0.055	0.038
Diazinon alone	0.32, 0.35	0.44
Chlorpyrifos in mixture	0.024, 0.020 (0.41 toxic unit)	0.02 (0.52 toxic unit)
Diazinon in mixture	0.23, 0.24 (0.70 toxic unit)	0.15 (0.34 toxic unit)
Total Toxic Units	1.11	0.88
Additive Index	-0.11	0.14

Harris et. al., (1998) reported a diazinon 16-day LC50 for green frogs of 0.005+/-0.0001 mg/L active ingredient (a.i.). Harris also reported that Basudin® 500EC, a diazinon based pesticide, had a similar 16-day LC50 of 0.0028+/- 0.0003 mg/L a.i. Diazinon is extremely toxic to amphibians.

Dr. Ronald S. Tjeerdema, Issue #2, Question #2: There is no clear indication as to whether the numeric targets are based on median-effect concentrations or no-effect concentrations, and whether the *Ceriodaphnia dubia* toxicity tests used lethality as the endpoint. A brief summary of the revised water quality criterion (WQC) published by Siepmann and Finlayson (2000) would be helpful in placing appropriate confidence in the numeric targets. Therefore, it is suggested that a brief summary of the revised WQC for diazinon be included.

San Diego RWQCB Response: A copy of the report by S. Siepmann and Finlayson B. entitled, *"Water quality criteria for diazinon and chlorpyrifos"* Administrative Report 00-3 California Department of Fish and Game is now available in the appendix of the TMDL. The report includes a summary of the water quality criterion.

Dr. Ronald S. Tjeerdema, Issue #2, Question #3: Numerous other toxicity tests have been conducted on diazinon with other aquatic invertebrates (please see Larkin and Tjeerdema, page 61). Was this information considered in developing the numeric targets? This again touches upon the rationale for using *Ceriodaphnia dubia* as the model test species for the native Chollas Creek fauna, as stated above.

Therefore, it is suggested that a brief summary of the toxicity of diazinon to other aquatic invertebrates be included to compare and contrast it to the information from Ceriodaphnia. Both the WQC and additional toxicity information will provide clear rationale for why the targets were set at their reported levels, which appear overly conservative.

San Diego RWQCB Response*:* A copy of the report by S. Siepmann and Finlayson B. entitled, *"Water quality criteria for diazinon and chlorpyrifos"* Administrative Report 00-3 California Department of Fish and Game is now available in the appendix of the TMDL. The report includes a summary of the water quality criterion.

Issue 3: Toxicity test protocols.

Dr. Ronald S. Tjeerdema, Issue #3, Question #1: The toxicity test protocols are completely lacking in this document. Issues of appropriate model species selection, endpoints, and effect levels have already been addressed above. A brief summary of the test protocols from which the numeric targets were derived would clarify the rationale for the targets and should be included.

Therefore, it is suggested that a summary of the testing protocol for the Ceriodaphnia tests used in preparing this TMDL be included.

Dr. Daniel Schlenk, Issue #3, Question #1: There are no toxicity test protocols provided in the document. Perhaps a table showing acute and chronic test values would suffice. In addition, tables showing mortality of the *Ceriodaphnid* results would be beneficial. Some abbreviated form of the protocol needs to be provided.

San Diego RWQCB Response: USEPA acute and chronic toxicity test protocols using the water flea, *Ceriodaphnia dubia* were utilized. For acute toxicity EPA/600/4-90/027F test method was utilized, and for chronic toxicity EPA/600/4-91/002 test method was utilized. A summary of the acute and chronic test values is provided in tabular format in the appendix of the TMDL.

Dr. Daniel Schlenk, Issue #3, Question #2: A summary of the TIE results should also be provided to justify the TMDL. Perhaps some field-based study results should be provided to determine if aquatic invertebrate populations in the field are being affected. One would think that with the concentrations reported in the document, that there should virtually no cladocerans present in this system. Is this true?
San Diego RWQCB Response: Comment noted. A summary of the TIE results are included as an appendix to the TMDL. A detailed survey of the aquatic fauna of Chollas Creek has not been found/done, therefore it is not known if cladocerans are present the system.

Issue 4: Assimilative capacity for diazinon.

Dr. Daniel Schlenk, Issue #4, Question #1: There is limited environmental fate data provided in the document. Perhaps a table with half-lives or degradative fate of diazinon and its metabolites should be included. Also the potential for diazinon to partition into sediment as a future source of input to the water column (i.e. desorption or re-suspension of sediment) or its ability to evaporate into the air should be discussed. Caution should also be used in using single time point water-borne concentrations in verifying compliance, as diazinon is only moderately persistent. Thus, false negatives in monitoring may occur.

In summary, it is difficult to evaluate the adequacy and validity of the technical analysis and interpretation of the data expressed by the TMDL as there is very limited data present. Certainly the strengths of the document center around mitigation strategies and documentation of the input sources. However, there should be more emphasis on the justification of the target concentration and more in-depth discussions about the monitoring mechanisms (i.e. temporal scale with perhaps other aquatic invertebrate species). It is also suggested that laboratories with a high degree of quality assurance/quality control be utilized during this monitoring process.

San Diego RWQCB Response: A table with half-lives and/or degradative fate of diazinon and its metabolites is included.

Dr. Ronald S. Tjeerdema, Issue #4, Question #2: Virtually no attempt was made to model the fate or movement of diazinon in the creek based upon its physical/chemical properties. For instance, sediment adsorption/desorption of diazinon was barely touched upon as either representing a sink or possible additional source for the insecticide in the water. The properties of diazinon are such that it will sorb to sediments, which may later serve as a source through desorption (please see Larkin and Tjeerdema, 2000, pages 51-56). In addition, it has a significant vapor pressure and Henry's law constant, indicating that volatilization represents a significant route of dissipation from the Chollas Creek (please see Larkin and Tjeerdema, 2000, pages 51-53).

Therefore, it is suggested that partitioning processes should be more thoroughly considered in modeling the ultimate concentrations of diazinon expected in the Chollas Creek.

In aquatic systems, diazinon is known to undergo degradation via hydrolysis, photolysis, and bacterial actions, or biodegradation (please see Larkin and Tjeerdema, 2000, pages 51-56). However, no estimate of their impacts on the TMDL for diazinon was included. Such actions may further influence the dissipation of the insecticide from the creek.

Therefore, it is suggested that an estimate of the impact of environmental degradation processes on diazinon in the Chollas Creek should be included when modeling the ultimate concentrations of diazinon expected in the Chollas Creek.

San Diego RWQCB Response: Comment noted. Data is not available upon which to model sediment diazinon concentrations.

Dr. Ronald S. Tjeerdema: The use of citizen and/or school groups for the routine monitoring of Chollas Creek for sources of toxicity in the future is advised against. Due to their obvious lack of expertise, quality control would potentially be seriously lacking, and data generated by such monitoring would be suspect in terms of quality. Ultimately, management decisions made based on such data would also be compromised.

San Diego RWQCB Response: Comment noted. Any poor quality data, whether it be collected by dischargers or citizens would not be appropriate for making management decisions. The Regional Board has not yet used citizen-monitoring data for routine monitoring of Chollas Creek for sources of toxicity.

A quality assurance/ quality control (QA/QC) plan was in place for the collection of the toxicity data that has been used for the monitoring of Chollas Creek for sources of toxicity. The Chollas Creek toxicity data was collected as part of the City of San Diego and Co-Permittee NPDES Stormwater Monitoring Program. Also toxicity data collected through the Southern California Coastal Water Research Project was utilized.

As to the future, the TMDL will require the dischargers to develop and implement a *"Monitoring and Reporting Program for Diazinon and Other Pesticides"* for tracking diazinon concentrations and long-term trends in the watershed against acute and chronic numeric targets, and to measure the effectiveness of corrective measures implemented in the TMDL. A quality assurance/ quality control (QA/QC) plan is required for both field and laboratory operations.

The quality assurance/ quality control (QA/QC) plan for field operations is required to cover the following, at a minimum: quality assurance objectives; sample container preparation; labeling and storage; chain-of-custody tracking; field setup; sampler equipment check and setup; sample collection; use of field blanks to assess field contamination; use of field duplicate samples; transportation to the laboratory; training of field personnel; and evaluation, and enhancement if needed of the QA/QC plan.

The QA/QC plan for laboratory operations is required to cover the following, at a minimum: quality assurance objectives; organization of laboratory personnel; their education, experience, and duties; sample procedures; sample custody; calibration procedures and frequency; analytical procedures; data reduction, validation, and reporting; internal quality control procedures; performance and system audits; preventive maintenance; assessment of accuracy and precision; correction actions; and a quality assurance report.

These QA/QC measures will ensure that the dischargers produce high quality data in both field and laboratory operations. The Regional Board does not specify whom the discharger selects for routine toxicity monitoring.

It is acknowledged that potential data users are often skeptical about citizen and/or school group data – they may have doubts about the goals and objectives of the project; how citizens were trained; how samples were collected, handled and stored; or how data were analyzed and reports written. However, given proper training and supervision, citizen and/or school groups can collect high quality data. A Quality Assurance Project Plan (QAPP) that details the citizen monitoring project's standard operating procedures (SOPs) in the field and laboratory are key tools towards ensuring high quality data are produced. Citizen and/or school groups that collect and provide high quality data would be acceptable for management decision making.