STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
Brian Sandoval, Governor
Leo M. Drozdoff, P.E., Director
Colleen Cripps, Ph.D., Administrator

December 6, 2012

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Subject: Request from Center for Biological Diversity to add Las Vegas Wash, Las Vegas Bay and Lake Mead to Nevada's 303(d) List

Dear Mr. Bazel,

Thank you for providing comments regarding the Center for Biological Diversity's request that the Nevada Division of Environmental Protection (NDEP) add the Las Vegas Wash, Las Vegas Bay, and Lake Mead to Nevada's 303(d) List of Impaired Waters due to endocrine disrupting chemical (EDC) pollution.

NDEP has determined there is not sufficient evidence to justify inclusion of the waterbodies for EDCs in Category 5 (303(d) List) of Nevada's 2008-10 Water Quality Integrated Report (IR). NDEP appreciates the information you provided to support this decision.

Nevada's final 2008-10 IR has been submitted to the U.S. Environmental Protection Agency for approval and is available at http://ndep.nv.gov/bwqp/303dlist.htm. Please contact me at (775) 687-9449 if you have any questions or would like to further discuss this matter.

Sincerely,

Kathy Sertic for
John O. Heggeness, Supervisor
Water Quality Standards and Monitoring
Bureau of Water Quality Planning

cc: Kathy Sertic, Chief, Bureau of Water Quality Planning

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By E-Mail and Federal Express

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Subject: Request From Center For Biological Diversity To Add Las Vegas Wash, Las Vegas Bay, And Lake Mead to Nevada's 303(d) List

Dear Mr. Heggeness:

On 12 November 2009, Jaclyn Lopez, a lawyer with the Center for Biological Diversity ("CBD"), wrote you and requested that Las Vegas Wash, Las Vegas Bay, and Lake Mead be 303(d) listed for a long list of "endocrine disrupting chemicals". On 16 March 2012, you wrote a response to CBD. I am now writing to provide a few additional points in response. This letter is being submitted on behalf of the City of Las Vegas, with the concurrence of the City of Henderson and the City of North Las Vegas.

This letter makes five main points. First, we concur with your conclusion that detection of a substance in water does not, by itself, establish impairment of beneficial uses. CBD reports that dozens of substances have been identified as being present in Lake Mead, but the quantities of many of these substances—their concentrations, typically expressed in micrograms per liter—are unknown. CBD asserts that actual concentrations are not needed for 303(d) listing, because any concentration of these substances, no matter how small, may cause harm. CBD is wrong. Speculation that a substance "may" cause harm is not enough for 303(d) listing. CBD has offered its speculations, but it has not provided evidence that the substances at issue really are causing impairment of any beneficial use.

Second, CBD asserts that the "reproductive condition" of fish in Las Vegas Bay (as evaluated with hormonal and histopathological data) is markedly reduced compared to fish elsewhere in Lake Mead. But the reports CBD cites do not support CBD's argument. On the contrary, they show that hormonal and histopathological data are highly variable, for reasons that are not understood. Furthermore, there is no established connection between the hormonal and histopathological data and "ecological" or "population-level" effects. In other words, CBD cannot show that any of the hormonal or histopathological effects are actually affecting the reproduction of any fish species in Lake Mead. And there are good data showing that the fish in Lake Mead are reproducing well.

Third, CBD accuses NDEP of illegal "take" of an endangered species, the razorback sucker. CBD argues that by "failing to protect" water quality, NDEP is engaging in take of razorbacks in Lake Mead. But data on razorbacks show that they are doing well in Lake Mead. The substances at issue are not causing take.

Fourth, CBD argues that the substances contaminate the drinking water supply. But CBD has not provided any evidence that any of the substances is present in the drinking water, much less that they are found in undesirable concentrations.

Fifth, CBD insists that the substances it has identified impair the propagation of fish and wildlife in Lake Mead, Las Vegas Bay, and Las Vegas Wash. They do not. There is good evidence that water quality in these segments maintains all beneficial uses. There is no impairment.

I. CHEMICAL DETECTION IS NOT BENEFICIAL-USE IMPAIRMENT

Again and again, CBD names a substance and asserts that "It has been detected in the waterbodies." (*E.g.* CBD Letter at page 18 (five times), page 19 (four times), page 20 (three times), page 21 (six times), page 22 (ten times).) Whenever this sentence appears, CBD says nothing about the concentration of the substance, and for good reason: It does not have concentration data.

CBD cites to Rosen (2009), which collected data with "passive samplers". These samplers typically remained in place for 4-6 weeks, and sequestered substances from the ambient water. (Rosen 2009.) Sequestering concentrates the substances, and thereby allows for detection of substances that might otherwise not be found because of their extremely low concentration in the ambient water. But this method does not determine actual concentrations in the ambient water, at least not for many substances.

CBD tries to get around this data deficiency by arguing that "any level of exposure at all—may cause endocrine or reproductive abnormalities." (CBD Letter at 11.) But speculation that something "may" cause abnormalities is not scientific evidence that something actually does cause abnormalities. For this reason alone, CBD's request should be rejected for each substance lacking data on concentration or dose.

CBD is also wrong because the substances at issue remain subject to fundamental principles of toxicology, including the principle that at sufficiently diffuse concentrations substances do not exhibit toxic effects. EPA rejected the argument CBD now makes when considering whether EPA guidelines for deriving water-quality criteria apply to contaminants of emerging concern, including endocrine-disrupting substances. EPA concluded that "there is nothing about [contaminants of emerging concern] that invalidates the principles embodied in" EPA guidelines for developing water-quality criteria. (EPA 2008 at 2-3, 12.)

CBD does not seriously argue that concentration is irrelevant, and no one seriously disputes that the concentration of a substance is relevant to an assessment of its effect. Consider perhaps the most well-known of the substances CBD identifies as an endocrine disrupter: caffeine. CBD asserts that the "[e]ffects of caffeine include decreased insulin sensitivity" and "adverse effects on the adrenal glands." (CBD Letter at 18.) But to suggest that these effects occur *at the concentrations found in Lake Mead* is wrong. CBD cites to Rosen (2009) for the proposition that caffeine "has been detected in waterbodies." (*Id*.) Rosen (2009) reports that the passive sampler in Las Vegas Bay contained 140 nanograms of caffeine—140 nanograms obtained by sequestering caffeine from the ambient water for 4-6 weeks. For a brief moment, let us make the extremely unrealistic assumption that the 140 nanograms of caffeine measured in the sampler reflected an ambient concentration of 140 nanograms *per liter* in the ambient water. The true value is undoubtedly much, much lower. A cup of coffee contains about 150 *milligrams* of caffeine.[1] A milligram equals one million nanograms.[2] A person would therefore have to drink more than one million liters of water from Las Vegas Bay to ingest the same amount of caffeine that the rest of us get from a single cup of coffee. We know from experience that a single cup of coffee does not cause decreased insulin sensitivity or adverse effects on adrenal glands. We can safely assert that no one drinks more than a million liters of Las Vegas Bay water. And we can safely conclude, therefore, that the caffeine in Las Vegas Bay is not harming anyone.

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[1] http://www.mayoclinic.com/health/caffeine/AN01211 (generic brewed contains 95-200 milligrams; 16 ounces of Starbucks contains 330 milligrams)
[2] http://en.wikipedia.org/wiki/Orders_of_magnitude_(mass)

To support its claim that the substances are causing harm, CBD must show that substances are found at concentrations that cause harm. But this it does not do. It asserts, for example, that ethynylestradiol ("EE2") was found "in the waterbodies at concentrations of up to . . . 0.5 ng/L", but then concedes that "the no-observed-effect concentration for EE2 to the fathead minnow (*Pimephales promelas*) is considered to be 1.0 ng/L." (CBD Letter at 5.) The maximum measured concentration, in other words, was only half of the no-observed-effect concentration for a standard test fish. The proper conclusion to be drawn from these data is that EE2 is present at concentrations too low to cause harm—directly contrary to CBD's argument.

CBD has not, in short, demonstrated that any substance is present in concentrations that actually cause harm.

II. THE LAKE MEAD FISHERY IS NOT IMPAIRED

CBD asserts that endocrine-disrupting substances have been detected in Las Vegas Wash, Las Vegas Bay, and Lake Mead, and argues that "[t]hese environmental conditions are not conducive to healthy populations of fish and wildlife, nor do they support the beneficial uses of these waterbodies." (CBD Letter at 4.) But CBD makes no real effort to prove that the substances at issue actually result in the impairment of any beneficial use.

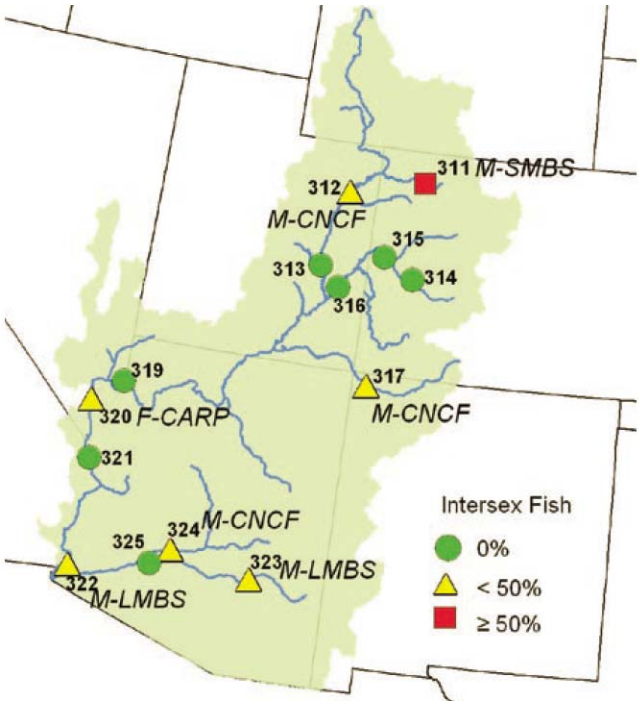
CBD argues that fish in Las Vegas Bay have hormonal and histopathological differences compared with fish at another location in Lake Mead. But scientists are still working out how these hormonal and histopathological data should be interpreted and compared. There are serious questions about the variability of the data, and about whether the effects seen are caused by the substances at issue here.

Consider the issue of Willow Beach, which is on the Colorado River downstream of Lake Mead. Concentrations of most of the substances at issue are nondetectable or much lower at Willow Beach than in Las Vegas Bay. If CBD is right—in other words, if it is true that the chemical concentrations in Las Vegas Bay are causing the hormonal and histopathological effects—then there ought not to be any substantial hormonal or histopathological effects in the fish at Willow Beach. But there are. And the papers cited by CBD recognize that there are hormonal or histopathological effects at Willow Beach.

CBD incorrectly argues that "[r]esults of a study by Linder and Little (2009) indicate that the reproductive condition of fish in Las Vegas Bay [is] markedly reduced compared to other fish farther away from Las Vegas Wash and the influx of [endocrine disrupting compounds]."

(CBL Letter at 7.) On the contrary, Linder and Little recognized that "fishes collected at Willow Beach . . . presented reduced [reproductive] condition" despite "a low incidence of [endocrine disrupting compounds]". (*Id*., conclusions section.) Linder and Little concluded that these results "indicated that other stressors may be acting independently or in concert with chemical stressors". (*Id*.) In other words, there is not a clear connection between the substances at issue and the hormonal and histopathological effects found in local fish.

A report prepared by U.S. Geological Survey staff shows some of the remarkable variability in the data. Hinck and others monitored water and fish at several sites within the Colorado River basin. (Hinck 2006.) They found "intersex" fish (fish with reproductive tissue of the opposite sex) at half the locations:



(*Id*. at 85.) Station 320 is Willow Beach. The notations refer to the type of fish that were identified as intersex:

M-SMBS: male smallmouth bass
M-CNCF: male channel catfish
F-CARP: female carp
M-LMBS: male largemouth bass

These results are remarkable for their lack of consistency. Whatever causes channel catfish, for example, to become intersex at one location is not sufficient to cause carp or bass to become intersex at that location. Nor is there a clear understanding of why these intersex fish became intersex. Hinck noted that the occurrence of intersex fish at station 311 (the Yampa River at Lay, Colorado) "was one of the most severe reported" as part of the USGS program of which this study was part, and yet "[t]he cause of intersex in these fish is unknown". (*Id*. at 90.) Whatever the cause, it cannot be municipal wastewater from Las Vegas Valley, because station 311 is far upstream.

Hinck noted that "[s]everal studies concluded that exposure to wastewater effluent and municipal runoff in Lake Mead *may* be altering reproductive biomarkers [as Hinck referred to the hormonal and histopathological data] in fish", and concluded that "[s]tudies are needed to determine the effects *and ecological significance* of wastewater effluent and agricultural runoff on fish from these areas." (Hinck 2006 at 89, emphasis added.)

These statements provide a good summary of the current state of the science. There may be a connection between the substances identified by CBD (or, more likely, some of them) and hormonal or histopathological effects, but the studies have not connected the "biomarker" data with is often called "ecological" effects and "population-level" effects. In other words, it is not clear that the hormonal and histopathological variations observed actually affect the ability of fish to reproduce.

Linder and Little (2009), on whom CBD relies, reached the same conclusions. They recognized that linkage between exposure to the substances detected and altered endocrine function "is possible." (*Id*., conclusions section.) But they also recognized that population-level effects *have not been observed*: "population-level responses in fishes that are linked to their diminished reproductive success associated with the disruption in their normal biochemical and physiological processes have not been observed." (*Id*.) Because available data, which Linder and Little referred to as "reconnaissance level analysis", were not able to answer questions about reproductive potential, Linder and Little concluded that future studies should focus on this issue: "Given that the reconnaissance level analysis of risks cannot answer questions related to the ecological significance of [endocrine-disrupting compound] exposures, this suggests that future

studies be focused on the effects of exposure to [endocrine-disrupting compounds] on the reproductive potential of fish." (*Id*.)

Data on fish in Lake Mead, including Las Vegas Bay, show the fish are doing fine. We are submitting five types of data in support of this conclusion: (1) data from the Nevada Department of Wildlife, which is responsible for fish in Nevada, (2) data from the consultant that has been monitoring the endangered razorback sucker (these are presented in the next section below), (3) a study performed by the EPA research center in Las Vegas, (4) a study performed by a consultant to the City of Las Vegas, and (5) evidence from eyewitness observations.

In 2009, the Nevada Department of Wildlife ("NDOW") published a "federal aid job progress report". (NDOW 2009.) This report provided a history of the management of fish in Lake Mead, including the introduction of striped bass, the expectation that they would not reproduce, their success in reproducing, and the deleterious effect striper predation has had on fish in the lake. (*Id*. at 2-4.) The key sentence for our purposes is found on the first page, which reports on the rate of fish caught per angler day and per angler hour, and concludes that "[t]hese values continued to be above the 24 year average Lake Mead angler success rates". (*Id*. at 1.)

As is well-known, the population of Las Vegas Valley has greatly increased in the 24 years between 1984 and 2008, and wastewater flows increased concurrently with the population increase. If any substance in the wastewater was impairing the reproduction of fish in the lake, there would be fewer fish in 2008 compared with 1984. If there were fewer fish, there would be a lower catch per angler day and a lower catch per angler hour. But the catch rates in 2008 were higher than average, not lower. These data therefore provide support for the conclusion that increased wastewater flows are not impairing the fishery. There is nothing in the NDOW report, or in any NDOW data that we are aware of, to suggest the contrary—that fish in Las Vegas Bay are not reproducing well.[3]

In 1998, EPA's research laboratory in Las Vegas conducted a study on mercury in fish in Lake Mead. (Cizdziel undated; Cizdziel 2003.) Although the purpose of the study was to consider a new method for measuring mercury, the results of the study are of interest here. Cizdziel compared fish inside Las Vegas Bay with fish outside Las Vegas Bay. For each fish, he

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[3] On page 1, the NDOW report reports that 2008 "harvest rate" was 2.89 fish per angler day, and in the next sentence asserts that the 2008 results were higher than the 24-year average "success rate" of 2.95. Success rate apparently refers to the number of fish caught, whereas harvest rate apparently refers to the number of fish kept. About three quarters of the catch was harvested. (*Id*. at 11.)

and his co-authors measured the mercury level and the "K factor", also called "condition factor", a measure of the weight of a fish compared with its length. According to Cizdziel, "[f]or Lake Mead striped bass, a condition factor of about 1, or higher, generally indicate[s] relatively well-nourished and healthy fish, while factors below about 0.8 indicate under-weight and perhaps starving fish." (Cizdziel 2003 at 806, some commas removed.) In his undated document, he provides a graph clearly showing which fish were found inside Las Vegas Bay and which outside Las Vegas Bay, and the mercury concentration and K factor for each. Virtually every fish in Las Vegas Bay had a K factor of more than 1, whereas virtually every fish outside of Las Vegas Bay had a K factor of less than 1, and most had a K factor of less than 0.8. (Cizdziel undated, figure 7.) This study provides evidence that the fish in Las Vegas Bay have better condition factors, and lower mercury levels, than fish outside Las Vegas Bay.

The differences identified by Cizdziel are consistent with earlier work done by the consultant V. W. Kaczynski, who compared fish in the inner Las Vegas Bay with fish in a control embayment outside Las Vegas Bay. (Kaczynski 1990.) He found that fish and invertebrates were much more plentiful in inner Las Vegas Bay: "at least 1,000 to 10,000 percent greater than the control". (*Id*. at 2.) "More fish (and especially schools of smaller fish) were found in Las Vegas Bay". (*Id*.) "Fish spawned very successfully in inner Las Vegas Bay (much more than the control bay)" and "inner Las Vegas Bay became a very productive nursery area." (*Id*.) "Individual fish in Las Vegas Bay generally were larger and had a higher condition factor (more plump) than their counterparts in Boulder Basin." (*Id*.) The fish in Las Vegas Bay were healthy: "The health of these wild fish populations, as indicated by incidence rate and degree of tissue abnormalities and parasite loads, appears normal." (*Id*.) Kaczynski's study, therefore, directly contradicts the assertion that the propagation of fish in Las Vegas Bay is impaired.

Finally, there is eyewitness evidence that carp are plentiful where Las Vegas Wash flows into the lake. For many years there was a marina not far from that location. The marina was there when I first visited Lake Mead in 1978, and it remained there until the early 2000s, when falling lake levels caused it to be moved to a location along Boulder Beach. I walked out onto the marina, where there was a store and an eatery, at least dozens of times over the years. Carp could always been seen swimming around the marina. The marina store sold popcorn, which was often used to feed the fish. When popcorn started falling, at least hundreds of carp, and perhaps thousands, would gather. They were pressed so tightly together that ducks would walk on their heads, entirely out of the water, to get to the popcorn before it reached the fish. I am enclosing a photo I took, in approximately the early 1990s, showing some of the fish at the old marina location. I observed no apparent decrease in the number of fish at the old marina location

over the years. These observations provide evidence that carp are plentiful near the mouth of Las Vegas Wash, which is where discharges from the treatment plants enter Lake Mead.

In short, the available data on fish in Las Vegas Bay and Lake Mead show that fish are propagating and abundant. These data all tend to contradict CBD's argument that substances flowing into the lake from Las Vegas Wash have impaired the fishery.

III. THE SUBSTANCES AT ISSUE ARE NOT CAUSING TAKE

To establish take, CBD says, it must show "'significant habitation modification or degradation' that 'actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." (CBD Letter at 8-9.) CBD asserts that the substances at issue "are likely injuring wildlife by disrupting behavior patterns such as breeding ability." (*Id*. at 9.) But CBD cannot back up this assertion, and the ongoing studies of razorbacks in Lake Mead support the opposite conclusion.

In support of its assertion that razorbacks are being harmed, CBD cites to a report on intersex roach in Great Britain. (*Id*. at 9.) This study has no apparent relationship to razorbacks in Lake Mead. CBD's point seems to be that the effects seen in intersex fish can affect reproduction. But the razorbacks in Lake Mead are not intersex fish.

CBD argues that "[d]istinct differences have been found in razorback suckers from Las Vegas Bay and razorback suckers from other locations." (*Id*. at 8.) CBD cites to a letter (not a scientific study) that does indeed use the phrase "distinct differences". (FWS 2001 at 4.) But the letter makes clear that it was merely comparing two razorbacks that were accidentally killed. Once was an adult from Las Vegas Bay, the other was a juvenile from another location in Lake Mead. And the distinct differences were in the concentrations of organochlorine compounds and selenium that they had accumulated, not in any hormonal or histopathological effects.

CBD also cites to this letter for the proposition that there are hormonal differences between razorbacks in Las Vegas Bay and elsewhere. But the letter provides nothing more than a hearsay report that there were hormonal differences in three species. It does not provide the data to support this contention, or even make clear what data were collected from each of the three species. (*Id*. at 3-4.)

CBD does not provide any of the data collected by the consultant Bio-West, which has been studying razorbacks in Lake Mead since the mid-1990s. Bio-West reports that razorbacks have become endangered because of the construction of dams, which have replaced the warm

Colorado River habitat with a cold reservoirs and tailwaters, and because of predation by non-native fish. (Kegerries 2009a at 1.) Direct monitoring of razorbacks shows that they have been spawning in Las Vegas Bay, and successfully moving their spawning location as the level of Lake Mead has dropped. (*Id*. at 35 and figure 7.) More razorbacks have been spawned in Las Vegas Bay than in other areas of the lake. (*Id*., figure 14.)

The razorback population in Lake Mead has become "self-sustaining, with natural, wild recruitment"—that is, by adding individuals to the razorback population through natural reproduction and survival. (Kegerries 2009b, slide 4.) Recruitment of razorbacks appears to be related to "the presence of inundated vegetative cover". (*Id*., slide 10.) In other words, razorbacks live long enough to become adults when they have cover that allows them to hide from predators, in particular stripers. The current state of razorback suckers in Lake Mead is best summed up by Kegerries' conclusion:

> The Lake Mead population of razorback sucker is one of the only populations that has shown continued, natural recruitment in the [Colorado River] basin[,] and razorbacks in Lake Mead are doing GREAT!

(*Id*., slide 18, emphasis in original.)

Because the razorbacks are doing great, and are naturally reproducing and increasing their population, there is nothing in Lake Mead that "actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." (*See* CBD Letter at 8-9.)[4]

IV. DRINKING WATER IS NOT IMPAIRED

Next, CBD asserts that the substances at issue "may be . . . contaminating Las Vegas' drinking water", and that "[t]he Saddle Island intake structures for Las Vegas' drinking water [are] only six short miles downstream of the Las Vegas Wash". (CBD Letter at 9.) Once again, speculation that something "may be" happening is not evidence that it actually is happening. Also, CBD may not be aware that Lake Mead is rarely fully mixed, and that the inflow from Las

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[4] CBD also asserts that "NDEP is likely already engaging in take . . . by failing to protect the water quality of these waterbodies". (CBD Letter at 9.) But it provides no authority for this remarkable proposition.

Vegas Wash almost always is found at an elevation different from the depths of the intakes, which draw Colorado River water from upstream. The data CBD cites were not taken at the intake depths, and are therefore not relevant to the question of whether any of the substances at issue are found in drinking water. CBD provides no data on the drinking water itself. Without data on the drinking water, there cannot be enough relevant data to find impairment of the drinking-water use.

V. THE WATERS ARE NOT IMPAIRED FOR FISH OR WILDLIFE

CBD asserts that the substances at issue are impairing two beneficial uses—the propagation of wildlife and the propagation of aquatic life, including fish—in Lake Mead, inner Las Vegas Bay, and Las Vegas Wash. (CBD Letter at 10-11.) But CBD has not submitted any evidence that the propagation of wildlife is being impaired. As explained above, the evidence CBD has submitted on fish is not enough to show that the propagation of fish is being impaired, and there is good evidence to the contrary.

CBD argues that "NDEP has set standards for some of these pollutants" and that "these standards are either being exceeded *or are not stringent enough* as they are being detected in both the waterbodies and in fish and wildlife and are preventing the beneficial uses of the waterbodies". (*Id*. at 13, emphasis added.) Let's take this sentence in three parts. If the first part of this argument were true—if the standards actually were being exceeded—then CBD's task would be simple. It would identify the standard and provide the data showing an exceedance. We gather, however, that CBD has not actually shown any exceedance.

In the second part if the sentence, CBD asserts that the standards are not stringent enough. But revising water-quality standards is not part of the 303(d) listing process.

In the third part of the sentence, CBD gives a reason for its assertion that the standards are not stringent enough: The substances at issue are being *detected*, and therefore (it says) the beneficial uses are being impaired. This is the essence of CBD's argument. Mere detection, it says, is impairment. But CBD is wrong. CBD acknowledges that, under endangered-species regulations, "harm" is not merely any measureable difference to an endangered species. Harm is degradation that "actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." (*See* CBD Letter at 8-9.) Under the Clean Water Act, impairment of a beneficial use is not merely a measureable difference in species of fish. Impairment requires population-level effects. Here there is no evidence that fish are being harmed at the population level, and there is substantial evidence that they are not.

For these reasons, CBD's listing requests should be denied.

Thank you for this opportunity to comment, and please call with any questions.

Sincerely,

Lawrence S. Bazel

cc (by mail):

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Enclosures:

1. L. Bazel (early 1990s), photo taken at Las Vegas Wash Marina, Lake Mead.

2. R. Kegerries et al., Bio-West, Inc. (2009a) Razorback Sucker Studies on Lake Mead, Nevada and Arizona, 2008-2009 Final Annual Report

3. R. Kegerries et al, Bio-West, Inc. (2009b) Lake Mead Razorback Suckers: An informative anomaly regarding continued, natural, wild razorback sucker recruitment despite nonnative fish presence (powerpoint presentation available at http://www.lakemeadsymposium.org/a1/a1.htm)

4. J. Czdziel et al (undated) A New Analytical Technique for Measuring Mercury in Fish Tissue.

5. J. Czdziel et al. (2003) Distribution of mercury in the tissues of five species of freshwater fish in Lake Mead, USA

6. J. Hinck et al. (2006) Biomonitoring of Environmental Status and Trends (BEST) Program: Environmental Contaminants, Health Indicators, and Reproductive Biomarkers in Fish from the Colorado River Basin

7. V. W. Kaczynski (1990) Las Vegas Bay Fisheries Ecology And Toxicology Study.

8. NDOW (2009) Federal Aid Job Progress Reports, F-20-44, Lake Mead, Southern Region

9. EPA, OW/ORD Emerging Contaminants Workgroup (2008). Draft White Paper, Aquatic Life Criteria For Contaminants of Emerging Concern, Part I, General Challenges and Recommendations