HUMBOLDT BAYKEEPER®

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January 31, 2006

Craig J. Wilson, Chief
Water Quality Assessment Unit
Division of Water Quality
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100
FAX: (916) 341-5550

Re: Comments on September 2005 Draft "Revision of California's Clean Water Act Section 303(d) List of Water Quality Limited Segments"

Dear Mr. Wilson:

On behalf of the staff and supporting members of Humboldt Baykeeper I would like to submit the attached letter requesting the inclusion of Humboldt Bay on California's 2006 List of Impaired Water Bodies. We appreciate the effort of yourself and your staff in completing this list, and would like to thank you for providing us the opportunity to provide you with our comments.

Humboldt Bay is currently listed as impaired for PCBs, but is also impaired by pentachlorophenol and polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-p-furans. The proposed list for 2006 does not include, or even analyze, this listing. We believe that contaminant levels show the need for this listing. The attached petition includes data that supports this listing.

Thank you,

Michelle D. Smith

Michelle D. Smith
Staff Attorney
Humboldt Baykeeper
422 First Street, Suite 'G'
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I. Introduction.

Humboldt Bay is impaired for both polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-p-furans (hereinafter "dioxin") and pentachlorophenol (hereinafter "penta"). Under the Clean Water Act California is required to list as impaired any water body that does not meet water quality standards. The levels of dioxin and pentachlorophenol that are found in Humboldt Bay preclude the ability of the Bay to meet applicable water quality standards. In California, water quality standards are comprised of the beneficial uses and the water quality objectives found in the Basin Plan of each region. For Humboldt Bay, the applicable Basin Plan is the Water Quality Control Plan for the North Coast Region. High levels of both dioxin and pentachlorophenol have been found in local sediments, crabs and oysters, negatively impacting the beneficial uses of Humboldt Bay.

II. The Humboldt Bay Environment

Located approximately 250 miles north of San Francisco on California's rugged North Coast, Humboldt Bay is the second largest natural bay in the state, smaller only than San Francisco Bay. Humboldt Bay is one of the largest and most biologically important coastal estuaries in California. Its wetlands, intertidal mudflats and marshes provide essential habitat for a great diversity of life, including approximately 141 invertebrate species, 115 fish species (of which at least 50 are resident) and 251 bird species. The diverse flora and fauna make the Bay highly attractive for educational, scientific, and recreational purposes. Humboldt Bay is used extensively for kayaking, diving, surfing, bird watching, nature photography, and the study of natural history, ecology and marine sciences.

For management purposes, Humboldt Bay consists of three segments: Entrance Bay, South Bay and North, or Arcata, Bay.[1] South Bay is a relatively pristine section of Humboldt Bay, with the southern extent comprised of the Humboldt Bay National Wildlife Refuge. Entrance Bay includes the entrance channel and the ports of Fields Landing, Samoa, and Eureka. Arcata Bay encompasses the northern most stretches of Humboldt Bay and includes areas used most extensively for aquaculture activities. For purposes of the CWA section 303(d) listing, only the Entrance and Arcata Bays are impacted by pentachlorophenol and dioxin contamination, and are thus required to be listed under the Act.[2]

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[1] *See* figure *from* Humboldt Bay Harbor, Recreation, and Conservation District Draft Humboldt Bay Management Plan, July 2005.

[2] In fact, sediments, mussels and crabs collected from South Bay have been analyzed both for penta and dioxin and show low to non-detect concentrations of both substances. *See* Marc Lappe', Report: Potential and Likely Environmental and Human Health Effects From Off-Site Movement of Chemicals From Sierra Pacific Industries Site at 2293 Samoa Road, Arcata, California, Table 1 (April 12, 2002). This data was collected in conjunction with a suit brought by local environmental groups against Sierra Pacific Industries, Arcata Division Sawmill that the North Coast Regional Water Quality Control Board and subsequently the State Water Resources Control Board became involved in. This suit resulted in a consent decree whereby continuing sampling for dioxins has occurred. Such sampling data is delivered directly to the Regional Board.

Existing beneficial uses of Humboldt Bay include: municipal and domestic supply; agricultural supply; industrial service supply; freshwater replenishment; navigation; water contact recreation; non-water contact recreation; commercial and sport fishing; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; marine habitat; migration of aquatic organisms; spawning, reproduction, and/or early development of fish; shellfish harvesting; estuarine habitat; aquaculture; Native American Culture.[3] Though not all of these uses are impacted by the existing dioxin and penta levels, most are. Penta and dioxin exposure result in health impacts from both ingestion and dermal exposure, from sport fishing and other recreational use. The existing contamination has impaired Humboldt Bay's use for commercial fisheries and for aquaculture, both from the direct impacts to the resources that existing contamination causes, and due to the health effects, human and wildlife, that result from exposure to such contamination. Each and every organism that contacts Humboldt Bay is affected by the penta and dioxin contamination found there.

The Bay is an important spawning and nursery ground for numerous fish and other aquatic species, hosting halibut, perch, green and white sturgeon, Pacific herring, lingcod, Dungeness crab, rock crab, rockfish, salmon, oysters, and clams. Humboldt Bay provides a critical link for migrating and wintering water birds in the chain of diminishing coastal wetlands from the Arctic Circle to South America, annually supporting millions of waterbirds, shorebirds, raptors, and songbirds. The Bay also supports large commercial and sport fishing, clamming, oystering and other seafood industries. Indeed, of California's twelve shellfish reserves set aside for public clamming and oystering, seven are located within Humboldt Bay. The Bay is also essential habitat for myriad mammal species, as more than 30 species of mammals have been found in and around the Bay. The populations of many of these plant and animal species have declined so dramatically that protection under the California and/or federal Endangered Species Acts has become necessary to prevent their demise. Such species include the Western lily, Menzie's Wallflower, Beach Layia, Marbled Murrelet, Brown Pelican, Western Snowy Plover, Aleutian Canada Goose, Peregrine Falcon, Gray Whale, Coho Salmon, Chinook salmon, and Steelhead Trout.

III. Pentachlorophenol Use Around Humboldt Bay

For several decades timber companies used the fungicide pentachlorophenol ("penta" or "PCP") to preserve lumber at their mills. Penta is itself a potent carcinogen, but more importantly, commercial-grade penta contains dioxin. Being one of the most potent reproductive and developmental toxins, there is no safe level of exposure to dioxin. Penta is a known carcinogen and also contains extremely toxic dioxin and furan impurities. Dioxins are considered by many to be the most potent carcinogenic chemicals known and, even in very small quantities, may disrupt the functioning of the human endocrine system. Particularly devastating is the harm caused to the endocrine system of a developing fetus. These chemicals are extremely long lived, bio-accumulating in the tissues of fish like salmon, shark, halibut, perch, crabs and other shellfish, causing a health hazard to people and wildlife who consume the contaminated fish.

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[3] *See* North Coast Regional Water Quality Control Board, Water Quality Control Plan for the North Coast Region ("Basin Plan"), at 2-8.00 (2005).

Timber companies applied these chemicals sloppily at their mills - using massive dip tanks and spray operations – and nearly all mills that treated wood are contaminated with penta and dioxin. The precise number of these mills is unknown, though there were an estimated 200 mills historically located around the Bay, and there are at least seven confirmed locations adjacent to Humboldt Bay.[4] Because it is so persistent in the environment, dioxin continues to be discharged from these mills indirectly into Humboldt Bay from local streams and rivers and additionally directly into Humboldt Bay from the sites located on its shores. Other sources of dioxin contamination exist, including Humboldt Bay's two pulp mills (one has been deactivated but continues to be a source of contamination), and scattered sources such as wood stoves, vehicles, and other combustion sources.

The methods of wood treatment which led to local contamination and subsequent pollution of Humboldt Bay are surface and penetrating treatments. Surface treatment of lumber is commonly used to provide short-term cosmetic protection against mold and sap stains. Surface treatment chemicals are often applied by using dip tanks and spraying operations. Penetrating wood treatment generally involves the penetration of preservative solutions into wood to provide longer-term protection from the damaging effects of fungi and insects. Both treatment methods are highly toxic and leave behind soil, surface water and groundwater contamination. The highly toxic chlorophenolic compound pentachlorophenol was widely used for both surface treatment and penetrating wood treatment from the 1950's until the use was restricted in the 1980's.

IV. Dioxin Toxicology

Dioxins and furans are the name used to refer to a class of highly toxic chemicals known as polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). They are made up of a number of congeners, with the most highly toxic being 2,3,7,8-TCDD. In order to normalize analysis, the concepts of the Toxicity Equivalent, or TEQ, and the Toxic Equivalency Factor, or TEF, has been developed. This equivalency method is based on summing the TEQs of 17 PCDD/PCDF congeners in each sample. The TEQ is calculated by multiplying the concentration of each PCDD and PCDF congener by the corresponding 1998 World Health Organization Toxic Equivalency Factor or TEF. The TEF is a value assigned to each of the dioxin and furan congeners based upon its toxicity relative to the toxicity of 2,3,7,8-TCDD. The TEFof the most potent PCDD/PCDF congener, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), is 1.[5]

Dioxins are extremely stable substances in the environment, remaining for extended periods of time once they are released. Studies show that some dioxin congeners in soil have a half life ranging from 25 to 100 years, though the binding of it to soil may in fact become permanent due to soil encapsulation by organic and mineral matter.[6] There is evidence, however, that anaerobic degradation of some congeners in sediments can occur at very slow rates. This degradation process

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[4] *See* Environmental Protection and Information Center and Californians to Alternatives to Toxics, Map of Pentachlorophenol Sites on Humboldt Bay, Forgotten But not Gone, (February 2002) *available at* http://www.wildcalifornia.org/cgi-files/0/images/1058599348_Humboldt_Bay_map_of_Pentachlorphenol_sites.jpg;
[5] FDA, Dioxin Analysis Results/Exposure Estimates, *at* http://www.cfsan.fda.gov/~lrd/dioxdata.html (June 2005).
[6] U.S. EPA, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS) Review Draft, Part I, Vol. I, at 2-34 (December 2003), *available at* http://www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part1_vol2/dioxin_pt1_vol2_ch02_dec2003.pdf.

appears to involve the de-chlorination of the higher-chlorinated congeners of dioxin into the lower, and more toxic, chlorinated congeners.[7]

Penta and dioxin are hydrophobic chemicals. As such, they are not generally found in high concentrations in the water column itself. Low to non-detect results from the water column therefore does not indicate nor ensure that a location is clear of either dioxin or penta. When discharged both substances bind themselves to organic materials, such as sediments, soils, and vegetative matter, and subsequently enter the food chain either through direct ingestion or through the ingestion of materials to which they have "sorbed", or attached, themselves.

Dioxins do not independently migrate readily in soils or sediments. They do, however, migrate readily in soils when there is a substance present to act as a solvent, such as waste oil or diesel.[8] The historical application practices that led to the contamination of local soils and groundwater involved either dissolving the penta in water or in oil or solvent that would act as a carrier for the preservative. The majority of these locations additionally had petroleum products such as diesel, gasoline, and motor oil onsite, substances used for a variety of activities. Just as the penta was often spilled or leaked into the environment, so too were these petroleum products often spilled or leaked into the environment. The sloppy practices that occurred at these locations resulted in their contamination with the carriers as well as the penta and dioxin themselves. Thus an oil or solvent carrier is available, sometimes directly mixed with the penta and dioxin, to act as a mobilizer for the dioxin to use and move through the environment, including soils and groundwater, and into the Bay.

Organisms have been shown to accumulate dioxins when exposed to contaminated sediments and also to bio-concentrate dioxins dissolved in water. However, because most dioxins in the water column and sediment are associated with particulate matter and dissolved organic matter, the accumulation observed in the environment is primarily food chain-based starting with uptake by benthic organisms (e.g., mussels, chironomids) directly from sediment pore waters and/or by ingestion or filtering of contaminated particles. Those organisms consuming benthic organisms (e.g., crayfish, suckers) would then pass the contaminants up the food chain.[9]

V. Legal Basis for the Listing of Humboldt Bay as Impaired for Dioxins and Penta

Federal regulations promulgated to implement the Clean Water Act require each state to identify those water quality limited segments for which effluent limitations or other pollution control requirements are not stringent enough to implement any of the water quality standards applicable to such waters.[10] The federal regulations clearly require States to identify waters on the Section 303(d) list if any component of the applicable water quality standards, including narrative criteria, is not being implemented. For the purposes of listing waters under Sec. 130.7 (b), the term ``water quality standard applicable to such waters'' and ``applicable water quality standards'' refer to those water

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[7] *Id.* at 2-15 to 2-16.
[8] *Id.* at p. 2-36.
[9] *Id.* at 2-38 (citing Muir et al., 1992; Fletcher and McKay, 1992; U.S. EPA, 1993).
[10] 40 C.F.R. 130.7(b)(1)

quality standards established under section 303 of the Act, including numeric criteria, narrative criteria, waterbody uses, and antidegradation requirements.[11]

The specific water quality standards applicable to Humboldt Bay with regards to dioxin and penta include, but are not necessarily limited to, the numeric and narrative requirements found in the Regional Water Quality Control Plan for the North Coast Region ("Basin Plan") and the California Toxics Rule ("CTR") found at 40 CFR 131.38. Under the Basin Plan there are specific water quality objectives that apply to Humboldt Bay and general water quality objectives that apply to all enclosed bays and estuaries such as Humboldt Bay. Specific objectives of the Basin Plan that are violated in Humboldt Bay due to the presence of dioxin and pentachlorophenol include toxicity, pesticides, and chemical constituents.

The Water Quality Objective for toxicity in the Basin Plan states "All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life."[12] Current levels of both penta and dioxin violate this standard. Penta and dioxin exposure in very low concentrations can lead to "detrimental physiological responses". Results of oral animal studies show that the effects from dioxin exposure that will occur at the lowest doses include immune, endocrine, and developmental effects.[13] For example, long term exposure to dioxin at levels of less than 1 pptr can lead to reproductive and developmental problems: such a level is lower than those found in the sediments and oysters of Humboldt Bay.[14] Long-term exposure to low levels of Pentachlorophenol such as those that occur in the workplace can cause damage to the liver, kidneys, blood, and nervous system.[15] Studies in animals also suggest that the reproductive, endocrine and immune system can also be damaged following long-term exposure to low levels of pentachlorophenol.[16]

The Basin Plan's Water Quality Objective for pesticides states "No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no bioaccumulation of pesticide concentrations found in bottom sediments or aquatic life."[17] Dioxin and pentachlorophenol are covered by the Basin Plan's water quality objective regarding pesticides and pesticide concentrations.[18] They are present in Humboldt Bay in concentrations that adversely affect beneficial uses and they are bioaccumulating in both sediments and aquatic life. Dioxin has been found in Humboldt Bay sediments at values ranging from 1.4 pptr (TEQ) to 15.6 pptr (TEQ), it has been found in commercial oysters at values ranging from .8 pptr (TEQ) to 4.3 pptr (TEQ).[19] Dioxins have also been found in local crabs at levels ranging from .13

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[11] 40 C.F.R. 130.7(b)(3); *see also*....Memorandum from Diane Regas, Office of Wetlands, EPA Guidance for 2004 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act; TMDL-01-03, July 21, 2003, *at* 20, *available at* http://www.epa.gov/owow/tmdl/tmdl0103/2004rpt_guidance.pdf.

[12] Basin Plan at 3-4.00

[13] Agency for Toxic Substances and Disease Registry, Toxicological Profile for Chlorinated Dibenzo-p-Dioxins (update), Public Health Statement at 12 (1998).

[14] *Id.* at 126.

[15] Agency for Toxic Substances and Disease Registry, Toxicological Profile for Pentachlorophenol, Public Health Statement, at §1.5, (September 2001) *available at* http://www.atsdr.cdc.gov/toxprofiles/phs51.html.

[16] *Id.*

[17] Basin Plan at 3-4.00

[18] Basin Plan at 3.4.

[19] ENVIRON, Evaluation of the results of Dioxin and Pentachlorophenol Testing of Commercial Oyster Beds in Humboldt Bay, California, at p. 11 (July 18, 2002).

ppt TEQ to 11.41 ppt TEQ.[20] Penta has been found in local mussels at values ranging from 4.2 ppb to 960 ppb.[21] These levels show a bioaccumulation in both sediments and aquatic life. They also negatively impact the beneficial uses of Humboldt Bay, such as municipal and domestic supply; both contact and non-contact water recreation; commercial and sport fishing; cold water habitats; wildlife habitat; rare, threatened, or endangered species; marine habitat; migration of aquatic organisms; spawning, reproduction, and/or early development; shellfish harvesting; estuarine habitat; aquaculture; and Native American culture. With regards to the beneficial uses related to local fauna, there is the requirement that such uses support "the preservation or enhancement" of the species that are addressed by the designated beneficial use, or that they "support high quality habitats". These beneficial uses are not being met when these species are being exposed to, and are consuming, levels of dioxin and penta as are found in the Bay.

Regarding human use beneficial uses, such as shellfish harvesting and commercial or sport fishing, for example, the levels of dioxin that have been found exceed the OEHHA screening level (the level used by the State Board in the Evaluation Guideline for the Protection of Human Health from the Consumption of Fish and Shellfish), of 0.3 ng/kg for tissue samples.[22] Additionally, the EPA has developed a fact sheet relating to dioxins and fish advisories. EPA recommends consuming no fish with contaminant levels exceeding 1.2 ppt TEQ of dioxin and restricting consumption of fish consumption to less than .5 fish meals per month of fish that have contaminant levels ranging from .62 to 1.2 ppt TEQ.[23]

The California Toxics Rule (CTR) establishes limits for both dioxin and penta for the protection of human health for the consumption of water and organisms, and human health levels for the consumption of organisms only. As noted above, dioxin and penta are hydrophobic chemicals. Thus, they are not often found in concentrations that exceed the water quality objectives in the water column itself. They are, however, found in concentrations in the sediments and aquatic life that exceed those concentrations. The CTR sets a limit for dioxin in waters that are designated for municipal use, such as Humboldt Bay, at a 0.000000013 ppt human health level for consumption of water and organisms, and at 0.000000014 ppt for consumption of organisms only. The levels established by the CTR for penta are an 0.28 ppt human health level for consumption of water and organisms, and an 8.2 ppt human health level for consumption of organisms only. Though these limits are established for the water column itself, the fact that they are exceeded by both penta and dioxin in the organisms that have been sampled in Humboldt Bay illustrates the extent of the impairment of the Bay.[24]

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[20] Marc Lappe', Report: Potential and Likely Environmental and Human Health Effects From Off-Site Movement of Chemicals From Sierra Pacific Industries Site at 2293 Samoa Road, Arcata, California, Table 1 (April 12, 2002). These samples were taken of yellow shore crab, rock crab, and red crab. The highest TEQ was found in yellow shore crabs, a species that is not consumed by humans. Marc Lappe's declaration used the EPA TEFs, not the WHO TEQ's as currently adopted. The references in theis paragraph has been corrected to reflect concentrations using the WHO TEQs.

[21] California State Mussel Watch data, *available at* http://www.waterboards.ca.gov/programs/smw/index.html.

[22] State Water Resources Control Board, Draft Staff Report Revision of the Clean Water Act 303(d) List of Water Quality Limited Segments, Table 2 at p. 8-9 (September 2005).

[23] Environmental Protection Agency, Office of Water, Fact Sheet, Polychlorinated Dibenzo-p-dioxins and Related Compounds Update: Impact on Fish Advisories, at 4 (September 1999).

[24] *See* California State Mussel Watch Data, SMW Program Data 1977-2000 , *available at* http://www.waterboards.ca.gov/programs/smw/index.html; Sierra Pacific Industries data *available at* http://www.waterboards.ca.gov/northcoast/geninfo/sp/sierrapac.html; ACOE data, attached.

VI. Recent Sampling Shows High Levels of Penta and Dioxin in Humboldt Bay

Though the water column of Humboldt Bay has never been sampled for dioxin or penta, both Bay sediments and Bay fauna has been sampled and analyzed. The Army Corps of Engineers samples Bay sediments for dioxin prior to dredging, both during their maintenance dredges and during their channel deepening project; the State Water Resources Control Board sampled both native and transplanted California mussels for penta as part of the State Mussel Watch Program; the Humboldt Bay Harbor Recreation, and Conservation District and the City of Eureka recently sampled for both penta and dioxins as part of their harbor maintenance dredge project; and sampling has been (and continues to be) conducted as part of a consent decree entered between Sierra Pacific Industries and the North Coast Regional Water Quality Control Board.

In identifying the waters for which effluent limitations are not stringent enough to implement water quality standards, states are required to assemble and evaluate "all existing and readily available water quality-related data and information. 40 CFR 130.7(b)(5). "At a minimum "all existing and readily available water quality-related data and information" includes but is not limited to all of the existing and readily available data and information about waters for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions. These organizations and groups should be actively solicited for research they may be conducting or reporting."[25] The data regarding the contamination of Humboldt Bay with dioxins and pentachlorophenol is "readily available". Most, if not all, of this data is included in the Regional Board files, and is incorporated herein by reference.[26]

A. California State Mussel Watch Data

From 1977 to 2000 the state of California conducted what is known as the State Mussel Watch Program (SMWP). This program sampled native and transplanted California Mussels, as well as occasional oysters, for various chemical constituents in order to develop a picture of the state of California's waters. The SMWP provided the State Water Resources Control Board (SWRCB) with a uniform statewide approach to the detection and evaluation of the occurrence of toxic substances in marine waters. The SMWP primarily targeted areas with known or suspected impaired water quality. The SMWP data was compiled by the state and is available on the SWRCB website.[27]

The SMWP data contain levels of pentachlorophenol found in local native and transplanted California mussels. Though pentachlorophenol was a known contaminant of concern in Humboldt Bay, the samples were only analyzed for penta in the years 1983 to 1992. The samples show elevated levels of penta in wet weight concentrations ranging from .6 parts per billion (ppb) wet weight concentration at the Eureka Sewage Treatment Plant control site in 1984 to 153.6 ppb wet

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[25] 40 C.F.R. 130.7(b)(5)(emphasis added).

[26] The North Coast Regional Water Quality Control Board maintains files on a number of the sites in the Humboldt Bay region that have used pentachlorophenol in the past. A list of such sites and their corresponding Regional Board file numbers is attached.

[27] *See* California State Mussel Watch Data, SMW Program Data 1977-2000., *available at* http://www.waterboards.ca.gov/programs/smw/index.html

weight concentration at the Mad River Slough in 1984.[28] More recent results show .7 ppb in 1990 at the Eureka Sewage Treatment Plant control site and 32 ppb at the Mad River Slough. Additional analysis was conducted of percent lipid concentration as well as dry weight concentrations of pentachlorophenol.[29] These State Mussel Watch data are evidence of violations of water quality objectives, including the objectives established for toxicity and pesticides.

B. Army Corps of Engineers Data

Data regarding sediments from Humboldt Bay is collected and compiled by the Army Corps of Engineers ("ACOE") during various dredging projects they undertake in the Humboldt Bay shipping channels. These channels are located in North and Entrance Bay, and include the Samoa Turning Basin, the Fields Landing Turning Basin, and the Eureka Channel.[30] These sampling events include, but are not limited to: a Baseline Survey conducted in 1993, 1994, and 1995; additional sampling conducted in 1991 for the Channel Deepening Project; and the Eureka Channel maintenance project conducted in 1999.

The dioxin and furan congeners 2,3,7,8-TCDD and 2,3,7,8-TCDF were sampled in the 1993 and 1994 Baseline Surveys. The 1993 sampling event had non-detect results for all dioxin and furan congeners with detection limits set at .24 parts per trillion (ppt) and .39 ppt, respectively. The 1994 sampling event found 2;3,7,8-TCDF at .51 ppt, dry weight and total TCDF at .94 ppt dry weight from samples taken in the Eureka Channel, with all other samples non-detect and a detection limit of .22-.33 ppt for TCDD and .13-.45 ppt for TCDF. These results are unsurprising as 2,3,7,8-TCDD and 2,3,7,8-TCDF are not generally associated with penta. The 1995 Baseline survey, where analysis for the higher chlorinated congener PCDD, showed different results. Total PCDD ranged from 87.03 ppt to 621.49 ppt, while total PCDF ranged from 3.65 ppt to 84.7 ppt The calculated TEQs from this sampling event ranged from .76 to 3.5 ppt[31]

From 1988 to 2000 various studies were conducted regarding the proposed deepening of Humboldt Bay's shipping channels in order to facilitate increased shipping and port development on Humboldt Bay. The sampling for the 1999-2000 Humboldt Bay Channel Deepening project, conducted in 1991, detected octachlorinated dibenzodioxins ("OCDD") at 79 and 2.2 ppt in sediments from the Samoa Turning Basin at depths from the mudline to -44 MLLW. During this sampling event there were detectable levels of several other dioxin and furan congeners, including the most toxic 2,3,7,8-TCDD at .3 ppt and 2,3,7,8-TCDF at 1.6 ppt.

The 1999 maintenance dredge of the Eureka Channel consisted of a total of 12 samples which were composited into 3 samples for analytical purposes taken from the Eureka Channel. The results of these samples showed PCDD and PCDF occurring in all three locations. Total PCDD results ranged from 10.5ppt, at the most northerly location, to 373.4 ppt, from the middle stretch of the

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[28] *See* California State Mussel Watch Data, *available at* http://www.waterboards.ca.gov/programs/smw/index.html.
[29] *See* California State Mussel Watch Data, SMW Program Data 1977-2000 , *available at* http://www.waterboards.ca.gov/programs/smw/index.html
[30] *See* figure attached *from* Humboldt Bay Harbor, Recreation, and Conservation District Draft Humboldt Bay Management Plan, July 2005..
[31] *See* State Water Resources Control Board, Chlorinated Dibenzo-p-dioxin and dibenzofurans Contamination in California from Chlorophenol Wood Preservative Use, Report No. 88-5WQ Division of Water Quality (March 1988).

Channel, and total PCDF results ranging from 1 to 73.8 ppt, from the same relative locations. The calculated TEQs for this sampling event were .092, .95, and 2.2.

C. Sierra Pacific Industries Consent Decree

There is additional sediment and oyster data available as a result of sampling done in conjunction with a consent decree entered into by the State Board and Sierra Pacific Industries.[32] Sierra Pacific Industries operates a lumber mill in Arcata, California. This mill is located directly adjacent to the Mad River Slough, a tributary of Humboldt Bay, and just across Highway 255 from the Bay itself.

On June 21, 2002 Sierra Pacific Industries' consultant, ENVIRON, collected oysters and sediment from 9 commercial oyster beds in Humboldt Bay. They additionally collected oysters and mussels from a storage platform located in the Mad River Slough, a tributary of Humboldt Bay.[33] Approximately 12-24 oysters were collected from each of the commercial oyster beds, and approximately 50-60 mussels were collected from the storage platform. Additionally, sediment samples were collected from four of the commercial oyster beds. From these samples, ten composite samples of whole oyster tissues and one composite sample of mussel tissue were analyzed for dioxins, furans, and pentachlorophenol.

The total dioxin concentration found in the oysters ranged from 36 to 174 ppt. The total dioxin TEQ in oysters ranged from 0.08 to 4.3 pg TEQ /gram. Of the ten composite oyster samples all except two exceeded the EPA monthly fish consumption limit of 1.2 ppt TEQ. The dioxin TEQ in the mussel sample was 1.0 pg TEQ/ gram, while the total dioxin concentration was 91 ppt.[34] Under EPA's monthly fish consumption limit, consumption of mussels should be restricted to no more than .5 fish meals per month.

In 2004-2005, pursuant to a court order, Sierra Pacific Industries' consultant, Geomatrix , performed sediment and tissue sampling and dioxin analyses for a Scoping Ecological and Human Health Risk Assessment of Humboldt Bay and the Bay's Mad River Slough. Geomatrix found extremely high levels of dioxin in shallow Bay sediments (up to 114.3 ppt/TEQ) and found levels in fish tissues that ranged from .03 ppt TEQ to .39 ppt TEQ. Under EPA guidance consumption would be limited to no more than three times a week, on the high end, to no more than one meal per month.[35] These results are somewhat misleading, however, due to the fact that only the filets were sampled and all skin was removed.[36] The results and conclusions from the risk assessment are currently being reviewed by Humboldt Baykeeper's consultants and state agencies including California's Office of Environmental Health Hazard Assessment.

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[32] Data is available at http://www.waterboards.ca.gov/northcoast/geninfo/sp/sierrapac.html. Additional data which has not been posted on the North Coast Regional Water Quality Control Board's website, yet which shows high levels of dioxins, have been attached.

[33] ENVIRON, Evaluation of the results of Dioxin and Pentachlorophenol Testing of Commercial Oyster Beds in Humboldt Bay, California, at p. 11 (July 18, 2002).

[34] *Id.* at 14.

[35] Geomatrix, Supplement to Scoping Ecological and Off-Site Human Health Risk Assessment Sierra Pacific Industries Arcata Division Sawmill Arcata, California, at table 2 (October 2005).

[36] *Id.*

D. Humboldt Bay Harbor, Recreation, and Conservation District and the City of Eureka Sampling

In November of 2005 the Humboldt Bay Harbor, Recreation, and Conservation District and the City of Eureka conducted sampling of sediments from the Eureka Channel in order top conduct analysis for dioxins, furans, and pentachlorophenol. The California Coastal Commission required this sampling as a prerequisite to a permit for a proposed dredge project for the Woodley Island Marina and 11 Eureka Waterfront moorage facilities (all located in the Eureka Channel). A total of 55 sediment core samples were collected from the 12 locations.

Dioxin levels found in the samples taken from these 12 locations ranged from .78 ppt TEQ to 6.03 ppt TEQ, with the overall TEQ ranging from 1.78 ppt TEQ to 7.70 ppt TEQ.[37] Levels of 2,3,7,8-TCDD, the most toxic of the dioxin congeners, ranged from .49 to .68 ppt[38] The EPA's Environmental Monitoring and Assessment Program sampled approximately 56 sites in San Francisco Bay in 2000 and found mean and median TEQs of 5 pptr and 2pptr, respectively, which effectively represents the background dioxin TEQ for San Francisco Bay.[39] San Francisco's background level is comparable to that identified as the national background of 5.3 ppt TEQ determined from approximately 11 non-source impacted sites from around the United States.[40]

These sediments, sampled from the various locations for the Harbor District and City of Eureka Maintenance Dredge, are "new" sediments: these locations are dredged on approximate ten year intervals, with the most recent previous dredge occurring in 1998. Thus any dioxins in the sediments represent either new discharges or are the result of re-suspended contamination. The sampling results show that dioxin continues to infiltrate into Humboldt Bay and represent an ongoing problem

V. Comparison of Humboldt Bay Dioxin Levels with Levels Found in San Francisco Bay

In 1999 EPA Region 9 listed San Francisco Bay as impaired for dioxins and dioxin like compounds (PCBs).[41] San Francisco Bay showed levels of dioxin contamination that rightfully placed it on the Clean Water Act 303(d) list of impaired waterbodies. The same factors that led to

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[37] Pacific Affiliates, City of Eureka and Humboldt Bay Harbor, Recreation and Conservation District Cooperative Eureka Waterfront Facilities Maintenance Dredging Project Eureka Channel, Humboldt Bay, California, Sampling Results Report For Dioxin/Furans, PCP and PCB Testing, 15 (December, 2005). The overall TEQ is calculated by including one-half of the reporting limit when a congener is non-detect and multiplying the half of the reporting limit by the TEF. o

[38] *Id.* at Appendix B.

[39] Pedersen, J.A., *et. al.* Distribution of dioxin-like compounds in surficial sediments of San Francisco Bay.

[40] U.S. EPA, Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS) Review Draft, Part I, Vol. II, Ch. 3 (December 2003), *available at* http://www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part1_vol2/dioxin_pt1_vol2_ch03_dec2003.pdf

[41] California State Water Resources Control Board, 1998 CWA 303(d) List of Water Quality Limited Segments, *available at* http://www.waterboards.ca.gov/tmdl/docs/303dtmdl_98reg2.pdf (last visited January 31, 2006).

that listing apply to Humboldt Bay. In fact, as the data show, Humboldt Bay has higher levels of dioxin and is not listed.

EPA's letter to the State Water Resources Control Board regarding its decision to list San Francisco Bay for dioxins and furans discusses its rationale for making the listing.[42] The primary reasons cited by the EPA were an evaluation of a 1997 EPA assessment of health risks to San Francisco Bay anglers and an analysis of fish tissue data.

In 1994 OEHHA used fish tissue data generated as the result of an initial study of chemical contaminants in fish tissue to issue a fish consumption advisory for San Francisco Bay.[43] This fish consumption advisory was an additional reason, in conjunction with the fish tissue data itself, cited by EPA in making its listing determination.[44] The fish tissue data from 1994 show a total TEQ ranging from 0.12 to 1.75 ppt I-TEQ.[45]

As a result of the initial study, a Regional Monitoring Program Fish Contamination Committee was established in order to continue the fish contaminant monitoring.[46] In 1997 this group conducted additional sampling of fish in San Francisco Bay for dioxins, among other substances.[47] The 1997 sampling showed dioxin I-TEQs ranging from 1.2 to 1.9 ppt I-TEQ.[48] In the staff report that accompanied the listing decision, the EPA stated "(w)e have concluded that available information indicates that significant health risk to consumers of fish from San Francisco Bay is associated with dioxins and furans in addition to health risk associated with dioxin- like PCBs...".

The State Water Resources Control Board had declined to list San Francisco Bay for dioxins and furans based on the fact that water column dioxin levels did not exceed water quality criteria for dioxins, dioxin concentrations were below national background levels, and the fish consumption advisory that was issued by OEHHA was an interim advisory that was not based on a quantitative risk assessment of dioxins.[49] The reasoning of the State Board in not listing for dioxins was summarily rejected by EPA and is directly applicable to the listing of Humboldt Bay.

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[42] Letter from Alexis Strauss, acting director of water division, US EPA Region 9 to Walter Petitt, Executive Director State Water Resources Control Board dated May 12, 1999, *available at* http://www.awra.org/state/socal/laws_regulations/tmdl/usepa51299tmdlltr.pdf.

[43] OEHHA, Fish Consumption Advisory for San Francisco Bay *at* http://www.oehha.ca.gov/fish/general/sfbaydelta.html, (last visited January 31, 2006). *See also* 1995 Chemical Contamination in San Francisco Bay, *at* http://www.oehha.ca.gov/fish/nor_cal/sfresult.html (last visited January 31, 2006).

[44] Letter from Alexis Strauss, acting director of water division, US EPA Region 9 to Walter Petitt, Executive Director State Water Resources Control Board dated May 12, 1999, *at* http://www.awra.org/state/socal/laws_regulations/tmdl/usepa51299tmdlltr.pdf.

[45] San Francisco Regional Water Quality Control Board, Contaminant Levels in Fish Tissue from San Francisco Bay at 85 (June 1995). The I-TEQ is the total TEQ of both dioxins and furans and does not include any PCBs or dioxin like PCBs.

[46] San Francisco Estuary Institute, Contaminant Concentrations in Fish from San Francisco Bay, 1997, at 1 (May 1999) *available at* http://www.sfei.org/rmp/reports/fish_contamination/fish_contamination.pdf.

[47] San Francisco Estuary Institute, Contaminant Concentrations in Fish from San Francisco Bay, 1997 (May 1999) *available at* http://www.sfei.org/rmp/reports/fish_contamination/fish_contamination.pdf.

[48] San Francisco Estuary Institute, Contaminant Concentrations in Fish from San Francisco Bay, 1997, at 37 (May1999) *available at* http://www.sfei.org/rmp/reports/fish_contamination/fish_contamination.pdf.

[49] United States Environmental Protection Agency, Review of California's 1998 Section 303(d) List, Attachment to Letter from Alexis Strauss, USEPA to Walt Pettit, SWRCB, at 66 (November 3, 1998).

As with San Francisco Bay, there is little evidence of ambient water column levels of dioxin in Humboldt Bay. However, available data from Humboldt Bay demonstrate that fish and shellfish tissue bioaccumulation and contamination by these long lasting pollutants has occurred. The ambient water column data, or lack thereof, are not the defining criteria in determining whether the Bay should be listed. "Rather, the record supports a finding that the beneficial use of fish consumption is not being supported, and that the narrative standard which prohibits pollutants at levels which impair designated uses is being exceeded."[50] In making an impairment determination, an analysis of water quality objectives, which include narrative standards and beneficial uses, must occur.[51]

The second reason cited by the State Board in its decision not to list San Francisco Bay, that concentrations of dioxins and furans are within national background levels, is even less applicable to Humboldt Bay. In rejecting this line of argument, EPA stated "(i)nformation about national background levels does not address potential human health risk,...(and) (m)oreover, there is evidence that at national background levels, human health risk associated with dioxins/furans may be significant."[52] Humboldt Bay has much lower background levels than those found at the national level. In fact, mussels and crabs collected from South Bay, an area of Humboldt Bay that has not experienced the industrial impacts found on North and Entrance Bay, have been analyzed for dioxin and show low to non-detect concentrations of both substances.[53] Sediments from South Bay show total dioxin TEQs of .025 ppt, considerably lower than the rest of Humboldt Bay, as well as that of San Francisco Bay and the national average.[54] Humboldt Bay's Entrance and North Bays have levels comparable to national background levels and additionally has numerous hot-spots, such as that found at the Sierra Pacific Industries Mill discussed above. Additionally, dioxin levels in one sampling event of Humboldt Bay oysters, discussed above, ranged from 0.08 to 4.3 pg TEQ /gram, considerably higher than that found in San Francisco Bay.[55]

Though OEHHA has not issued a fish consumption advisory for Humboldt Bay, a comparison to the dioxin levels of San Francisco Bay, as noted above, show that such an advisory is appropriate. The average chemical concentration of dioxins and furans in fish tissue samples for San Francisco

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[50] United States Environmental Protection Agency, Review of California's 1998 Section 303(d) List, Attachment to Letter from Alexis Strauss, USEPA to Walt Pettit, SWRCB, at 67 (November 3, 1998).

[51] 40 CFR 130.7(b)(3); *see also* Memorandum from Diane Regas, Office of Wetlands, EPA Guidance for 2004 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act; TMDL-01-03, July 21, 2003, *at* 20, *available at* http://www.epa.gov/owow/tmdl/tmdl0103/2004rpt_guidance.pdf.

[52] United States Environmental Protection Agency, Review of California's 1998 Section 303(d) List, Attachment to Letter from Alexis Strauss, USEPA to Walt Pettit, SWRCB, at 67 (November 3, 1998).

[53] *See* Marc Lappe', Report: Potential and Likely Environmental and Human Health Effects From Off-Site Movement of Chemicals From Sierra Pacific Industries Site at 2293 Samoa Road, Arcata, California, Table 1 (April 12, 2002). This data was collected in conjunction with a suit brought by local environmental groups against Sierra Pacific Industries, Arcata Division Sawmill that the North Coast Regional Water Quality Control Board and subsequently the State Water Resources Control Board became involved in. This suit resulted in a consent decree whereby continuing sampling for dioxins has occurred. Such sampling data is delivered directly to the Regional Board and OEHHA.

[54] Marc Lappe', Report: Potential and Likely Environmental and Human Health Effects From Off-Site Movement of Chemicals From Sierra Pacific Industries Site at 2293 Samoa Road, Arcata, California, Table 1 (April 12, 2002).

[55] San Francisco Regional Water Quality Control Board Contaminant levels in Fish Tissue from San Francisco Bay at 85 (June 1995). The I-TEQ is the total TEQ of both dioxins and furans and does not include any PCBs or dioxin like PCBs.

Bay was approximately 1.6 ppt.[56] The mean concentration of dioxin in oysters in Humboldt Bay, however, are 1.8 ppt TEQ.[57] "EPA's national guidance for assessing fish tissue data for use in fish advisories indicates that where fish tissue dioxin/furan levels are on the order of 2 ppt, consumption of three fish meals a month (0.5 pound portions) would be associated with a cancer risk level of 10-4. (USEPA, 1997a, p. 4-68). This cancer risk level is 10-100 times higher than the risk level usually defined as acceptable."[58]

The same factors that led EPA Region 9 to determining that San Francisco Bay is impaired, and should therefore be listed under the Clean Water Act, apply and require the listing of Humboldt Bay for dioxin. Fish data show similar or higher dioxin levels and sediment levels are comparable, if not even higher than those found in San Francisco. By all relevant criteria Humboldt Bay is more impaired than San Francisco Bay and is required to be listed.

VI. Conclusion

Humboldt Bay is impaired for both pentachlorophenol and dioxin. The levels of pentachlorophenol and dioxin found in Bay sediments and fauna illustrate the systemic problem that is facing the Bay today. The beneficial uses of Humboldt Bay are not being met due to the levels of these pollutants, nor are the narrative water quality criteria.

Additional data is not available from other state programs such as the Surface Water Ambient Monitoring Program or the Toxic Substance Monitoring Program due to the lack of sampling by the State for dioxin or pentachlorophenol in Humboldt Bay.

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[56] United States Environmental Protection Agency, Review of California's 1998 Section 303(d) List, Attachment to Letter from Alexis Strauss, USEPA to Walt Pettit, SWRCB, at 68 (November 3, 1998).
[57] ENVIRON, Evaluation of the results of Dioxin and Pentachlorophenol Testing of Commercial Oyster Beds in Humboldt Bay, California, at p. 14 (July 18, 2002).
[58] United States Environmental Protection Agency, Review of California's 1998 Section 303(d) List, Attachment to Letter from Alexis Strauss, USEPA to Walt Pettit, SWRCB, at 68 (November 3, 1998). *See also* Mark Lappe', Potential and Likely Environmental and Human Health Risks from Off Site Movement of Chemicals from the Sierra Pacific Industries Site, (April 12, 2002).