STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD

In the Matter of the Petition of ROBERT JAMES CLAUS For Review of Inaction of California Regional Water Quality Control Board, Central Valley Region. Our File No. A-354.	)	ORDER NO. WQ 85-1

BY THE BOARD:

On April 27, 1984, Robert James Claus (petitioner) appeared before the California Regional Water Quality Control Board, Central Valley Region, (Central Valley Regional Board) and requested the Central Valley Regional Board to take certain enforcement actions against the United States Bureau of Reclamation (Bureau), Grassland Water District (Grassland), and the approximately eighteen entities which discharge agricultural drainage flows into Grassland (draining entities). The Central Valley Regional Board declined to take the requested action, and on May 18, 1984, petitioner appealed this inaction to the State Water Resources Control Board (State Board or Board).

On October 15, 1984, the State Board held an evidentiary hearing to assist the Board in determining whether the Central Valley Regional Board's inaction was appropriate and proper. The State Board held a second evidentiary hearing on December 7, 1984, to consider alternative courses of action available to the State Board to address problems associated with the discharge of subsurface agricultural drainage flows to Kesterson Reservoir, which is owned and operated by the Bureau. As a result of the second evidentiary

hearing, the State Board conducted a third hearing on January 8, 1985, to specifically consider adoption of an order directing the Bureau to cleanup and abate the effects of wastes discharged to Kesterson Reservoir.

I. INTRODUCTION

This petition raises issues relating to discharges of agricultural drainage flows in the west side of the San Joaquin Valley to Kesterson Reservoir, Grassland and the San Joaquin River. These discharges are taking place in response to the drainage problems faced by agriculture in this area.

Historically, the introduction of irrigated agriculture to arid areas has presented drainage problems. The California Department of Water Resources noted in 1974 that:

> "The salt management problem in the San Joaquin Valley is not a unique one; the problem has plagued irrigated agriculture in all arid and semi-arid areas of the world since before the beginning of recorded history. Many flourishing early civilizations fell principally because of an inability to understand and cope with salt balance and drainage problems. The Tigris and Euphrates river valleys in ancient Mesopotamia became mostly desert because of the accumulation of salts in the surface soil layers. Relics of abandoned irrigation systems, alkali areas, and salt accumulation extending from the Sahara Desert through ancient Persia show that a lack of proper drainage eventually resulted in the physical and economic ruin of vast agriculturally productive areas." (Bulletin 127-74, p. 2)

The unique geology, climate and hydrology of the west side of the San Joaquin Valley make the drainage problem particularly complex. Evapotranspiration rates are high, drainage is poor, and the drainage water contains not only salts but a complex mixture of other materials which occur naturally in

the soil. As stated by the petitioner, this area is in essence a "flowerpot without a hole". If just enough water is used to replace what the crops use in evapotranspiration, over time, salts and other materials dissolved in the water will accumulate in the soils at the surface and eventually render the area unsuitable for agriculture. If extra water is applied to flush soluble salts into the soil below the roots of the plants, over time, the water will be stopped by the underlying clay layer and will rise toward the surface, drowning the roots and carrying the salts and other materials back up. Thus, a way must be found to get rid of this drainage water. Discharges to Kesterson Reservoir, Grassland and the San Joaquin River have been one such method of waste disposal.

II. KESTERSON RESERVOIR

A. Background

In 1960 Congress authorized the Secretary of Interior to construct the San Luis Unit of the federal Central Valley Project.[1] The principal purpose of the construction project was to furnish water for the irrigation of approximately 500,000 acres of land in Merced, Fresno and Kings counties. The act authorizing construction provided, however, that construction of the San Luis Unit could not commence until the Secretary of the Interior had either received assurances from the State of California that it would make provision for a master drainage outlet and disposal channel for the San Joaquin Valley, or the Secretary had made provision for constructing a San Luis interceptor drain to the Delta.

The State subsequently determined not to participate in construction of a master drain. Consequently, after authorization of the San Luis Unit, the

Bureau made plans to construct a drain which would extend 207 miles from Kettleman City in the southern San Joaquin Valley north to a discharge point in the Delta at Suisun Bay. Between 1968 and 1975, 85 miles of the drainage system, known as the San Luis Drain, and the first stage of Kesterson Reservoir, a regulatory reservoir, were constructed by the Bureau. The constructed portion of the San Luis Drain extends from the town of Five Points north to Kesterson Reservoir.

Kesterson Reservoir is located in Merced County two miles east of Gustine and ten miles north of Los Banos along the northern boundary of Grassland. The reservoir was originally designed to contain 43 ponds, which would be constructed in two phases. The first stage of Kesterson Reservoir, which was completed in 1971, consists of 12 interconnected ponds with a maximum design depth of 4 1/2 feet, comprising approximately 1,280 acres.

Kesterson Reservoir was designed to serve as a regulatory reservoir to regulate flows in the San Luis Drain prior to their discharge into the Delta. The San Luis Drain north of Kesterson was never built, however. The ponds at Kesterson, therefore, serve as the drain's terminus and are presently used as a storage and disposal facility for the subsurface agricultural drainage flows which discharge into the completed portion of the San Luis Drain.

Kesterson Reservoir is also a part of the 5,900 acre Kesterson National Wildlife Refuge, one of four state and national refuges located in the Grasslands area. This area is of central importance to Pacific Flyway waterfowl which winter and feed in the area. Kesterson National Wildlife Refuge was established in 1970 by a cooperative agreement signed by the Regional Directors

of the Bureau and the Bureau of Sport Fisheries and Wildlife, now the United States Fish and Wildlife Service. Since 1972 Kesterson Reservoir has been managed by the Fish and Wildlife Service as a wildlife refuge; however, management for this purpose is considered secondary to the main purpose of the reservoir to control drainage flows.

Before 1978 surface runoff was the primary source of water discharged into the reservoir. In 1978 increasing amounts of subsurface drainage started to flow to the Kesterson ponds. Since 1981 flows in the San Luis Drain have principally consisted of saline subsurface agricultural drainage flows from Westlands Water District. Kesterson Reservoir currently receives approximately 7,000 acre feet of subsurface agricultural drainage flows from the equivalent of 8,000 acres of farmland in Westlands Water District.

The Bureau's position is that, until 1981, there was no indication that, apart from salinity, the constituents in the subsurface drainage water being discharged to Kesterson Reservoir might present a toxicity problem. Petitioner vigorously disputes this position. Regardless of this dispute, it is clear that serious problems have occurred at Kesterson Reservoir since 1981.

In 1982 the Fish and Wildlife Service first noticed problems at Kesterson Reservoir.[2] Prior to 1981 the San Luis Drain and Kesterson Reservoir had supported a variety of fish, including largemouth and striped bass, catfish, carp, and mosquito fish. Since 1981 only mosquito fish have been observed in the reservoir.[3] Laboratory analyses of mosquito fish collected by the Fish and Wildlife Service in October of 1982 from the drain and Kesterson Reservoir revealed extremely high levels of selenium, a natural

trace element, in fish tissues. The concentrations of selenium reached as high as 66,000 parts per billion (ppb) in fish tissues and were as much as 100 times higher than concentrations in fish from the nearby Volta Wildlife Management Area, which does not receive subsurface agricultural (tile) drainage flows.[4] In September 1983 the Columbia National Fishery Research Laboratory conducted a toxicity testing program on San Luis Drain wastewater which revealed that drain wastewater was toxic to test invertebrates at levels of 25, 50 and 100 percent concentrations and that all test fish died at 50 and 100 percent strength concentrations.[5]

In addition, field observations in the spring of 1983 at Kesterson Reservoir showed very high incidence of mortality and deformities among newborn coots, grebes, stilts, and ducks.[6] Concentrations of selenium in the eggs of all waterfowl species at Kesterson were high. Concentrations of selenium in adult birds were also high.[7] In 1984, grebe, stilt and duck populations using the reservoir for nesting remained at about the 1983 level. The Fish and Wildlife Service observed no coot nests, however, in comparison to 100 nests observed in 1983.[8] Additionally, the Fish and Wildlife Service found many dead coots, as well as some dead birds of other species, throughout the reservoir area, during the spring and summer.[9] The Fish and Wildlife Service identified selenium poisoning as the cause of death of the adult birds and most probable cause of deformities in the chicks and embryos.[10]

The discharge of wastewater to Kesterson Reservoir is not currently regulated under waste discharge requirements. In March 1981, the Regional Board informed the Bureau that the Bureau was required to file a report of waste discharge, pursuant to California Water Code Section 13260,[11] prior to

use of the Kesterson ponds for the discharge of wastewater. In response to a Bureau request, the Regional Board, by a letter dated August 26, 1981, supplied the necessary forms, filing fee schedule, and a list of information needs for a technical report covering Kesterson Reservoir. The Regional Board sent a second request for a report of waste discharge and technical report to the Bureau in a letter dated December 31, 1982.

In February 1983, the Bureau filed a report of waste discharge on the operation of Kesterson Reservoir and in July 1983 filed a technical report.[12] The Regional Board has not yet adopted waste discharge requirements for the facility but has indicated that it intends to do so by August 1985.

On April 27, 1984, petitioner appeared before the Central Valley Regional Board. Petitioner owns 650 acres of land, used for duck hunting and cattle grazing, in Merced County. Petitioner's property is bordered on the northwest by Kesterson Reservoir and a portion of his property is included in Grassland. Petitioner requested that the Central Valley Regional Board take a number of actions to address the discharge of subsurface agricultural drainage flows to Kesterson, Grassland, and the San Joaquin River and its tributaries, including Mud Slough and Salt Slough.

The actions petitioner requested the Regional Board to take were described in a letter, dated March 16, 1984, addressed to Hugh Johns, Chairman of the Central Valley Regional Board, and included a referral to the Attorney General for injunctive relief prohibiting the discharge of wastewater by the Bureau, Grassland, and the draining entities prior to the filing of a report of waste discharge or the issuance of waste discharge requirements, as provided in Water Code Section 13264(b)[13] and a referral to the Attorney General for

civil monetary penalties under Section 13350,[14] the issuance of a cease and desist order pursuant to Section 13301[15] prohibiting the discharge of the subsurface flows to Kesterson, Grassland, and the San Joaquin River and its tributaries, and the issuance of a cleanup and abatement order under Water Code Section 13304[16] directing the Bureau and the draining entities to cleanup the waste and abate the effects thereof.

The Central Valley Regional Board refused to take the action requested by petitioner but decided instead to continue with its efforts to develop a salt management plan for the San Joaquin River basin. This approach consists of a program of cooperative water quality monitoring and sampling by affected irrigation and drainage districts in the San Joaquin Valley. Data developed as a result of the monitoring program would be used to establish appropriate basin plan amendments for the San Joaquin River basin, which would incorporate effluent limitations and receiving water objectives for waste discharges within the basin. After adoption of basin plan amendments, the Central Valley Regional Board would regulate groups of dischargers with common irrigation and drainage patterns under waste discharge requirements. In addition, the Central Valley Regional Board directed its staff to prepare waste discharge requirements for significant interim facilities such as Kesterson Reservoir.

Petitioner appealed the Central Valley Regional Board's failure to act on his request to the State Board in May 1984. Petitioner requested that the State Board take the actions originally requested of the Central Valley Regional Board and any other enforcement actions deemed appropriate by the State Board.

B. Contentions and Findings

1. Contention: Petitioner contends that the discharge of wastewater by the Bureau is in violation of Water Code Section 13264.[17] He seeks a referral to the Attorney General for injunctive relief to prohibit discharge until the Bureau complies with this section.

Finding: The discharge of wastewater by the Bureau does not appear to violate the provisions of Water Code Section 13264 at present. This section bars any person from initiating any new discharge of waste or making any material change in any discharge prior to the filing of a report of waste discharge pursuant to Water Code Section 13260 and, thereafter, prior to the issuance of waste discharge requirements, the expiration of 120 days after compliance with Section 13260, or the Regional Board's waiver of waste discharge requirements, whichever occurs first.

The Bureau did not file a report of waste discharge until some two years after discharges of waste to Kesterson Reservoir began. Eventually, as stated above, a report was filed.

The Bureau has complied with Water Code Section 13260 by filing a report of waste discharge and more than 120 days have elapsed since compliance by the Bureau with this section. Therefore, the relief requested by petitioner, i.e. a referral to the Attorney General for injunctive relief prohibiting discharge until the Bureau achieves compliance with Section 13264, would be inappropriate.

Nevertheless, compliance by the Bureau with the provisions of Water Code Sections 13260 and 13264 does not give the Bureau a vested right to continue discharging wastewater at Kesterson Reservoir. As Water Code

Section 13263(g) specifically states, "[n]o discharge of waste into the waters of the state, whether or not such discharge is made pursuant to waste discharge requirements, shall create a vested right to continue such discharge. All discharges of waste into waters of the state are privileges, not rights."

In particular, compliance by the Bureau with Water Code Sections 13260 and 13264 does not give the Bureau the right to create or threaten to create conditions of pollution or nuisance resulting from the discharge of wastewater. In this regard, Water Code Section 13304 authorizes the State or Regional Boards to issue a cleanup and abatement order to any waste discharger, whether or not the discharger has filed a report of waste discharge or been issued waste discharge requirements, who "has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance."

Additionally, the Bureau's position that all of petitioner's contentions should be summarily dismissed because the Bureau eventually filed a report of waste discharge is without merit. Petitioner has requested the State Board to take any appropriate enforcement actions regarding Kesterson Reservoir; and, in any event, we could take such action under Water Code Section 13320 on our own motion regardless of how the petitioner framed his contentions. For the reasons explained in the succeeding section of this Order, the State Board concludes that issuance of a cleanup and abatement order to the Bureau in this case is appropriate.

2. Contention: In addition to a referral to the Attorney General for injunctive relief to enforce the provisions of Water Code Section 13264,

petitioner requests that the State Board take a number of enforcement actions against the Bureau, including issuance of a cleanup and abatement order pursuant to Water Code Section 13304.

Finding: Based upon our review of the record, we conclude that issuance of a cleanup and abatement order to the Bureau is appropriate. In reaching this conclusion, we disagree with the Bureau's position that they have succeeded in removing the risks associated with discharges to Kesterson Reservoir. We find that the weight of the evidence[18] in the record supports the conclusion that the Bureau is discharging wastewater which is reaching waters of the state and is creating and threatening to create conditions of pollution and nuisance.

Kesterson Reservoir is located 2.3 miles from the San Joaquin River and is bordered on the west by Mud Slough, a tributary of the San Joaquin River. The reservoir also overlies a groundwater body which is the major source of drinking water for the San Joaquin Valley.

The beneficial uses of these water bodies are identified in the Water Quality Control Plan Report, Central Valley Region (Basin Plan). The existing beneficial uses of the waters of the San Joaquin River and its tributaries, including Mud Slough and Salt Slough, in the area near Kesterson Reservoir are irrigation, stock watering, industrial process supply, water contact and non-contact recreation, use by migratory fish, warm freshwater habitat and wildlife habitat.[19] Municipal and domestic water supply is identified as a potential beneficial use.[20] The beneficial uses of the groundwater under Kesterson Reservoir are irrigation, stock watering, and municipal and domestic water

supply.[21] The Basin Plan also classifies the area occupied by Kesterson Reservoir as a critical habitat because it is "essential to the well-being, protection or conservation of the fish and wildlife resources of the state".[22] The area was designated as a critical habitat because it is a wetlands area, essential to waterfowl and water-dependent wildlife.

The tile drainage flowing into Kesterson Reservoir contains many elements and chemical compounds. The extent of the potential hazard posed by the drainage flows can be partially assessed by comparing the average concentration of some of these constituents[23] with water quality criteria established for the protection of freshwater aquatic life[24] and for the protection of human health.[25] It should be noted that some of the criteria are based on hardness.[26] The hardness of the wastewater at Kesterson Reservoir is approximately 2,000 mg/l, while the San Joaquin River has a hardness of 200 mg/l. Both of these hardness values must be considered in establishing water quality criteria for the reservoir and the receiving waters. Constituents found at Kesterson Reservoir which exceed applicable criteria[27] are briefly discussed below:

> Arsenic (As): The Environmental Protection Agency (EPA) has established a primary drinking water standard of 50 micrograms per liter (ug/l). EPA has also determined that one person in 100,000 is at risk of contracting cancer if their lifetime drinking water supply contains 0.022 ug/l of arsenic. The average concentration of arsenic in Pond 12 of Kesterson Reservoir is 1 ug/l.

Boron (B): Boron is an essential element for growth of crops; however, at certain levels boron can have toxic effects on plant growth. For example, some crops have shown toxic effects at 1,000 ug/l or less of boron. The criterion of 750 ug/l was established to protect sensitive crops during long term irrigation.[28] The average concentration of boron rises as high as 24,000 ug/l in some parts of Kesterson Reservoir.

Cadmium (Cd): EPA criteria at a hardness of 200 mg/l for 24-hour average and maximum total recoverable cadmium are 0.051 ug/l and 6.3 ug/l, respectively. At a hardness of 2,000 mg/l the appropriate values are 0.58 ug/l and 70 ug/l. The EPA primary drinking water standard is 10 ug/l. The average concentration of cadmium in Kesterson Reservoir consistently falls below 1 ug/l, which is the detection limit. However, it has been reported at concentrations ranging from the detection limit to 100 ug/l in the San Luis Drain, and a single sample by the Bureau in 1984 from Kesterson Reservoir was reported to have a concentration of 1 ug/l.[29]

Chromium (Cr): There are two common oxidation states for chromium, the trivalent and hexavalent ions. Hexavalent chromium is more toxic. The recommended EPA criteria for 24-hour average and maximum total hexavalent chromium

concentrations for protection of freshwater aquatic life are 0.29 ug/l and 21 ug/l, respectively. All but one of 24 samples analyzed for hexavalent chromium at Kesterson Reservoir exceeded the 24-hour average criterion.[30] None of the samples exceeded the maximum hexavalent chromium criterion or any trivalent chromium criteria.

Copper (Cu): The 24-hour average recommended criterion for the protection of freshwater aquatic life is 5.6 ug/l. The maximum average concentration[31] of copper in Kesterson reported by the Bureau is 4 ug/l, and the highest reported level is 15 ug/l. Copper concentrations ranging from the detection limit to 20 ug/l have been reported in the San Luis Drain.[32]

Mercury (Hg): Mercury is highly toxic to human and aquatic life; and some mercury compounds bioaccumulate. The recommended EPA criteria for the protection of freshwater aquatic life are 0.2 ug/l and 4.1 ug/l for the 24-hour average and the maximum concentrations, respectively. The EPA primary drinking water standard is 2 ug/l, and the EPA ambient water criterion for the protection of human health from ingesting water and contaminated aquatic organisms is 0.144 ug/l. The average concentration in Kesterson Reservoir Pond 9 is 0.2 ug/l.

Molybdenum (Mo): No well established criteria for molybdenum exists. However, it is known to be toxic to plants and to bioaccumulate in them. There is some evidence that molybdenum acts in a synergistic manner with selenium, increasing toxicity.[33]

Nickel (Ni): EPA has established an ambient water criterion of 13.4 ug/l for the protection of public health from ingesting water and contaminated aquatic organisms. The maximum average concentration of nickel at a portion of Kesterson Reservoir is 67 ug/l, and it has been reported at concentrations of 120 ug/l.

Selenium (Se): Selenium is an essential micronutrient for humans and other species; however, it is toxic in excessive amounts. Both the EPA primary drinking water level and the ambient water criterion for the protection of public health are 10 ug/l. This is also the level at which selenium has been found to adversely impact aquatic life. Specifically, fish population declines have been observed at selenium concentrations of 10 ug/l.[34] The EPA criteria for the protection of freshwater aquatic life are 35 ug/l and 260 ug/l for the 24-hour average and the maximum concentration, respectively; however, these criteria are for the selenite ion form of selenium. The average concentration of selenium entering Pond 2 of Kesterson Reservoir is 430 ug/l.

Silver (Ag): The available data indicate that chronic toxicity to freshwater aquatic life may occur at concentrations as low as 0.12 ug/l.[35] The silver concentration at Kesterson Reservoir has consistently fallen below 1 ug/l, which is the detection limit of the analytical technique employed. However, silver concentrations ranging from the detection limit to 20 ug/l have been reported in the San Luis Drain.[36]

Zinc (Zn): The 24-hour average recommended criterion for the protection of aquatic life is 47 ug/l. The average zinc concentration found at Pond 9 in Kesterson Reservoir is 160 ug/l.

To summarize the foregoing discussion, it is evident that the selenium concentration in Kesterson Reservoir exceeds the EPA primary drinking water standard. Selenium, mercury and nickel concentrations in parts of the reservoir exceed EPA ambient water criteria for the protection of human health from the toxic properties of these elements ingested through water and contaminated aquatic organisms. The concentrations of hexavalent chromium, zinc, copper, and cadmium, in some instances, exceed EPA water quality criteria established for the protection of freshwater aquatic life.[37] The concentration of mercury in Pond 9 of the reservoir is equal to the EPA recommended criteria for the protection of freshwater aquatic life.[38]

The degree to which pesticides pose a threat at Kesterson Reservoir is difficult to gauge. The monitoring undertaken by the Bureau in 1984 reported pesticide concentrations in the San Luis Drain service area.[39] Most of the pesticide concentrations reported were sufficiently low that they were not of concern.[40] However, because pesticide contamination often occurs as pulses of high concentration, it is not possible to assess potential hazards by inspection of isolated samples, none of them taken in the reservoir itself. Also, in 1983, Marine Bioassay Laboratories, a consultant hired by the Bureau, released a report[41] and an errata,[42] which assessed the potential hazard posed by pesticides in the San Luis Drain. Their analysis was based on pesticide concentrations found by the Department of Water Resources in the drain service area. They concluded that the initial biological concerns for the San Luis Drain receiving water biota are as follows: (1) acutely lethal toxicity is possible but unlikely; (2) some chronic toxicity is likely; (3) elevated tissue burdens are likely for some compounds in some species; (4) highly elevated tissue burdens are possible but unlikely.[43]

In summary, the complex chemical mixture being discharged from the San Luis Drain to Kesterson Reservoir contains many constituents in concentrations known to be harmful to human, animal and aquatic life. It should also be noted that the elements discussed above do not necessarily constitute a complete list of the constituents of concern. Other constituents are present in Kesterson Reservoir which have not yet been analyzed. In addition, for the most part, more complex issues such as potential synergistic interactions have not yet been addressed.

The wastewater in Kesterson Reservoir not only contains constituents which exceed established water quality criteria but also, as the background

discussion in Part II.A. of this Order indicates, the wastewater has been demonstrated to cause severe biological problems for waterfowl and to be toxic to fish and invertebrates. The Fish and Wildlife Service has linked the deaths and deformities of waterfowl to selenium poisoning, and selenium appears to be the element of most concern at the reservoir.

Selenium occurs in nature in several forms. In the alkaline soil of the western San Joaquin Valley, most of the selenium occurs as selenate ions.[44] The selenate form of selenium is water soluble, available to vegetation, and readily transported in groundwater.[45] The concentration and distribution of selenium in the soils of the San Joaquin Valley is poorly known, but Bureau water quality samples indicate that the alluvial fans of Panoche and Little Panoche Creeks in Fresno County are one of the highest selenium sources.[46]

A probable selenium pathway from the wastewater at Kesterson Reservoir to the waterfowl is through the food chain.[47] Information in the literature and data collected from Kesterson Reservoir indicates that selenium can accumulate and biomagnify through the food chain.[48] Food chain organisms at Kesterson Reservoir contain 50 to 100 times the normal concentration of selenium.[49] For example, the mean concentration of selenium in algae at Kesterson in May 1983 was 35.2 parts per million (ppm) dry weight; in submerged aquatic plants it was 52.7 ppm. By contrast, the values at the nearby Volta Wildlife Management Area, which does not receive subsurface agricultural drainage, were less than 0.5 ppm for both.[50] Further, in studies conducted by the Fish and Wildlife Service algae and aquatic plants were determined to be the most common food in coots shot for study purposes.[51]

The Bureau contends that Kesterson Reservoir, an artificial surface impoundment, is not waters of the state. This contention overlooks several points. The first is the broad definition of "waters of the state" as provided by statute. Water Code Section 13050(e) defines the term to mean "any water, surface or underground, including saline waters, within the boundaries of the state." As mentioned previously, the Regional Board's Basin Plan designates the area occupied by Kesterson Reservoir as a wetlands area. Historically, beneficial uses of this area have been as habitat for waterfowl and water-associated wildlife. Since 1972 Kesterson Reservoir has been managed as a wildlife refuge. Before 1978, surface runoff was the primary source of water impounded at Kesterson Reservoir. Under these circumstances, the discharges of wastewater into the area in which Kesterson Reservoir is located can be considered discharges to state waters.

The wastewater discharged into Kesterson Reservoir has also reached waters of the state through both direct surface discharge and seepage. The record reflects that wastewater has been directly discharged from Kesterson Reservoir to Mud Slough in the past and that such discharges are threatened in the future.

In March 1983, the Bureau requested permission from the Central Valley Regional Board to make an emergency discharge into Mud Slough at a point adjacent to Kesterson Reservoir. The discharge was necessitated by heavy rains which resulted in large subsurface drainage flows into the San Luis Drain. In addition, there was considerable surface water flooding adjacent to the Drain which the Bureau pumped into the drain to protect the structural integrity of

the drain lining. The combination of flood flows and subsurface inflow into the San Luis Drain during the month of March 1983 was estimated to be 70 cubic feet per second.[52] Since Kesterson Reservoir was approaching its design capacity of 4,800 acre feet, Bureau personnel installed pumps and siphons with a combined capacity of 135 cubic feet per second along the reservoir.[53] A total of 2,742 acre feet of wastewater was released from Kesterson Reservoir to Mud Slough from March 5 through March 30.[54]

In January 1984, the Bureau again requested permission from the Central Valley Regional Board to discharge wastewater from Kesterson Reservoir into Mud Slough.[55] Subsequent to the request, the San Joaquin Valley received below normal amounts of rainfall, however, and discharge became unnecessary.[56]

The Bureau has changed its policy and no longer will allow surface flows into the Drain.[57] Nevertheless, the Bureau has indicated that during high rainfall events in the wet winter months, inflow into the reservoir may exceed the storage and disposal capability of the facility and necessitate future discharges to Mud Slough.[58]

The major concern with these discharges is their potential impact on the water quality of Mud Slough and the San Joaquin River. An estimate of the potential maximum impact is provided in Attachment 7 to this Order. It should be noted that, with the exception of electrical conductivity, the figures provided in Attachment 7 reflect the maximum possible concentration increase in the receiving waters of the various constituents, not the maximum possible final concentration. Inspection of Attachment 7 indicates that the maximum concentration increases of boron, chromium, nickel, selenium, and zinc, in

particular, in Mud Slough would exceed water quality criteria established for the protection of human health, aquatic life or plant life. Surface discharge from Kesterson Reservoir would also cause a significant increase in constituents of concern in the San Joaquin River. It must be concluded that a surface discharge from Kesterson Reservoir would pollute the waters of Mud Slough and degrade the waters of the San Joaquin River.

As Attachment 7 indicates, the concentrations of trace elements and salts will rise in the San Joaquin River if wastewater is directly discharged from Kesterson Reservoir. The confluence of Mud Slough and the San Joaquin River is less than ten miles upstream from the junction of the San Joaquin River and the Merced River. The direct discharge of wastewater from Kesterson Reservoir to Mud Slough, therefore, threatens to cause further degradation of the San Joaquin River downstream of the junction of Mud Slough and the San Joaquin River.

In this regard, we note that the Legislature has declared that "a serious problem of water quality exists in the San Joaquin river between the junction of the San Joaquin River and the Merced River and the junction of the San Joaquin River with Middle River".[59] Further, this Board is under a legislative mandate to "do nothing, in connection with [its] responsibilities, to cause further significant degradation of the quality of water in that portion of the San Joaquin River" previously specified.[60]

Wastewater from Kesterson Reservoir also reaches waters of the state through seepage from the ponds. Seepage is a significant problem at Kesterson Reservoir. In 1982 the total seepage was estimated at 4,200 acre feet or about 60 percent of the measured inflow.[61] Although the Bureau has indicated that

Kesterson Reservoir is functioning as an evaporation facility, the majority of the wastewater is, in fact, disposed of through seepage, not evaporation.

The groundwater aquifer system in the Kesterson area is complicated. The United States Geological Survey (Geological Survey) has divided it into three zones.[62] The top zone, or perched aquifer, is very shallow. The base of this zone is generally felt to be 5 to 25 feet below the land surface. The shallow groundwater levels are generally highest in the winter months (November through February) and lowest during the summer months (July through September). The shallow groundwater levels are consistently less than 8 feet from the natural ground surface at any time throughout the year in the Kesterson area, and typically range from 2 to 4 feet from the land surface unless the area is flooded. During flood events, the groundwater may rise from 1 to 2 feet inside measuring pipes above the natural ground surface.

The second zone, or upper water-bearing zone, extends to approximately 230 feet beneath the surface of Kesterson Reservoir. Sediments in this zone consist of interbedded sands, clay and gravels. Groundwater in the upper zone is found under various degrees of confinement. In the Kesterson area the shallow water-bearing zone is continuous with the upper zone, and no apparent barrier to groundwater flow exists between them.

At the base of the upper zone lies the Corcoran Clay layer. This layer is approximately 60 feet thick and is a barrier to downward groundwater flow. This clay layer underlies an extensive part of the San Joaquin Valley. Beneath the Corcoran Clay is the lower water bearing zone. This deep aquifer system contains high quality water and is approximately 650 feet thick.

Groundwater movement in this area is generally northeastward.[63] A local high groundwater condition exists, however, under Kesterson Reservoir

causing a flow outward from the reservoir in all directions. Mud Slough, a tributary of the San Joaquin River, is immediately adjacent to Kesterson Reservoir and is in the path of this subsurface flow. Consequently, Mud Slough will pick up seepage from Kesterson Reservoir. Eventually, the groundwater flow probably returns to the northeast gradient outside the influence of Kesterson Reservoir. Ultimately, these subsurface flows discharge into Salt Slough and the San Joaquin River.[64] Available data indicates that the rate of groundwater movement in this area ranges from 1.7 to 6.8 feet per year.[65]

Vertical movement within and between zones is subject to local conditions, but because of an overall downward hydraulic gradient in the Kesterson area, the flow is downward.[66] There is no barrier to the flow of wastewater seeping from Kesterson Reservoir until it reaches the Corcoran Clay layer at a depth of 230 feet.[67]

The evidence indicates that trace elements in the wastewater from Kesterson Reservoir are migrating with the subsurface seepage. The Bureau maintains that there is no conclusive evidence that the seepage contains harmful concentrations of constituents with toxic potential. They state that Kesterson Reservoir appears to be a contained and controlled situation. We disagree.

Concentrations of boron, chromium and nickel, in particular, are essentially unchanged from surface concentrations down to a depth of 40 feet.[68] Selenium has also been detected in the groundwater underneath Kesterson Reservoir in concentrations which are significantly less than surface

concentrations but which are still in excess of EPA primary drinking water levels and ambient water criteria.[69] Because the area is not naturally seleniferous,[70] selenium levels in the groundwater reflect seepage from the reservoir.

Although it appears clear that wastewater is seeping from Kesterson into the upper aquifer, the degree to which the upper aquifer has been degraded by the seepage of trace elements, other than boron, is difficult to determine because there are no trace element analyses in the record prior to 1984 for constituents other than boron. Some data for boron and specific conductance from wells in the Kesterson area prior to construction of the ponds are available from Geological Survey files.[71] A comparison of this data with the results of 1984 trace element analyses by the Bureau of groundwater at Kesterson Reservoir[72] reveals that the boron concentrations and specific conductance of groundwater underneath Kesterson have markedly increased since construction of the Kesterson ponds. This conclusion is further verified by a review of data provided by the Bureau of boron concentrations in shallow wells at the present site of Kesterson Reservoir before the reservoir was constructed. The maximum boron concentration in the 15 wells sampled in 1968 was 9,000 ug/l, and the average concentration was 3,600 ug/l.[73] Presently, the maximum reported boron concentration in the groundwater underneath Kesterson Reservoir is 25,000 ug/l, and the average concentration is 13,500 ug/l.[74]

It must be concluded, on the basis of the above data, that seepage from Kesterson Reservoir has degraded the groundwater under the reservoir. Additionally, because the perched zone underneath Kesterson Reservoir is

continuous with the entire upper zone, seepage from the reservoir can impact the entire upper aquifer. The record indicates that the upper aquifer is used for drinking water supply.[75] We, therefore, further conclude that seepage from Kesterson Reservoir has polluted the upper aquifer and that continued discharge of wastewater from the reservoir threatens to cause further pollution. Because subsurface flows under Kesterson will eventually reach Salt Slough, Mud Slough, and the San Joaquin River, seepage from Kesterson also threatens to pollute these waters.

The upper aquifer is separated from the lower water bearing zone by the Corcoran Clay layer. A number of permeability tests have been performed on samples of Corcoran Clay in the Los Banos area. The results indicate that the clay is of consistently low vertical permeability. Therefore, pollutants from Kesterson Reservoir can reach the lower water bearing zone only through wells. Wells in the area, either active or abandoned, can act as vertical conduits for the migration of pollutants through the clay and into the lower water bearing zone in response to the downward hydraulic gradient in the area. This situation may occur at a particular well if one or more of the following conditions are present: (1) The well has been perforated in both the upper and lower water bearing zones; (2) The well has a filter envelope passing entirely through the Corcoran Clay, and there is no seal isolating the upper zone from the lower zone; (3) The well has been improperly abandoned, allowing groundwater to move from the upper to the lower zone through the well bore or casing.[76]

An analysis of wells in the area indicates that within two miles of Kesterson Reservoir there are 16 wells which extend into the lower zone. Also

in the same area there are another 17 wells of unknown depth.[77] Therefore, there are at least 33 wells in the immediate vicinity of Kesterson Reservoir which could possibly serve as vertical conduits for pollutants into the lower water bearing zone. It is not possible to assess the potential of any particular well to serve as a vertical conduit, however, because there is no data on well construction in the record. Because of the downward hydraulic groundwater gradient in the Kesterson area and the existence of numerous wells extending into the lower zone, the discharge of pollutants from Kesterson Reservoir into the upper zone threatens to pollute the waters of the lower zone.

The discharge of wastewater at Kesterson Reservoir has also created a public nuisance. Kesterson Reservoir is surrounded by the largest tract of native grasslands remaining in the San Joaquin Valley. This area plays a vital role in the Pacific Flyway. Its preservation is one of the Fish and Wildlife Service's highest priorities. Most of the surrounding land is maintained as waterfowl habitat for the recreational use of duck hunters.

The record clearly establishes that the waters of Kesterson Reservoir are toxic to the waterfowl that feed there. Selenium, and possibly other constituents, bioaccumulate in the plants of the reservoir and, in turn, in the flesh of the waterfowl. The flesh of waterfowl which feed at Kesterson can pose a hazard to any person who consumes it.[78] For this reason, the State Department of Health Services (DOHS) has recommended that pregnant women and children under ten not eat any ducks from the Kesterson National Wildlife Refuge Area. This area is in western Merced County between Highway 99 and the Coast Range and from Dos Palos to Patterson. In addition, DOHS has advised

others not to eat more than one meal of duck from the area each week and not to eat duck liver.[79] In the previous year, the State Department of Fish and Game posted a warning at Kesterson Reservoir, cautioning hunters to limit their consumption of coots. In addition, the Fish and Wildlife Service closed Kesterson Reservoir to hunting for the 1984-1985 season.[80]

Because waterfowl are highly mobile, it is impossible for hunters to know which ones have been feeding at Kesterson Reservoir. We conclude, on the basis of the record, that the conditions in the reservoir pose a threat to public health due to the possibility of consumption of selenium contaminated waterfowl and threaten to obstruct the free use of the lands surrounding the reservoir for waterfowl habitat, including duck hunting.

We note that the Bureau began a waterfowl hazing program on September 15, 1984, to reduce waterfowl exposure to drainage water. The record indicates that this program has been successful for ducks and geese but ineffective for such birds as raptors, bitterns, coots, herons and blackbirds, as well as terrestrial mammals. Coots have been the most numerous waterfowl observed at the reservoir, and the hazing program has been successful in scaring away only approximately half of the birds which would normally be expected at the reservoir. For example, in November 1984, the Fish and Wildlife Service observed 319 coots on an average daily basis at Kesterson Reservoir, whereas 600 coots would normally be expected at the site during this time of year.[81]

The Bureau contends that the Board's authority to regulate nuisance is limited to those situations which occur as a direct result of discharges to waters of the state. The Bureau has construed our authority too narrowly.

Jurisdiction over nuisances extends to all situations associated with treatment or disposal operations. In Order No. WQ 78-16, we concluded that a Regional Board has jurisdiction over nuisance odors from waste treatment plants. Similarly, we have jurisdiction over nuisance conditions created by a discharger at the disposal site. The Bureau's reliance on 16 Ops.Atty.Gen. 125 (1950) is misplaced since that opinion dealt with a definition of "nuisance" that has been superseded by the present language of Water Code Section 13050(m). That section states in relevant part "[n]uisance means anything which...occurs during or as a result of the treatment or disposal of wastes."

In summary, the record contains substantial evidence that the Bureau is discharging wastewater at Kesterson Reservoir, itself located in a wetland area, which reaches other waters of the state and which has created and threatens to create conditions of pollution and nuisance. In arriving at this conclusion, we have considered the Bureau's position that more data is needed to get a complete picture of the present and projected impacts of discharge to Kesterson Reservoir. We also note that the Bureau estimates that it would take from three to five years to collect and analyze the necessary data. It is our position that we do not have the luxury of waiting so long to require remedial action. In this regard, the legislative history of the Porter-Cologne Act states that corrective actions must be initiated before a problem becomes acute and forces are set in motion which may well be irreversible except over very long periods of time.[82] We conclude that a cleanup and abatement order should, therefore, be issued by this Board to address the problems created by operation of the reservoir, including the seepage of wastewater from the site,

the threat of future surface discharges from the reservoir, and the public nuisance created by exposure of waterfowl to wastewater in the ponds. We find that the evidence supports issuance of a cleanup and abatement order and will now address the contents of the cleanup and abatement order contained in the attached Appendix.

C. Regulatory Programs Applicable to Kesterson Reservoir

At the outset the Bureau argues that the two major regulatory programs which guide our consideration in this matter, the Toxic Pits Cleanup Act of 1984 (Toxic Pits Act) and our Subchapter 15 regulations governing waste disposal to land, are inapplicable to Kesterson Reservoir. This argument appears to be based upon the assumption that the State derives its authority to regulate federal facilities which generate or dispose of hazardous wastes from the federal Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Sections 6901 et seq. Because RCRA exempts irrigation return flows from regulation[83] and because the tile drainage flowing into Kesterson Reservoir may constitute irrigation return flow, the Bureau contends that Kesterson Reservoir may, therefore, be exempt from State regulation.

This argument is without merit. Both the Toxic Pits Act and this Board's Subchapter 15 regulations are water pollution control measures. In Section 313(a)[84] of the federal Clean Water Act, 33 U.S.C. Sections 1251 et seq., Congress expressly authorized state regulation of federal facilities and property which result, or may result in, water pollution. Specifically, this section provides, in part:

> "Each department, agency, or instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants, and each officer, agent, or employee thereof in the performance of his official duties, shall be subject to, and comply with, all Federal, State, interstate, and local requirements, administrative authority, and process and sanctions regarding the control and abatement of water pollution in the same manner, and to the same extent as any nongovernmental entity including the payment of reasonable service charges. The preceding sentence shall apply (A) to any requirement whether substantive or procedural (including any recordkeeping or reporting requirement, any requirement respecting permits and any other requirement, whatsoever), (B) to the exercise of any Federal, State, or local administrative authority, and (C) to any process and sanction, whether enforced in Federal, State, or local courts or in any other manner. This subsection shall apply notwithstanding any immunity of such agencies, officers, agents, or employees under any law or rule of law...." (Emphasis added)

It should also be noted that RCRA, in any case, does not pre-empt the field of hazardous waste regulation. RCRA specifically subjects federal facilities to state and local hazardous waste control requirements, including requirements more extensive or more stringent than federal requirements. Congress was careful to preserve the State's independent police power over hazardous wastes:

> "Nothing in this title shall be construed to prohibit any State or political subdivision thereof from imposing any requirements, including those for site selection, which are more stringent than those imposed by [the hazardous waste management system regulations promulgated by EPA at 40 C.F.R. Sections 260-270]."[85]

Finally, the State does not derive its authority to regulate the disposal of solid or hazardous wastes from RCRA. In particular, this Board's Subchapter 15 regulations were adopted pursuant to our authority under state

law, the Porter-Cologne Water Quality Control Act, (Porter-Cologne Act) Water Code Sections 13000 et seq. This act grants the State and Regional Boards broad authority to regulate waste discharges to land, whether such wastes are hazardous or nonhazardous. Irrigation return flows are not exempted from regulation under the Porter-Cologne Act.

1. Character of Wastewater

The character of the wastewater discharged into Kesterson Reservoir determines the applicability of the Toxic Pits Act and the degree of water quality protection required under this Board's Subchapter 15 regulations. Therefore, we will first consider whether the wastewater is hazardous for purposes of both of these regulatory schemes.

Subchapter 15 defines a "hazardous waste" as "any waste which, under Section 66300 of Title 22 of [the California Administrative Code], is required to be managed according to Chapter 30 of Division 4 of Title 22",[86] the hazardous waste management regulations of DOHS. Section 66300 provides, in pertinent part, that the provisions of Chapter 30 apply to the management of any liquid waste "which conforms to the definition of hazardous waste in Section 25117 of the Health and Safety Code including but not limited to the following: (1) Waste which is hazardous pursuant to any criterion in Article 11 of [Chapter 30] and consists of or contains a hazardous material cited in Article 9 of [Chapter 30]...."

Similarly, the Toxic Pits Act defines "hazardous waste" to mean a waste that is a hazardous waste, under Chapter 6.5, of Division 20 of the Health and Safety Code.[87] The applicable definition of hazardous waste in Chapter 6.5 is contained in Health and Safety Code Section 25117. Department

of Health Services regulations implementing Chapter 6.5, additionally, provide that a waste shall be considered hazardous if it (1) meets the definition of hazardous waste in Health and Safety Code Section 25117 or (2) satisfies any of the criteria for hazardous waste in Article 11 of Chapter 30, Title 22.[88]

The wastewater in Kesterson Reservoir can be considered hazardous on two grounds. First, it meets the definition of a hazardous waste in Health and Safety Code Section 25117. Secondly, it contains hazardous materials cited in Article 9 and is hazardous pursuant to a criterion in Article 11.

Health and Safety Code Section 25117 defines a hazardous waste as:

> "A waste, or combination of wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may either:
>
> (a) Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness.
>
> (b) Pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, or disposed of, or otherwise managed."

As stated previously in Part II.B.2. of this Order, the wastewater discharged from the San Luis Drain to Kesterson Reservoir contains a variety of constituents in concentrations which exceed established water quality criteria. To reiterate, selenium concentrations in the reservoir exceed the EPA primary drinking water standard. Selenium, mercury and nickel concentrations in parts of the reservoir exceed EPA ambient water criteria for the protection of human health from the toxic properties of these elements ingested through water and contaminated aquatic organisms. Concentrations of hexavalent

chromium, copper, cadmium and zinc, in some instances, exceed EPA criteria for the protection of freshwater aquatic life.

Further, experience has amply demonstrated that the wastewater in Kesterson Reservoir, in fact, poses a substantial threat to waterfowl, fish and aquatic life. The Fish and Wildlife Service has identified selenium poisoning as the cause of mortalities of adult waterfowl and the most probable cause of deformities in chicks and embryos at the facility. Their studies have also indicated that selenium concentrations in Kesterson have accumulated and biomagnified through the food chain. Additionally, the San Luis Drain wastewater flowing into Kesterson has been determined to be toxic to fish and invertebrates. It must be concluded, on the basis of the available data, that the combination of constituents discharged into Kesterson Reservoir poses a substantial present and potential hazard to human health and the environment if the wastewater is improperly stored, disposed of, or otherwise managed, and that the wastewater, therefore, meets the definition of hazardous waste in Health and Safety Code Section 25117.[89]

In addition, the wastewater in Kesterson Reservoir contains a number of components which are cited as hazardous in Article 9 of the DOHS regulations, including selenium and selenium compounds, mercury, chromium compounds and cadmium compounds,[90] and the wastewater is hazardous pursuant to a criterion in Article 11, specifically, a toxicity criterion. Article 11 provides, in pertinent part, that a waste is toxic and hazardous if it "[h]as been shown through experience or testing to pose a hazard to human health or environment because of its carcinogenicity, acute toxicity, chronic toxicity, bioaccumulative properties or persistence in the environment...."[91] As

previously stated, tests conducted in 1983 of the San Luis Drain wastewater flowing into Kesterson Reservoir showed that the wastewater was acutely toxic to fish and invertebrates.[92] In addition, experience has shown that the wastewater in the reservoir poses a hazard to the environment because of its chronic toxicity, bioaccumulative properties, and persistence in the environment. The record amply demonstrates that an abnormally high incidence of reproductive failures, embryo and chick deformities and mortalities of waterfowl have occurred at Kesterson Reservoir. Further, all fish, other than mosquito fish, have disappeared. The wastewater contains a number of substances, including selenium, mercury and molybdenum, which are known to bioaccumulate. Selenium, in particular has been linked to the mortalities of adult waterfowl and the deformities of chicks and embroys at the site.

The DOHS regulations in Article 11 contain an additional criterionwhereby a waste may be considered hazardous. Specifically, Section 66699 of Article 11, Title 22 of the California Administrative Code, provides that a waste is hazardous if it contains specified inorganic persistent and bioaccumulative toxic substances in concentrations above certain limits. In particular, Section 66699 provides that selenium is hazardous if its soluble threshold limit concentration (STLC) exceeds one milligram per liter (mg/l) or if its total threshold limit concentration (TTLC) exceeds 100 milligrams per kilogram (mg/kg).

The Bureau and other parties contend that the wastewater in Kesterson Reservoir cannot be considered hazardous because the selenium levels in the ponds do not rise above the STLC or TTLC limits. This argument must be rejected for several reasons. First, the DOHS hazardous waste management

regulations indicate that a waste will be considered hazardous if it meets the statutory definition even if its components do not exceed the specific concentration limits in Article 11.[93] Secondly, Section 66696(a)(6) clearly indicates that experience, as well as testing, of the effects of a wastestream on the environment is an important criterion in assessing the hazardous properties of the waste.

In any event, however, we note that the concentrations of selenium in bottom sediments in certain portions of the San Luis Drain currently exceed the TTLC level of 100 mg/kg. Twelve sediment samples from the drain were collected in August 1984; four of the samples contained a total selenium concentration of 100 mg/kg or greater, ranging up to 210 mg/kg.[94]

Preliminary indications from laboratory analyses of soil samples taken from Kesterson Reservoir are that the selenium concentrations are less than 50 mg/kg.[95] These results appear to be questionable, however, for several reasons. First, the sediment samples taken from the San Luis Drain were analyzed by a different laboratory and by a different technique than the samples taken from Kesterson Reservoir.[96] Secondly, the locations at Kesterson Reservoir where the highest selenium concentrations in sediments would be expected were not sampled. These locations would be Ponds 1 and 2 near the inlet from the San Luis Drain.[97] Lastly, as the Bureau has indicated, selenium concentrations in sediments in the San Luis Drain appear to be the result of bioconcentration of the substance by phytoplankton and periphyton and subsequent deposition into the organic rich muck in the bottom of the drain.[98] Rather than sampling the organic material near the surface of the Kesterson ponds, however, the soil samples at Kesterson Reservoir

consisted of one, two, and three-foot core samples.[99] We note that the San Luis Drain is in hydraulic continuity with the ponds of Kesterson Reservoir. Further, the conditions in the San Luis Drain which apparently caused high concentrations of selenium in the sediments, that is, bioconcentration by phytoplankon and periphyton, also occur at Kesterson Reservoir. Therefore, we are concerned that the selenium concentrations in sediments in parts of the reservoir have already reached the TTLC level.

At the present time, the concentration of selenium in the wastewater in parts of Kesterson Reservoir rises as high as .5 mg/l, or one-half of the STLC limit. The Bureau contends that the wastewater in Kesterson Reservoir is not hazardous, but rather is either a designated or a nonhazardous waste under this Board's Subchapter 15 regulations. Subchapter 15 defines a "designated waste" in part, as a "nonhazardous waste which consists of or contains pollutants which, under ambient environmental conditions at the waste management unit, could be released in concentrations in excess of applicable water quality objectives, or which could cause degradation of waters of the state."[100] As the preceding discussion in Part *II.B.2. of this Order* indicates, the release of pollutants from Kesterson Reservoir has degraded the upper groundwater aquifer and threatens to degrade the lower aquifer. Release of wastewater from Kesterson Reservoir also threatens to degrade the waters of Mud Slough, Salt Slough and the San Joaquin River. The wastewater in the reservoir, at the very minimum, must, therefore, be considered a designated waste under Subchapter 15. Assuming, for the sake of argument, that the wastewater in Kesterson Reservoir is at most a designated waste and that the facility is properly lined in accordance with the Subchapter 15 requirements

for disposal of a designated waste, we calculate that the selenium levels in the wastewater at Kesterson would eventually rise to the STLC level of 1 mg/l.[101] When this occurred, the wastewater would also be hazardous under Section 66699 of the DOHS regulations.

It is readily apparent, from a review of the record in this case that the wastewater in Kesterson Reservoir poses a hazard to the environment because the reservoir has been improperly located, constructed, and managed. The ponds at Kesterson Reservoir are located immediately adjacent to Mud Slough, a tributary of the San Joaquin River, in a wetlands area where the perched groundwater table at times is above the ground surface.[102] The ponds also overlie a groundwater body which is used for drinking water supply. In addition to posing a threat to ground and surface water quality, the location of the ponds clearly poses a hazard to the resident and migratory waterfowl which frequent the area. Kesterson Reservoir is situated in the Pacific Flyway, adjacent to several wildlife refuges in the Grasslands area. The reservoir is in an area designated in the Basin Plan as a critical habitat for waterfowl and water-dependent wildlife. Further, the ponds were constructed in a manner which allows more than fifty percent of the inflow to seep into the perched groundwater table and with inadequate capacity to handle flows during certain wet weather events. Additionally, the ponds were managed for the dual purposes of drainage control and as a wildlife refuge. Vegetation attractive to waterfowl, for example, has been allowed to grow in the ponds. Due to these factors, principally the improper construction and location of the reservoir, we are of the opinion that the facility cannot be operated in a manner which does not pose a hazard to waterfowl and other wildlife.

While we conclude that the wastewater contained in Kesterson Reservoir clearly poses a hazard to the environment because of the improper location and construction of the reservoir, we are also of the opinion that the wastewater could be properly managed in other locations, for example in ponds in certain parts of Westlands Water District, in a manner which did not pose a similar threat to the environment. In this regard we note that Section 66310(a)(2) of the DOHS regulations provides that the Department may grant a variance from the hazardous waste management regulations if a hazardous waste is "[h]andled, stored or disposed of pursuant to regulations of another governmental agency in a manner which is consistent with the hazardous waste management provisions of this chapter and which will not result in a hazard to human health and safety, livestock or wildlife." If ponds were constructed to meet this Board's Subchapter 15 requirements for a Class II surface impoundment, there should be minimal seepage from the ponds, and the ponds should be adequately sized to handle anticipated flows. In addition, ponds could be constructed in a location which did not pose a hazard to waterfowl or to ground and surface water quality. Features to protect waterfowl, such as adequate pond depth, lack of vegetation, and screening, if necessary, could be included as additional measures to protect waterfowl. We conclude that compliance with the Subchapter 15 requirements for a Class II surface impoundment, together with proper location of waste management facilities and inclusion of features to protect waterfowl, should ensure that the wastewater would not pose a hazard to human health and safety, livestock or wildlife.

Having concluded that the wastewater in Kesterson Reservoir is hazardous, therefore, we will now consider the regulatory programs applicable to this facility. The first is the State Board's Subchapter 15 regulations.

2. Subchapter 15

In 1972, the State Board enacted regulations governing waste disposal to land in Subchapter 15 of Chapter 3, Title 23, California Administrative Code. On October 18, 1984, the State Board adopted a revised Subchapter 15. These regulations, with one exception not pertinent here, were approved by the Office of Administrative Law on November 26 and became effective on November 27, 1984.

The Subchapter 15 regulations are fairly broad in scope and cover both hazardous and nonhazardous wastes in landfills, surface impoundments, waste piles, and land treatment units. The Subchapter 15 regulations contain provisions covering both seepage and surface discharge from a surface impoundment, which are applicable to the Kesterson Reservoir ponds and which have been incorporated into the cleanup and abatement order contained in the attached Appendix. These provisions are summarized below.

a. Surface Discharge

Subchapter 15 includes specific requirements governing the containment of wastes in a surface impoundment. Specifically, Section 2548 of Title 23 of the California Administrative Code requires, in part, that:

> (1) Surface impoundments shall have sufficient freeboard to accommodate seasonal precipitation (in no case less than 2 feet [measured vertically]), and shall be designed and constructed to prevent overtopping as a result of wind conditions likely to accompany such precipitation conditions.
>
> (2) An operation plan shall be submitted to the Regional Board which will provide operation levels and waste input quantities permitted each month based on anticipated precipitation and on past precipitation conditions for the year.

> (3) Direct pipeline discharge to surface impoundments shall be either equipped with devices or shall have fail-safe operating procedures to prevent overfilling. Discharges shall be stopped in the event of failure of the containment systems which cause a threat to water quality.
>
> (4) There shall be no discharge from a surface impoundment except as authorized by waste discharge requirements.
>
> (5) Surface impoundments shall be designed and constructed to prevent scouring of containment structures at points of discharge into the impoundments and by wave action at the waterline.

b. Seepage

The newly adopted Subchapter 15 contains a number of detailed requirements which address seepage from a surface impoundment. The subchapter contains a waste classification system; and, as a general rule, the waste classification determines the class of waste management unit at which the waste may be disposed. Wastes are classified according to their risk to water quality. The higher the waste classification, the more stringent the controls imposed by Subchapter 15. For example, the discharge of hazardous wastes is, generally, permitted only at a Class I waste management unit, unless the discharger is granted a variance by DOHS.[103] Liquid hazardous wastes may only be discharged at a Class I surface impoundment.[104] Designated wastes, which pose a less severe water quality hazard, may be discharged at either a Class I or Class II waste management unit.[105] The discharge of liquid designated wastes is permitted at a Class I or Class II surface impoundment.[106]

The criteria for a Class I waste management unit include both siting and construction standards. Compliance with these standards by a waste discharger should minimize any seepage from the waste management unit. For a Class I unit, the regulations specify that the site must be underlain by natural geologic materials of low permeability and of sufficient thickness to prevent vertical movement, that natural or artificial barriers must be used to prevent lateral movement, and that the site must be located outside of floodplains and earthquake prone areas.[107] The construction criteria for a Class I unit specify, in part, that the unit must be designed and constructed to prevent migration of wastes from the unit to adjacent geologic materials and ground and surface waters.[108] In particular, the site must be double lined and equipped with leachate collection and removal systems and precipitation and drainage control facilities, or their equivalent.[109]

Class II waste management units must be located where site characteristics and containment structures isolate the wastes from waters of the state.[110] Existing Class II surface impoundments, in particular, must be fitted with liners and leachate collection and removal systems as feasible, with subsurface barriers as needed and feasible, and with precipitation and drainage control facilities.[111] The liner requirements for a Class II surface impoundment are either a double liner or a single clay liner, provided that the single clay liner is removed or replaced before the last 25 percent (minimum one-foot thickness) of the liner is penetrated by fluid, including waste or leachate.[112] Class II surface impoundments which are designed and constructed with a double liner system may use natural geologic materials, which have a permeability of $1x10^{-6}$ cm/sec and which are of sufficient

thickness to prevent vertical movement of fluid, including waste and leachate, to waters of the state, for the outer liner.[113]

We have previously concluded that the wastewater in Kesterson Reservoir is a hazardous waste under Subchapter 15. The Bureau must, therefore, either upgrade the reservoir to meet the Subchapter 15 requirements for a Class I surface impoundment, discontinue use of the reservoir as a waste management facility and operate it solely as a wildlife refuge, or close the facility in accordance with the provisions of the subchapter. If the facility is closed, all liquid wastes must be removed and the residual wastes either removed or adequately covered in accordance with Section 2582 of Title 23.

The Bureau is currently obligated to dispose of the approximately 7,000 acre feet of drainage flows entering the San Luis Drain from Westlands Water District. If the Bureau closes Kesterson Reservoir, the Bureau must find an environmentally acceptable and legal alternative for disposal of these wastes. In this regard, we note that several of the participants in this proceeding, including Westlands Water District, contend that closure of Kesterson Reservoir could, over time, result in the creation of approximately "200 mini-Kestersons" in the Westlands area. However, there appear to be several disposal options available to the Bureau and Westlands which would not have this adverse environmental impact. These options include: Discharging the wastewater into properly located, constructed and maintained evaporation ponds, recycling, i.e. mixing the effluent with high quality irrigation water, and reusing it within Westlands, and appropriate dilution of the effluent and disposal to the San Joaquin River.[114] The Bureau has also indicated that it is considering conversion of the San Luis Drain into a freshwater conveyance and operation of Kesterson Reservoir solely as a national wildlife refuge, and we strongly encourage consideration of such use.

We wish to emphasize that nothing in this Order is intended to prevent consideration of any other disposal options, which are legally and environmentally sound. It appears that the Bureau, by virtue of the act authorizing construction of the San Luis Unit of the Central Valley project, is obligated to provide drainage service to those areas served by the project. If the Bureau closes Kesterson Reservoir and continues to supply irrigation water to Westlands Water District without implementing an adequate disposal option, continued irrigation in the affected area of Westlands Water District could constitute an unreasonable use of water.

c. Other Requirements

The newly adopted Subchapter 15 has a number of other requirements which are applicable to Kesterson Reservoir. Specifically, the regulations require that dischargers at existing waste management units which have not been issued waste discharge requirements must file a report of waste discharge, containing detailed information regarding waste characteristics, geologic and climatologic characteristics of the unit and surrounding region, installed features, operation plans for waste containment, precipitation and drainage controls, and closure and post-closure maintenance plans, within 60 days of the effective date of the regulations.[115] If the Bureau decides to upgrade Kesterson to meet the requirements for a Class I surface impoundment, the Bureau must submit a revised report of waste discharge in compliance with this reporting requirement. Alternatively, if the Bureau chooses to close Kesterson Reservoir and selects some other disposal option, the Bureau must submit a closure and post-closure maintenance plan in accordance with the applicable Subchapter 15 requirements.

The cleanup and abatement order contained in the attached Appendix requires the Bureau to submit a plan to the State Board for its approval within five months of the date of this Order which addresses the pollution and nuisance problems at Kesterson Reservoir. We conclude that it would be appropriate for the Bureau to submit a revised report of waste discharge subsequent to the submission of the required plan. As explained previously, the Bureau has already submitted a report of waste discharge. Pursuant to our authority under Water Code Section 13269, we will require the Bureau to submit a revised report of waste discharge or a closure and post-closure maintenance plan, as appropriate, to this Board and the Central Valley Regional Board within six months of the date of this Order.

Additionally, Subchapter 15 requires that dischargers develop and submit monitoring programs within six months of the date of the regulations which comply with the provisions of Article 5 of the subchapter.[116] Although we note that the Bureau is currently conducting extensive monitoring at Kesterson, the Bureau must review its ongoing monitoring programs to determine whether they comply with Subchapter 15.

3. Toxic Pits Cleanup Act of 1984

The Toxic Pits Act, which was recently signed by the Governor, establishes a new program to regulate the discharge of hazardous waste into surface impoundments. Stats. 1984, Ch. 1543. The Toxic Pits Act added a new Article 9.5 to Chapter 6.5, Division 20, of the Health and Safety Code, which became effective on January 1, 1985. The provisions of the Toxic Pits Act are consistent with the State Board's Subchapter 15 regulations. The Toxic Pits Act contains two discharge prohibitions which are applicable to Kesterson Reservoir.

The Toxic Pits Act contains a general prohibition against the discharge of any liquid hazardous waste or hazardous wastes containing free liquids into a surface impoundment after January 1, 1989, unless the surface impoundment meets certain specified criteria.[117] The criteria include double lining, installation of a leachate collection system, and groundwater monitoring.[118] The statute also contains detailed provisions for an exemption from this general prohibition.[119]

The Toxic Pits Act contains an additional prohibition applicable to surface impoundments located within one-half mile upgradient from a potential source of drinking water. Specifically, the discharge of liquid hazardous wastes or hazardous wastes containing free liquids into such impoundments is prohibited after June 30, 1988, unless an exemption is granted by the Regional Board.[120] The Regional Board can grant an exemption only if the following conditions are met:

a. An application for an exemption is filed with the Regional Board by January 1, 1986.

b. The Regional Board finds that:

(1) No extremely hazardous wastes are currently being discharged into the surface impoundment;

(2) The records of the person applying for an exemption indicate that no extremely hazardous wastes have been discharged into the surface impoundment, or extremely hazardous wastes are not present in the surface impoundment, in the vadose zone, or in the waters of the state;

(3) The surface impoundment is in compliance with Health and Safety Code Section 25208.5, which mandates double lining, leachate collection

systems, and groundwater monitoring, unless exempted;

(4) A hydrogeological assessment report has been filed, pursuant to Health and Safety Code Section 25208.8;

(5) The impoundment does not leak hazardous wastes into the vadose zone or waters of the state in concentrations which pollute or threaten to pollute these waters.[121]

Kesterson Reservoir is clearly a "surface impoundment", as defined in the Toxic Pits Act. That is, it is a "waste management unit...which is a[n]...artificial excavation, or diked area formed primarily of earthen materials...which is designed to hold an accumulation of liquid hazardous wastes...including, evaporation ponds...."[122] Further, Kesterson Reservoir overlies a groundwater aquifer which is extensively used for domestic and municipal water supply and which is designated for these uses in the Central Valley Regional Board Basin Plan.

Whether the Toxic Pits Act prohibitions apply to Kesterson Reservoir, therefore, depends upon whether the wastewater in the reservoir is "hazardous". For the reasons explained above, we have concluded that the wastes in Kesterson Reservoir are hazardous under the applicable Health and Safety Code provisions and implementing regulations.

Even if we were to assume, however, for the sake of argument that the wastes are not hazardous but only designated wastes under Subchapter 15, the wastes would reach hazardous levels, as explained above, if the facility were properly lined in accordance with the Subchapter 15 requirements for a Class II surface impoundment. The Toxics Pits Act includes storage in the definition of

"discharge".[123] Consequently, even assuming that Kesterson Reservoir is not covered by the Toxic Pits Act at the present time, the facility would undoubtedly be covered by this statute in the future when the selenium levels in the reservoir rose to the STLC or TTLC levels specified in the DOHS regulations.

In conclusion, under the Toxic Pits Act the Bureau must cease discharging wastewater to Kesterson Reservoir by June 30, 1988, unless the Bureau obtains an exemption from the Regional Board. In order to obtain an exemption, as stated above, the Bureau will have to demonstrate compliance with the provisions of Health and Safety Code Section 25208.5, regarding double lining, installation of a leachate collection system, and groundwater monitoring.

It should be noted that Section 25208.5 contains provisions for an exemption from its requirements. An exemption cannot be granted, however, unless the Regional Board finds that (1) no hazardous waste constituents have migrated from the surface impoundment into the vadose zone or waters of the state in concentrations which pollute or threaten to pollute waters of the state; and (2) continuing the operation of the impoundment without double lining and the other requirements does not pose a significant potential of hazardous waste constituents migrating from the impoundment into the vadose zone or waters of the state in concentrations which pollute or threaten to pollute waters of the state.[124] As the preceding discussion in Part II.B.2. indicates, we have already concluded that hazardous waste constituents are being discharged into Kesterson Reservoir and are migrating from the surface impoundment in concentrations which threaten to pollute waters of the state.

Therefore, an exemption from the double lining requirement of Section 25208.5 would be inappropriate. The practical effect of the Toxic Pits Act, as a consequence, is that the Bureau will either have to double line Kesterson Reservoir, install a leachate collection system, and institute groundwater monitoring in accordance with Section 25208.5 or cease discharging wastewater to the Reservoir by June 30, 1988. (See Section 25208.6).

D. Potential Costs of Compliance with Cleanup and Abatement Order

Both the Bureau and Westlands Water District have provided extensive information regarding the potential costs of implementing various disposal options.[125] We have considered these submittals and note that some of the alternatives could involve substantial costs. We further observe that this Order allows flexibility in the selection of a disposal option. The costs of at least one of the options being considered, i.e. operation of Kesterson Reservoir solely as a wildlife refuge and recycling and reuse of the tile drainage from Westlands which is currently being discharged into the San Luis Drain, do not appear disproportionate to the environmental gains.

The federal government would, of course, be a potential source of financing for implementation of measures necessary to comply with a cleanup and abatement order. It is also possible that the Bureau could pass some of the costs of compliance with a cleanup and abatement order along to those entities which benefit from the provision of drainage service, i.e., Westlands Water District.

III. GRASSLAND AND THE SAN JOAQUIN RIVER

A. Background

1. Grassland

Grassland is located in Merced County and consists of approximately 52,000 acres of seasonally flooded, managed wetlands. Grassland is divided into two separate areas. The 31,000 acre northern area lies one mile north of Los Banos and extends 12 miles north to the Kesterson National Wildlife Refuge boundary. The southern area is located three miles southeast of Los Banos and contains 21,000 acres.

Grassland encompasses the largest tract of native grasslands remaining in the San Joaquin Valley. The State's wetlands have dwindled from 5,000,000 to 300,000 acres. Grassland comprises 17 percent of this remaining acreage. Its preservation is one of the Fish and Wildlife Service's highest priorities in its overall waterfowl habitat preservation program. To this end, a federal easement program to protect the Pacific Flyway was established. In return for a maximum payment of $315 per acre, some landowners within Grassland have agreed to maintain their land as waterfowl habitat. Petitioner is a participant in this program. In addition, the federal government has instituted a Water Bank Program, applicable to Grassland, under which landowners are paid from $10.00 to $15.00 per acre to maintain their lands in marshland to accommodate the returning waterfowl migration.

Grassland receives water from several different sources--surface and subsurface agricultural drainage flows and fresh water. Grassland manages this water by an open system of temporary ponding during the fall and winter months to create waterfowl habitat. In the spring the marshes are drained into the San Joaquin River; during the summer the marshes are irrigated in order to generate forage for cattle grazing.

It should be noted that, although Grassland and Kesterson Reservoir are contiguous, they are operated quite differently. The reservoir receives only tile drainage flows, which are concentrated in a closed marsh. Grassland, on the other hand, receives a mixture of surface and subsurface drainage flows and freshwater and is operated as a open marsh, i.e. it is drained once a year.

Under contracts with the Department of the Interior, Grassland receives 53,500 acre feet of Class I irrigation water each year between September 15 and November 30. Of this amount, approximately 7,000 acre feet are lost due to seepage and evaporation, leaving about 46,500 acre feet of firm Class I contract water for application on 52,000 acres of land. It takes one and one-half to two acre-feet of water to flood one acre of land. Because there is not enough firm Class I contract water to flood the marshes, Grassland is heavily reliant upon other water sources, including agricultural surface runoff (tail water) and tile drainage water to meet its water requirements.[126]

Grassland receives agricultural drainage flows from approximately 18 entities, including irrigation districts and individual farmers. The majority of these entities supply drainage water pursuant to a contract with Grassland. Three irrigation districts claim an historic right to drain across Grassland and, consequently, do not have a drainage contract with Grassland.[127] Those entities supplying drainage flows to Grassland pursuant to contract are not required to provide a minimum amount of flow. With the exception of the Poso Canal Company and the entities claiming an historic right to drain, all of the

entities draining into Grassland are subject to contractual limitations on flows. In addition, Grassland has established a moratorium on the receipt of any additional drain waters.

The quantity of tile drain effluent flowing into Grassland cannot accurately be determined at the present time. In 1981 the Bureau estimated that 53,000 acre feet of tile drainage was generated in the Grasslands area and that, of this amount, 7,160 acre feet were distributed to Kesterson Reservoir, 28,700 acre feet to Grassland, and the remainder (17,140 acre feet) to the San Joaquin River. More recent estimates are that from 28,000 to 40,000 acre-feet of tile drain water are currently being discharged into Grassland.[128] Due to the number of entities draining into Grassland and the lack of monitoring data on flows from these entities, an accurate estimate of the quantity of tile drainage presently being received by Grassland cannot be made.

Grassland has had a water quality monitoring program in place for a number of years for the measurement of the total dissolved solids (TDS) and boron concentrations of incoming waters. The contractual agreements between Grassland and the draining entities specify that incoming drainage flows must not exceed concentrations of 2,500 parts per million (ppm) TDS and 6 ppm boron. There is no data in the record to indicate the present status of compliance by the draining entities with these limits.

In general, the quality of drain water flowing into Grassland has been poorly documented. The results of a synoptic survey by the Geological Survey which were released in November 1984, however, establish that Grassland, like Kesterson Reservoir, receives agricultural drainage from seleniferous areas.[129] Also, the Bureau has recently released data on concentrations of

trace elements in the waters of canals flowing into Grassland.[130] In some samples, the elements boron, cadmium, chromium, copper, mercury, nickel, lead, selenium and zinc were present in concentrations which exceed drinking water standards or criteria established for the protection of human health, freshwater aquatic life or irrigated agriculture. The concentration of selenium in the canals ranged from less than 1 ug/l to 102 ug/l.[131] It should be emphasized that these samples were taken during summer months when water quality is poor. During the winter months, the agricultural return flows are diluted with high quality irrigation supply water.

Even more recently the State Board received a preliminary summary by the Fish and Wildlife Service of the latest study results of selenium levels in aquatic birds in the Grasslands area.[132] The results indicate that elevated selenium levels are present in the livers of birds in the area. These elevated levels were found in the resident bird population not the migratory bird population.

Higher selenium levels were detected in birds nesting in the southern region of Grassland than those nesting in the northern region. Some of the entities draining into the southern area are situated in the highly seleniferous Panoche Fan area. Consequently, the water flowing into the southern portion of Grassland contains higher concentrations of selenium than that which is discharged to the northern area and this is reflected in the higher selenium levels detected in birds from the southern area.

2. San Joaquin River

The existing and potential beneficial uses of the San Joaquin River and its tributaries were previously delineated in Part II.B.2. of this Order.

The applicable Basin Plan contains only two specific water quality objectives for the upper reach of the San Joaquin River in question. These objectives are: (1) Chlorinated hydrocarbon pesticides shall not be present in detectable quantities; and (2) the pH shall not be depressed below 6.5 nor raised above 8.5 units as a result of waste discharges.[133]

The Basin Plan does contain specific water quality objectives for the lower San Joaquin River near Vernalis.[134] These objectives and a summary of monitoring data compiled from the EPA Water Quality Data Computerized Storage and Retrieval System (STORET) are contained in Attachment 10 of this Order. An inspection of Attachment 10 indicates that most of the water quality objectives are exceeded at least occasionally; and, in some cases, the mean concentration of a particular element exceeds the applicable objective.

The constituents cited in Attachment 10 are not the only water quality indices of concern in the San Joaquin River. For example, the mercury concentration in the river often exceeds the 24-hour average criterion recommended by EPA for the protection of aquatic life (0.2 ug/l).[135] Also, even though the Basin Plan provides that chlorinated hydrocarbon pesticides shall not be present in detectable quantities, monitoring data at Vernalis indicates that a large number of these pesticides are present in the river.[136]

The fact that the lower San Joaquin River is of such poor quality that beneficial uses cannot be protected and water quality objectives cannot be met is recognized in the Basin Plan. The Basin Plan classifies the lower San Joaquin River from just south of its confluence with the Merced River to its point of discharge in the Delta as a Water Quality Limited Segment.[137]

The major cause of water quality problems in the San Joaquin River is considered to be the discharge of agricultural return flows. There is no data in the record on the percentage of flow in the San Joaquin River which is agricultural drainage flow. It is generally acknowledged, however, that most of the river flow during the summer months consists of agricultural return flow.

The San Joaquin River receives both tailwater and tile drainage. These two types of agricultural drainage generally have distinct water quality problems. Surface runoff can have high concentrations of pesticides and fertilizers, whereas tile drainage often has high concentrations of salts and trace metals.

The quantity and quality of tailwater being discharged into the San Joaquin River cannot be determined from the existing record. With respect to tile drainage, it is presently estimated that approximately 84,000 acres in the western San Joaquin Valley have tile drains. The Bureau asserts that another 169,000 acres now need drainage. Further, the Bureau estimates that western San Joaquin Valley land needing drainage will increase to 345,000 acres by the year 2020 and 493,000 acres by 2095. The quantity of tile drainage presently being generated in the area lies between 50,000 and 75,000 acre feet. With the exception of the 7,000 acre-feet presently discharged at Kesterson Reservoir, this drainage ultimately reaches the San Joaquin River. There are also some tile drain systems installed in the eastern San Joaquin Valley. Neither the number of tile drained acres nor the quantity or quality of drainage water from the eastern San Joaquin Valley can be determined from the existing record.

B. Contentions and Findings

1. Contention: Petitioner contends that the Central Valley Regional Board has failed to implement the Porter-Cologne Act with respect to the discharge of agricultural return flows to Grassland and to the San Joaquin River and its tributaries. In his petition filed on May 18, petitioner originally requested that the State Board take enforcement measures to prohibit the discharge of agricultural drainage flows to Grassland and the river prior to the filing of a report of waste discharge by the various dischargers and prior to the issuance of waste discharge requirements by the State or Central Valley Regional Board. In a later submittal, petitioner revised his request with respect to Grassland. He now requests that the State Board require all entities draining into Grassland to undertake a monitoring program with respect to their discharges. The monitoring program would cover those parameters normally found in agricultural drainage flows, such as boron, TDS and chlorides, and such constituents as trace elements and pesticides. Additionally, he requests that the State Board, in cooperation with the Fish and Wildlife Service, appoint a study team to develop standards for the Grassland area, which will protect the area for waterfowl habitat.[138]

Finding: The Porter-Cologne Act requires "[a]ny person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the state...[to] file with the regional board of that region a report of the discharge, containing such information as may be required by the board."[139] When a report is filed, the appropriate Regional Board is required to prescribe requirements for the discharge "with relation to the conditions existing from time to time in the disposal area or

receiving waters upon or into which the discharge is made or proposed."[140] The waste discharge requirements "shall implement relevant water quality control plans, if any have been adopted, and shall take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of [Water Code] Section 13241."[141]

The Porter-Cologne Act also authorizes a Regional Board to waive the filing of a report of waste discharge and to waive the adoption of waste discharge requirements "as to a specific discharge or a specific type of discharge where such waiver is not against the public interest." Such waivers are conditional and may be terminated at any time.[142]

The Central Valley Regional Board has not required the filing of a report of waste discharge from any of the entities discharging agricultural drainage flows into Grassland or into the San Joaquin River or its tributaries. Based upon our review of the record, we conclude that it is appropriate to waive the filing of a report of waste discharge by these entities, on a temporary basis, until sufficient data is collected to adequately characterize the agricultural drainage waters flowing into Grassland and the San Joaquin River and until appropriate water quality objectives for the San Joaquin River basin are formulated.

With respect to Grassland, in particular, we find that the quantity and quality of agricultural drainage flows into the district are not well documented, and there is a serious need for additional data in order to adequately characterize these wastewaters. There is no evidence in the record at the present time to indicate that the acute problems which have developed at

Kesterson Reservoir have been encountered at Grassland. We, therefore, conclude that it is appropriate to gather additional data prior to regulation of the discharges from the draining entities into Grassland under waste discharge requirements.

Although we conclude that a temporary waiver of waste discharge requirements is appropriate for the draining entities, nevertheless, it is apparent that Grassland must take action in this interim period to reduce selenium levels in wastewater entering the district. The fact that adverse environmental impacts, stemming from the discharge of subsurface agricultural flows into the district, have not become evident may be partly due to the manner in which Grassland is operated and the different water sources received by the district. The potential for water quality problems, however, clearly exists in Grassland because the percentage of tile drain water flowing into Grassland is increasing. In addition, the limited monitoring data which is available on the quality of agricultural drainage waters flowing into Grassland indicates that some of the drainage flows contain constituents, including selenium and other trace elements, in concentrations which exceed water quality criteria. Further, the most recent data regarding selenium levels in birds in the Grasslands area indicates that adverse impacts on avian reproduction in portions of Grassland can be expected if control measures are not undertaken. For this reason, the State Board will require submission of a technical report by Grassland, pursuant to Water Code Section 13267, within four months of the date of this Order, detailing the measures the district will employ to control selenium levels in wastewater entering the district and a time schedule for implementation of these measures.

There is a similar serious lack of data on the quantity and quality of agricultural return flows being discharged into the San Joaquin River. This data is necessary in order to determine the waste load of the various constituents being discharged into the river. We conclude that the Central Valley Regional Board should collect monitoring data from all of the irrigation districts or other appropriate entities in the San Joaquin River Basin (Basin 5C) and the San Luis Drain service area, which characterizes the quantity, quality and destination of all agricultural drainage flows discharged across the boundaries of each district.

We note that the Central Valley Regional Board has already instituted a voluntary program to obtain the necessary monitoring data, and we concur in this program. If the Central Valley Regional Board is unable to obtain the necessary data through this voluntary approach, the Central Valley Regional Board is authorized to, and should require, the data under its authority pursuant to Water Code Sections 13260 or 13267. Water Code Section 13260 authorizes a Regional Board to require any information it deems necessary from a discharger in a report of waste discharge, and Section 13267 empowers a Regional Board to require appropriate technical and monitoring reports from a discharger. We further conclude that the Central Valley Regional Board should finalize its monitoring program within two months of the date of this Order and complete the data gathering within 14 months of the date of this Order.

Additionally, we conclude that, concurrently with the Central Valley Regional Board's program to collect monitoring data on agricultural drainage discharges in the San Joaquin River basin, a process should be instituted which will result in the development of specific water quality objectives for the

San Joaquin River basin, the adoption of appropriate basin plan amendments by the Central Valley Regional Board, and the development of a program to regulate agricultural drainage discharges in the basin. To this end, a technical committee, consisting of State and Central Valley Regional Board staff selected by the State Board's Executive Director, will be formed within 30 days of the date of this Order.

The technical committee will be charged with the specific tasks of developing: (1) proposed water quality objectives for the San Joaquin River basin; (2) proposed effluent limitations for agricultural drainage discharges in the basin; and (3) a proposal to regulate these discharges. In developing a proposed regulatory program, the committee should consider such issues as: (1) whether different effluent limitations should be developed for discharges during high flow periods in the winter months; and (2) whether effluent limitations should be based, in some cases, on mass loading rather than concentration. Additionally, the technical committee must seek, receive and consider input from the Bureau, affected irrigation and drainage districts, academia, and other interested parties. The committee must also develop an estimate of the total cost of the proposed regulatory program and identify potential sources of financing.[143]

The final recommendations and report of the technical committee must be submitted to the State Board for its approval no later than 18 months from the date of this Order. The Central Valley Regional Board must adopt appropriate basin plan amendments for the San Joaquin River basin within 6 months of approval of the report by the State Board. After the adoption of basin plan amendments, the Central Valley Regional Board must undertake a

program to regulate the discharge of agricultural drainage flows in the San Joaquin River basin, either through the adoption of waste discharge requirements for such discharges or the waiver of requirements under appropriate circumstances.

Petitioner, having indicated that the Central Valley Regional Board has failed to take appropriate action to regulate agricultural drainage, asks us to undertake such a program. This we decline to do. However, given the concerns raised in this matter and their statewide significance, we reserve the right to exercise our authority should the Regional Board fail to develop an adequate regulatory program. In this regard we will require the Central Valley Regional Board to submit monthly reports to our Executive Director detailing progress and activities in developing and implementing a program to regulate the discharge of agricultural drainage flows in the San Joaquin River basin.

We wish to observe that whatever regulatory program is adopted by the Central Valley Regional Board could have far-reaching implications for the San Joaquin Valley. The Bureau is currently seeking a long-term solution to the problem of agricultural drainage in the valley; however, even assuming that the Bureau finds a solution which is economically and politically feasible, it is likely that implementation of the solution will take 15 to 20 years. Therefore, the regulatory program adopted by the Central Valley Regional Board will determine the options for disposal of agricultural drainage from the San Joaquin Valley for at least the interim period prior to development of a long-term solution by the Bureau.

IV. CONCLUSIONS

For the reasons explained above, the State Board concludes as follows:

1. The Bureau is discharging wastewater at Kesterson Reservoir which reaches waters of the State and is causing and threatening to cause conditions of pollution and nuisance; therefore, an Order should be issued to the Bureau directing the Bureau to cleanup and abate such effects;

2. The wastewater in Kesterson Reservoir is a hazardous waste for purposes of Subchapter 15, Title 23, Chapter 3 of the California Administrative Code; consequently, the Bureau must upgrade Kesterson Reservoir to meet the Subchapter 15 requirements for a Class I surface impoundment or find some other acceptable waste disposal alternative;

3. The wastewater in Kesterson Reservoir is also a hazardous waste for purposes of the Toxic Pits Act. Kesterson Reservoir is located within one-half mile upgradient of a drinking water source. The Bureau must, therefore, comply with the discharge prohibition in Section 25208.4 of the Toxic Pits Act.

4. Within 6 months of the effective date of this Order, the Bureau must either file a revised report of waste discharge for Kesterson Reservoir, in compliance with the provisions of Article 9 of Subchapter 15, or a closure and post-closure maintenance plan in compliance with the provisions of Articles 8 and 9 of Subchapter 15;

5. No later than May 27, 1985, the Bureau shall develop and submit a monitoring program to the Central Valley Regional Board which complies with the requirements of Article 5 of Subchapter 15.

6. It is appropriate for the Central Valley Regional Board to waive the filing of a report of waste discharge, on an interim basis, for those

entities discharging agricultural drainage flows into Grassland and into the San Joaquin River and its tributaries until sufficient data is collected to adequately characterize the wastewater and until appropriate water quality objectives are developed for the San Joaquin River basin.

7. Grassland must submit a technical report, pursuant to Water Code Section 13267, within four months of the date of this Order, for the approval of the Executive Director of the State Board and the Executive Officer of the Central Valley Regional Board, detailing the measures the district will undertake to control selenium levels in wastewater entering the district and a time schedule for implementation of these measures.

8. Within two months of the date of this Order, the Central Valley Regional Board shall complete development of monitoring programs for the collection of data from irrigation districts or other appropriate entities in the San Joaquin Valley River basin and the San Luis Drain service area, which adequately characterize the quantity, quality, and destination of agricultural drainage flows across the districts' boundaries. Within 14 months of the date of this Order, the Central Valley Regional Board shall complete the gathering of monitoring data from these programs.

9. Within 30 days of the date of this Order, the State Board's Executive Director shall select a technical committee, composed of State and Central Valley Regional Board staff, for the purposes outlined in Part III of this Order;

10. Within 18 months of the date of this Order, the technical committee shall submit final recommendations and a final report to the State Board for its approval, which fulfills the tasks delineated in this Order;

11. Within 6 months of State Board approval of the committee's final report, the Central Valley Regional Board shall adopt appropriate basin plan amendments for the San Joaquin River basin;

12. After adoption of appropriate basin plan amendments, the Central Valley Regional Board should implement a program to regulate the discharge of agricultural drainage flows in the San Joaquin River basin, either through waste discharge requirements or a waiver of requirements in appropriate circumstances.

13. The Central Valley Regional Board shall submit monthly progress reports, beginning in March 1985, detailing progress and activities in developing and implementing a program to regulate the discharge of agricultural drainage flows in the San Joaquin River basin.

V. ORDER

IT IS HEREBY ORDERED that the cleanup and abatement order contained in the attached Appendix is hereby adopted.

IT IS FURTHER ORDERED that, within 6 months of the effective date of this Order, the Bureau shall submit a revised report of waste discharge for Kesterson Reservoir, in compliance with the provisions of Article 9 of Subchapter 15, or a closure and post-closure maintenance plan for the reservoir in compliance with the provisions of Articles 8 and 9 of Subchapter 15.

IT IS FURTHER ORDERED that, no later than May 27, 1985, the Bureau shall develop and submit a monitoring program to the Central Valley Regional Board which complies with the requirements of Article 5 of Subchapter 15.

IT IS FURTHER ORDERED that, within four months of the date of this Order, Grassland shall submit a technical report to the Executive Director of the State Board and the Executive Officer of the Central Valley Regional Board, for their approval, detailing the measures the district will undertake to control selenium levels in wastewater entering the district and a time schedule for implementation of these measures.

IT IS FURTHER ORDERED that, within two months of the date of this Order the Central Valley Regional Board shall complete development of monitoring programs for the collection of data from irrigation districts or other appropriate entities in the San Joaquin River basin and the San Luis Drain service area, which adequately characterize the quantity, quality and destination of agricultural drainage flows across the districts' boundaries. Within 14 months of the date of this Order, the Central Valley Regional Board shall complete the gathering of monitoring data from these programs;

IT IS FURTHER ORDERED that, within 30 days of the date of this Order this Board's Executive Director shall select a technical committee, composed of State and Central Valley Regional Board staff, for the purposes outlined in Part III of this Order;

IT IS FURTHER ORDERED that, within 18 months of the date of this Order, the technical committee shall submit final recommendations and a final report to the State Board for its approval, which fulfills the tasks delineated in this Order;

IT IS FURTHER ORDERED that, within 6 months of State Board approval of the final report, the Central Valley Regional Board shall adopt appropriate basin plan amendments for the San Joaquin River basin;

IT IS FURTHER ORDERED that, after adoption of appropriate basin plan amendments, the Central Valley Regional Board shall undertake a program to regulate agricultural drainage discharges in the San Joaquin River basin;

IT IS FURTHER ORDERED that the Central Valley Regional Board shall submit monthly progress reports, beginning in March 1985, detailing progress and activities in developing and implementing a program to regulate the discharge of agricultural drainage flows in the San Joaquin River basin.

IT IS FURTHER ORDERED that the petition is otherwise denied.

VI. CERTIFICATION

The undersigned, Executive Director of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on February 5, 1985.

Aye: Carole A. Onorato
Warren D. Noteware
Kenneth W. Willis
Darlene E. Ruiz
Edwin H. "Ted" Finster

No: None

Absent:

Abstain:

Michael A. Campos
Executive Director

FOOTNOTES

[1] P.L. 86-488, 74 Stat. 156.

[2] Reporter's Transcript for the State Board's October 15, 1984 Hearing on the Claus petition [hereinafter R.T., 10/15/84], p. 77.

[3] E. F. Bullock and R. D. Meyer, "Salinity, Selenium...What are we to do?", Soil and Water (Spring 1984), p. 8; Statement by David G. Houston, Regional Director, Mid-Pacific Region, Bureau, presented to California Assembly Water, Parks, and Wildlife committee, November 16, 1984 [hereinafter Statement], p. IV-4.

[4] M. K. Saiki, "Recent Findings of Contaminants in Fish and Aquatic Invertebrates from Kesterson Reservoir and the San Luis Drain", Agricultural Wastewater Workshop Abstract, UCD, February 23-24, 1984; Statement, p. IV-4.

[5] R.T., 10/15/84, p. 79.

[6] Statement, fn. 3 supra, p. IV-4 through IV-5.

[7] Dr. Harold Ohlendorf, "Summary of Research Status and Results: Kesterson NWR and the Grasslands", September 21, 1984 [hereinafter Ohlendorf Summary].

[8] Statement, fn. 3 supra, p. IV-5; R.T., 10/15/84, p. 80.

[9] Ohlendorf Summary, fn. 7 supra.

[10] Statement, fn. 3 supra, p. IV-5.

[11] Section 13260 requires, in pertinent part, that "[a]ny person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the state...file with the regional board of that region a report of the discharge, containing such information as may be required by the board."

[12] The report is entitled, "Kesterson Reservoir - First Stage, Technical Report in support of Report of Waste Discharge to the California Regional Water Quality Control Board", July 1983 [hereinafter Technical Report].

[13] Section 13264 provides:

> "(a) No person shall initiate any discharge of waste or make any material change in any discharge prior to the filing of the report required by Section 13260 nor shall any such person do so thereafter and prior to: (1) the issuance of waste discharge requirements pursuant to Section 13263, (2) the expiration of 120 days after his compliance with Section 13260, or (3) the regional board's waiver..., whichever of (1), (2), or (3) occurs first.

(b) The Attorney General, at the request of a regional board, shall petition the superior court for the issuance of a temporary restraining order, preliminary injunction, or permanent injunction, or combination thereof, as may be appropriate, prohibiting forthwith any person who is violating or threatening to violate this section from: (1) discharging the waste in question or (2) making any material change therein, whichever of (1) or (2) is applicable."

[14] Section 13350 provides that civil liability may be imposed upon "[a]ny person who (1) intentionally or negligently violates any cease and desist order or cleanup and abatement order hereafter issued, reissued, or amended by a regional board or the state board, or (2) in violation of any waste discharge requirement or other order or prohibition issued, reissued, or amended by a regional board or the state board, intentionally or negligently discharges waste, or causes or permits waste to be deposited where it is discharged, into the waters of the state and creates a condition of pollution or nuisance...."

[15] Section 13301 authorizes a Regional Board to issue a cease and desist order when the board "finds that a discharge of waste is taking place or threatening to take place in violation of requirements or discharge prohibitions prescribed by the regional board or the state board."

[16] Section 13304 provides, in pertinent part:

"(a) Any person who has discharged or discharges waste into the waters of the state in violation of any waste discharge requirement or other order or prohibition issued by a regional board or the state board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the regional board clean up such waste or abate the effects thereof or, in the case of threatened pollution or nuisance, take other necessary remedial action."

[17] See fn. 13 supra.

[18] State Board action under Water Code Section 13320 must be supported by "the weight of the evidence." See Water Code Section 13330(b) and C.C.P. Section 1094.5(c). The weight of the evidence standard is considered synonymous with a preponderance of the evidence. Chamberlain v. Ventura County Civil Service Com'n, 69 C.A.3d 362, 368, 138 Cal.Rptr. 155, 158 (1977).

Additionally, courts have recognized that when environmental disputes involve conflicting theories and experimental results, certain areas of uncertainty must be accepted and findings can do little more than determine the existence of potential harm to human health. That such potential harm may require the

abatement of waste discharges to waters is well illustrated by Reserve Mining Company v. EPA, 514 F.2d 492, 520 (8th Cir. 1975). The court held that the record demonstrated a potential for harm from Reserves's discharges, although conflicting scientific test results were received. The court concluded:

"These concepts of potential harm, whether they be assessed as 'probabilities and consequences' or 'risk and harm,' necessarily must apply in a determination of whether any relief should be given in cases of this kind in which proof with certainty is impossible....

"In assessing probabilities in this case, it cannot be said that the probability of harm is more likely than not. Moreover, the level of probability does not readily convert into a prediction of consequences. On this record it cannot be forecast that the rates of cancer will increase from drinking Lake Superior water or breathing Silver Bay air. The best that can be said is that the existence of this asbestos contaminant in air and water gives rise to a reasonable medical concern for the public health. The public's exposure to asbestos fibers in air and water creates some health risk. Such a contaminant should be removed." (Emphasis added)

That the need for public health protection demands a margin of safety to protect against unknowns and caution in the regulation of toxic substances cannot be overstated. "What scientists know about the causes of cancer is how limited is their knowledge.... If regulation were withheld until the danger was demonstrated conclusively, untold injury to public health could result." Environmental Defense Fund v. EPA, 598 F.2d 62, at 89 (D.C. Cir. 1978) concerning polychlorinated biphenyls.

[19] Basin Plan, p. I-2-3.

[20] Id.

[21] Id., p. I-2-5.

[22] Id., pp. I-6-62 and I-6-64.

[23] The average concentration of some of the elements in the drainage flowing into Kesterson Reservoir has been determined by the Bureau, and the results are given in Attachments 1 and 2 of this Order. Attachment 3 represents averages of the concentrations listed in Attachment 2, which lists average concentrations of monthly samples collected during March through June 1984, plus some additional samples.

[24] Attachment 4 to this Order lists the water quality criteria adopted by the Environmental Protection Agency (EPA) in 1980 for the protection of freshwater

aquatic life. Attachment 5 lists criteria proposed by EPA in 1984 for the protection of freshwater aquatic life.

[25] Attachment 6 to this Order lists EPA drinking water standards and criteria for the protection of human health.

[26] Water hardness is a measure of polyvalent metallic ions dissolved in water. In fresh water, these are primarily calcium and magnesium. Hardness commonly is reported as an equivalent concentration of calcium carbonate.

[27] Only those water quality criteria which have been adopted by EPA are considered in this discussion.

[28] EPA Quality Criteria for Water, July 1976.

[29] San Luis Drain Water Quality Analyses, Department of Water Resources, 1984, [hereinafter DWR data]; Department of the Interior's Post-Hearing Submission before the State Board, December 17, 1984 [hereinafter Post-Hearing Submission], USBR 1984 Grasslands W.D. Trace Element Analyses.

[30] Post-Hearing Submission, fn. 29 supra, Part 4a.

[31] The maximum average concentration is the maximum of the average concentrations listed in Attachments 1 and 2.

[32] DWR data, fn. 29, supra.

[33] J. E. McKee and H. W. Wolf, Water Quality Criteria, SWRCB Publication No. 3-A, 1963.

[34] F. E. Smith, Memorandum dated August 17, 1984, "A Discussion of Selenium Sources and Associated Problems in the San Joaquin Valley", p. 6.

[35] 45 Fed. Reg. 79340 (November 28, 1980).

[36] DWR data, fn. 29, supra.

[37] On the basis of the existing record, it is not possible to determine whether the EPA criteria for the protection of freshwater aquatic life, which was established for selenium, is exceeded in the reservoir because the criteria is for the selenite ion, and there is insufficient data in the record detailing the percentage of selenium which occurs as selenite ion in Kesterson.

[38] The preceding discussion is not significantly altered if EPA's 1984 proposed criteria for the protection of freshwater aquatic life are used. The proposed 1984 criteria for cadmium and copper would not be exceeded, and the existing 24-hour average concentration for mercury is expressed as a 30-day average under the 1984 proposed criteria.

Also, the proposed criteria are for dissolved concentrations, but the adopted criteria are for total concentrations. However, testimony received during the

December 7, 1984 hearing indicates that the sampling done by the Geological Survey on behalf of the Bureau of tile drain water is for the dissolved form of the constituents in the wastewater, and that the results for the total form of the constituents, when compared to the dissolved form, are the same. Reporter's Transcript for the State Board's December 7, 1984, Hearing [hereinafter R.T., 12/7/84], p. 180. With these exceptions noted above, the discussion is accurate, therefore, for both the adopted and the proposed EPA criteria.

[39] Written testimony of Lawrence F. Hancock before the State Board on October 15, 1984, [hereinafter Hancock Testimony] BOR-9.

[40] At the State Board's December 7, 1984 hearing on Kesterson Reservoir, Dr. Alvin Greenberg testified that the State of Florida has established a maximum contaminant level for EDB of 0.02 ug/l, which will go into effect in June of 1985, for the protection of human health. R.T., 12/7/84, p. 210. The concentration of EDB in the San Luis Drain Service area has been reported by the Bureau to range from below the detection limit to 1.74 ug/l with a mean of 0.13 ug/l.

[41] "Aquatic Toxicity Testing and Comprehensive Monitoring for the San Luis Drain", Marine Bioassay Laboratories, Watsonville, California, January 15, 1983.

[42] Marine Bioassay Laboratories, April 4, 1983, Supplement to January 15, 1983 report.

[43] Id.

[44] R. J. Arkley, "Selenium in the Soils of the West Side of the San Joaquin Valley", Soil and Water (Spring 1984), p. 5.

[45] F. E. Smith, Memorandum dated August 17, 1984, "A Discussion of Selenium Sources and Associated Problems in the San Joaquin Valley", p. 8.

[46] Hancock Testimony, fn. 39 supra, p. 15.

[47] Id. at 16.

[48] Id.

[49] Ohlendorf Summary, fn. 7 supra.

[50] Id.

[51] Id.

[52] Letter, dated March 15, 1983 from M. A. Catino, Regional Director, Mid-Pacific Regional Office, Bureau, to Loren J. Harlow, Supervising Engineer, Central Valley Regional Board.

[53] Technical Report, fn. 12 supra, p. 29.

[54] Id.

[55] Letter, dated January 13, 1984, from David G. Houston, Regional Director, Mid-Pacific Regional Office, Bureau, to William Crooks, Executive Officer, Central Valley Regional Board.

[56] Letter, dated March 21, 1984, from Neil W. Schild, Acting Regional Director, Mid-Pacific Regional Office, Bureau, to William Crooks, Executive Officer, Central Valley Regional Board.

[57] Department of the Interior's Post-Hearing Memorandum, submitted after the State Board's October 15, 1984, hearing on Claus Petition, [hereinafter Post-Hearing Memorandum], p. 35.

[58] Id.; Letter dated January 13, 1984, fn. 55 supra.

[59] Water Code Section 12230.

[60] Id. Section 12232.

[61] Post-Hearing Memorandum, fn. 57, supra, p. 28.

[62] Id., pp. 28-31; Hancock Testimony, fn. 39 supra, pp. 24-25.

[63] Post-Hearing Memorandum, fn. 57, supra, p. 30-31.

[64] Hancock Testimony, fn. 39 supra, p. 26; Memorandum, dated November 16, 1984, from Robert S. Ford, Chief, Hydrogeology Section, State Board, to Tom Howard, Division of Technical Services, State Board [hereinafter Ford Memorandum].

[65] Department of the Interior Submittal, 1/8/85, I.10.

[66] Post-Hearing Memorandum, fn. 57, supra, p. 31.

[67] Id. at 30.

[68] Hancock Testimony, fn. 39 supra, p.27, and Exhibits BOR-14, 15 and 16.

[69] Post-Hearing Submission, fn. 29, supra, p. 10 fn. 5, and 1984 USBR Kesterson Reservoir Trace Element Analysis Groundwater Sites, included in Post-Hearing Submission. Additionally, selenium has been detected in at least one 69-foot well near Kesterson at a concentration of 2 ug/l. Id., Part 2, p. 23, 1984 USBR Kesterson Reservoir Trace Element Analysis Groundwater Sites, and Part 4d.

[70] R.T., 12/7/84, p. 201.

[71] This data is summarized in Attachment 8 to this Order.

[72] See Attachment 9 to this Order.

[73] Technical Report, fn. 12, supra, Table 2.

[74] Hancock Testimony, fn. 39 supra, 1984 USBR Kesterson Reservoir Trace Element Analysis Groundwater Sites.

[75] At the State Board's December 7, 1984 hearing petitioner testified that a well located on his property approximately one and one-half miles from Kesterson Reservoir is used for drinking water supply and that the well depth is 200 feet. In addition, on December 20, 1983, the Division of Environmental Health of the Merced County Health Department sampled 13 private wells in the vicinity of Kesterson Reservoir. The depths of 8 of these wells were submitted to the State Board on December 17, 1984. (Letter, dated December 14, 1984, from Jeff Palsgaard, R.S., to Sheila Vassey, State Board). Five of the wells tap the upper zone above the Corcoran Clay layer; the depths of these wells are 60 feet, 60 feet, 81 feet, 116 feet and 213 feet. The wells are used for drinking water supply.

[76] Ford Memorandum, fn. 64 supra.

[77] Id.

[78] In the spring of 1983, studies of ducks shot at Kesterson Reservoir found the selenium concentration in the breast muscle ranged from 1,000 to 9,500 ug/kg. Patuxent Wildlife Research Center, Analytical Report PR-2817, 1983. It has been estimated that 500 ug/day is a maximum tolerable selenium intake level for humans. M.T. Lo and E. Sandi, Journal of Environmental Pathology and Toxicology, Vol. 4, pp. 193-218, 1980. Therefore, if no other source of selenium is present in the diet, the maximum tolerable limit will be exceeded by consuming .053 kg (1.9 ounces) of duck flesh, assuming a selenium level of 9,500 ug/kg is present.

[79] Statement, fn. 3 supra, pp. IV-6 through IV-7.

[80] Id.

[81] R.T., 12/7/84, pp. 100-101, 102.

[82] Final Report of the Study Panel of the California State Water Resources Control Board, March 1969, p. 3.

[83] 42 U.S.C. Section 6903(27).

[84] 33 U.S.C. Section 1323(a).

[85] 42 U.S.C. Section 6929.

[86] 23 C.A.C. Section 2521(a).

[87] Health and Safety Code Section 25208.2(K).

[88] 22 C.A.C. Section 66680(a). The DOHS regulations governing hazardous waste management, contained in Chapter 30, Division 4, of Title 22, were recently amended, effective October 27, 1984. Reg. 84, No. 41, October 13, 1984.

[89] In the DOHS response to comments regarding the revisions to Chapter 30, fn. 88 supra, the Department indicated that hazardous wastes include any wastes which meet the statutory definition in Health and Safety Code Section 25117 even though the wastes would not be hazardous pursuant to any Article 11 criterion. Pages 25 and 26. The response to comments, in this regard, states:

> "The H&S Code definition of Section 25117 of a hazardous waste, while qualitative in nature, is more inclusive of hazards to human health and safety and the environment than can be encompassed by the criteria of Article 11. It would not be responsive of the Department to its statutory mandate to limit the definition of hazardous wastes to the characteristics measured or limited by the criteria of Article 11." P. 26.

[90] 22 C.A.C. Section 66680(d), 152, 204, 472, 647A and 647B.

[91] Id. Section 66696(a)(6). In the Statement of Reasons, pp. 76-77, for the newly revised DOHS hazardous substances regulations, fn. 88 supra, the Department explained that the purpose of this subsection is "to address those potentially hazardous wastes and materials (a) for which criteria and testing procedures do not exist or which are not sufficiently standardized to include in regulations at this time or (b) which contain acutely toxic substances not previously tested." Further elaboration on this provision is contained in the response to comments:

> "As the Department explained in the Statement of Reasons (pages 76-77), the purpose of this section is to address serious toxic hazards for which standard, low cost laboratory tests do not exist or for unanticipated toxic events which compel the Department to regulate a waste material as hazardous.
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> * * *
>
> "....the Department must retain the flexibility to review the current status of toxicity tests in the literature and, on the basis of expert judgement of technical staff, determine if a chemical or waste is hazardous pursuant to the statutory definition of hazardous waste. The Department described the experiences with asbestos as an example of an unexpected human health hazard that no tests or quantitative criteria could have predicted. Another hypothetical example would be if an industrial waste material containing chemical "X" had previously been found to be nonhazardous. Large amounts of the waste are proposed for use to shore up river levees. Subsequently, long-term chronic toxicity tests show that chemical "X" bioaccumulates in a river benthic organism and adversely affects its reproductive cycle which, in turn, is vital in the food chain of a variety of aquatic organisms of commercial value. The Department must retain the flexibility to classify such a waste haardous so as to track its management and disposal in environmentally sensitive areas.
>
> "In regard to experience, the Department must retain similar flexibility. It is not possible to anticipate all events which might occur demonstrating that a waste conforms to the statutory definition of hazardous waste. An example of such an unanticipated event is the effect of DDT on the reproductive cycle of predatory birds. Accumulation of DDT in the food chains of the birds resulted in the thinning of their eggs' shells to the point where the existance (sic) of several species was threatened (Finkelstein, H., "Air Pollution Aspects of Pesticides", Litton Systems, Inc. Bethesda, Maryland, 1969).
>
> "This occurence (sic) could never have been anticipated or predicted by laboratory testing. Experience of the effects and behavior of wastes and toxic substances in the environment, must, therefore, remain an important criterion for assessing the hazardous properties of wastes." (Emphasis added) pp. 108-109

[92] At the January 8, 1985 hearing, the Bureau submitted a report to the State Board prepared by SRI International entitled "Acute Toxicity of San Luis Drain Effluent to Neomysis Mercedis". The results of the study indicate that the water used is toxic to 50 percent of the test organisms within two weeks. However, it is clear that the water used is not representative of the water in the San Luis Drain or Kesterson Reservoir. The conductivity of the water tested was approximately half the conductivity of the water in Kesterson Reservoir or in any major section of the San Luis Drain. Consequently, we conclude it is not appropriate to consider this data in our analysis.

[93] 22 C.A.C. Sections 66300(a) and 66680(a). See also fn. 89 and 91 supra.

[94] Letter, dated December 17, 1984, from David G. Houston, Regional Director, Mid-Pacific Regional Office, Bureau, to Carole Onorato, Chairwoman, State Board.

[95] Id.

[96] The San Luis Drain sediment samples were analyzed at the USGS Geologic Division Laboratory. The soil samples from Kesterson were analyzed at the USGS Water Laboratory. Different analytical methodologies are used in the water laboratory than in the soil laboratory. Reporter's Transcript for the State Board's January 8, 1985 Hearing (hereinafter R.T., 1/8/85), pp. 120-121.

[97] See Department of the Interior Submittal, dated January 8, 1985, VII. 1.

[98] Letter, dated December 17, 1984, fn. 93 supra.

[99] Department of the Interior Submittal, dated January 8, 1985, VII, 1.

[100] 23 C.A.C. Section 2521(b).

[101] The concentration of selenium averaged over all the ponds could rise to 1 mg/l in a minimum of 2.6 years. This statement is based on the following assumptions: (1) the evaporation rate is 3.75 feet per year; (2) the reservoir is filled to its capacity of 4,800 acre-feet, (3) the average selenium concentration in the reservoir initially is 0.385 mg/l; (4) no aquatic plant growth is present in the reservoir; (5) the exposed surface area of the ponds is 1,280 acres. It should also be noted that the concentration of selenium in the latter of the 12 ponds at Kesterson Reservoir would rise to 1 mg/l in a shorter time period.

[102] It should be noted that Water Code Section 13142.5 establishes a state policy that "[h]ighest priority shall be given to improving or eliminating discharges that adversely affect...(1) Wetlands...and other biologically sensitive areas...."

[103] 23 C.A.C. Section 2521(a).

[104] Id. Table 2.1; see id. Sections 2520(d) and 2521(b).

[105] Id. Section 2522.

[106] Id. Table 2.1; see id. Sections 2520(d) and 2522(b).

[107] Id. Section 2531.

[108] Id. Section 2540.

[109] Id. Section 2540(d) and Table 4-1.

[110] Id. Section 2532.

[111] Id. Section 2540(d).

[112] Id. Sections 2532(b)(4), 2542(e), Table 4.1 and Fig. 4.2.

[113] Id. Section 2532(b)(4).

[114] Westlands Water District has submitted a report entitled "Evaluation of Alternatives to Dispose of Subsurface Agricultural Drainage Water" by CH_2M Hill (January 1985). The report describes a reconnaissance-level analysis of three possible alternatives to dispose of the subsurface agricultural drainage water that Westlands Water District currently discharges through the San Luis Drain into Kesterson Reservoir. The alternatives include disposal of the drainage water within Westlands, recycling the drainage water by blending with irrigation water within Westlands, and diluting the drainage water with freshwater and subsequent discharge into the San Joaquin River.

The costs listed for each alternative are:

(1) evaporation ponds - $610 per acre per year.

(2) recirculation - $440 per acre per year.

(3) dilution and river disposal - $475 per acre per year.

Because average annual gross farm income in the area is $930 per acre, CH_2M Hill concludes that none of these alternatives is economically feasible.

This conclusion appears to be invalid. Westlands Water District contends that "[c]losing Kesterson would make it necessary to terminate irrigation on at least a 42,000 acre area of Westlands Water District where the drainage water discharged into Kesterson is collected, unless another feasible method of disposal could be developed." However, the cost of the three alternative drainage options described in the report is only distributed among 8,000 acres, rather than the 42,000 acres which benefit from drainage to Kesterson. When the cost is appropriately distributed among all 42,000 acres, the following results are obtained:

(1) evaporation ponds - $116 per acre per year.

(2) recirculation - $84 per acre per year.

(3) dilution and river disposal - $90 per acre per year.

These numbers indicate that the disposal options may, in fact, be economically feasible. Westlands should also consider the possibility of including the farmers upslope of the 42,000 acres in its cost allocation, because they may also receive a benefit from drainage. In addition, the possibility of cost sharing with the Bureau should be considered.

[115] Id. Sections 2510(d) and 2590(b)(3).

[116] Id. Section 2510(d).

[117] Health and Safety Code Section 25208.5(a).

[118] Id.

[119] Id.(c)

[120] Id. Section 25208.4(a).

[121] Id.(b).

[122] Id. Section 25208.2(w).

[123] Id.(f).

[124] Id. Section 25208.5(d).

[125] See, e.g., "Evaluation of Alternatives to Dispose of Subsurface Agricultural Drainage Water", fn. 114, supra; Department of the Interior Post-Hearing Submittal, 1/25/85, III.

[126] In addition to firm Class I contract water, Grassland receives approximately 30,000 acre feet of Class I operational spill water from several of the draining entities. Grassland defines "operational spill water" as water discharged under emergency circumstances for the protection of capital assets, health, safety or operation. Operational spill is not a firm source of water. It is received throughout the year.

[127] The three irrigation districts are Firebaugh Canal Company, San Luis Canal Company, and the Central California Irrigation District.

[128] Letter, dated December 3, 1984, from Dan Chapin, Chairman, Resources Committee, California Waterfowl Association, to Assemblyman Jim Costa, Assembly Water, Parks and Wildlife Committee.

[129] "Areal Distribution of Selenium and Other Inorganic Constituents in Shallow Ground Water of the San Luis Drain Service Area, San Joaquin Valley, California: A Preliminary Study, "USGS Water Resources Investigations Report 84-4319, November 1984.

[130] Post-Hearing Submission, fn. 29 supra, USBR 1984 Grasslands W.D. Trace Element Analyses.

[131] At the State Board's December 7, 1984 hearing, the Bureau testified that the selenium level in a canal in the Grassland area was as high as 360 ug/l. Grassland representatives contend that the canal does not drain into the district. We are unable to resolve this issue on the basis of the existing record.

[132] H. Ohlendorf and R. Hothem, Preliminary Summary, "Selenium in Birds Nesting in the Grasslands of Western Merced County."

[133] Basin Plan, I-3-3.

[134] Basin Plan, I-3-12.

[135] STORET Data.

[136] Id.

[137] Basin Plan, p. I-5-23 and Fig. 5-4.

[138] R. J. Claus, "The Department of the Interior in 1984: Orwell's Predictions Come True", October 15, 1984, pp. 164-165.

[139] Water Code Section 13260.

[140] Id. Section 13263.

[141] Id.

[142] Id. Section 13269.

[143] See Water Code Section 13141.

APPENDIX

STATE WATER RESOURCES CONTROL BOARD

Cleanup and Abatement Order No. 85-1

U. S. Department of the Interior
Bureau of Reclamation
Kesterson Reservoir

The State Water Resources Control Board (hereinafter State Board), finds that:

1. Kesterson Reservoir, a 1,280 acre evaporation facility consisting of 12 ponds with a storage capacity of 4,800 acre feet, is located in Merced County. The U. S. Department of Interior, Bureau of Reclamation (hereinafter Bureau), owns and operates the facility.

2. Kesterson Reservoir occupies a portion of the 5,900 acre Kesterson National Wildlife Refuge. This area plays a vital role in the Pacific Flyway.

3. Kesterson Reservoir is a feature of the San Luis Drain. The San Luis Drain was originally designed by the Bureau to carry subsurface agricultural drainage flows from Kettleman City in the southern San Joaquin Valley to the Delta at Suisun Bay. Kesterson Reservoir was designed to regulate flows in the San Luis Drain prior to their discharge to the Delta. Only 85 miles of the San Luis Drain, extending from Five Points north to Kesterson Reservoir, was constructed, however. Consequently, Kesterson Reservoir currently serves as a storage and evaporation facility for all flows in the San Luis Drain.

4. Kesterson Reservoir receives approximately 7,000 acre feet per year of subsurface agricultural drainage flows from the equivalent of 8,000 tile drained acres in Westlands Water District. The Bureau is obligated to provide drainage service to Westlands Water District.

5. Before 1978 only high quality water was supplied to Kesterson Reservoir. In 1978, tile drain water, originating in Westlands Water District and carried by the San Luis Drain, began to be discharged into the reservoir. Tile drainage has been essentially the only source of water supplied to the reservoir since 1981.

6. U. S. Fish and Wildlife Service (Service) first reported wildlife deformities and mortalities in Kesterson Reservoir in 1983. These problems have intensified in 1984. Selenium poisoning has been determined to be the cause of the mortalities of adult waterfowl and the most probable cause of the deformities of embryos and chicks at Kesterson Reservoir. Food chain organisms at Kesterson contain 50 to 100 times the normal concentration of selenium. Both information in the literature and data from Kesterson indicates that selenium accumulates and biomagnifies through the food chain. Aside from selenium poisoning, an aquatic toxicity assessment by the Service determined that the San Luis Drain water was acutely toxic to invertebrates and bullhead minnows.

7. The tile drain water stored in Kesterson Reservoir exceeds the Environmental Protection Agency (EPA) primary drinking water standard for selenium. Some samples of water in the reservoir for nickel, selenium and mercury exceed the EPA ambient water criteria established for the protection of public health from ingesting water and contaminated aquatic organisms. The elements cadmium, chromium (hexavalent), copper, and zinc have been found in the reservoir in concentrations which exceed the EPA water quality criteria for the protection of fresh water aquatic life.

8. Approximately 50 to 60 percent of the inflow to Kesterson Reservoir seeps into the underlying groundwater. This seepage has polluted the upper aquifer, which extends 230 feet beneath Kesterson ponds and which is used for drinking water supply. Additionally, this seepage threatens to pollute the lower high quality aquifer, which is extensively used for drinking water supply. Kesterson Reservoir is within one-half mile upgradient of a drinking water source.

9. Mud Slough, a tributary of the San Joaquin River, is immediately adjacent to Kesterson Reservoir and is in the path of seepage from Kesterson Reservoir. Groundwater movement in the area is generally northeastward toward Salt Slough and the San Joaquin River. Therefore, seepage of pollutants from Kesterson Reservoir into the upper groundwater aquifer threatens to pollute Mud Slough, Salt Slough and the San Joaquin River.

10. In March 1983, the Bureau directly discharged 2,742 acre feet of wastewater from Kesterson Reservoir into Mud Slough, a tributary of the San Joaquin River. The discharge occurred because Kesterson Reservoir had inadequate capacity to handle the surface and subsurface flows discharged to the San Luis Drain. Further direct discharges to Mud Slough were threatened in the spring of 1984, and the Bureau has indicated that future hydrologic events may necessitate further direct discharges. The discharge of wastewater from Kesterson Reservoir is threatened in the future due to the inadequate capacity of Kesterson ponds. Such discharges threaten to pollute the waters of Mud Slough and to degrade the San Joaquin River. Further, the Bureau has not been issued waste discharge requirements for a direct discharge to Mud Slough.

11. Operation of Kesterson Reservoir poses a threat to public health due to the potential for consumption of selenium contaminated waterfowl. Kesterson Reservoir also threatens to interfere with the free use of the lands surrounding the reservoir, which are used extensively for waterfowl habitat and duck hunting. Operation of the reservoir impacts both duck hunters and the surrounding property owners. Operation of Kesterson Reservoir, therefore, constitutes a public nuisance.

12. The Water Quality Control Plan Report, San Joaquin Basin (5c) (hereinafter Basin Plan) was adopted by the Regional Board and approved by the State Board in 1975. The Basin Plan establishes the following existing beneficial uses for the surface waters of the San Joaquin River and its tributaries, Salt Slough and Mud Slough, in the vicinity of Kesterson Reservoir:

    a. Agricultural Supply
    b. Stock Watering Supply
    c. Industrial Process Water
    d. Water Contact Recreation

e. Noncontact Water Recreation
f. Warm Freshwater Habitat
g. Warm Migrational Use
h. Cold Migrational Use
i. Warm Spawning Use
j. Wildlife Habitat

The following potential beneficial uses are also established in the Basin Plan:

a. Municipal and Domestic Water Supply
b. Cold Spawning Use

13. The Basin Plan establishes the following beneficial uses for groundwater in the vicinity of Kesterson Reservoir:

a. Municipal and Domestic Water Supply
b. Irrigation Supply
c. Stock Watering Supply

14. The Basin Plan identifies the area in which Kesterson Reservoir is located as an important marshland habitat for waterfowl and water associated wildlife.

15. The Bureau filed a Report of Waste Discharge with the Regional Water Quality Control Board, Central Valley Region (hereinafter Central Valley Regional Board) on February 16, 1983 and a supplemental report on July 13, 1983. To date, the Central Valley Regional Board has not adopted waste discharge requirements for the reservoir.

16. The combination of constituents discharged into Kesterson Reservoir poses a substantial present and potential hazard to human health and the environment if the wastewater is improperly stored, disposed of, or otherwise managed. The wastewater also contains constituents which have been shown to pose a hazard to the environment because of their bioaccumulative properties and persistence in the environment, and the wastewater contains constituents which are listed as hazardous in Article 9, Chapter 30, Title 22 of the California Administrative Code. The wastewater, therefore, is a hazardous waste under Health and Safety Code Section 25117 and the hazardous waste management regulations of the Department of Health Services (DOHS) in Chapter 30.

17. Kesterson Reservoir is a surface impoundment used for the storage and disposal of wastes. It is subject to regulation under Subchapter 15, Chapter 3, Title 23 of the California Administrative Code, the State Board's regulations on waste disposal to land.

18. The discharge of liquid hazardous wastes, under Subchapter 15, is permitted only at Class I surface impoundments, unless a variance is granted by DOHS. Subchapter 15 establishes both siting and construction standards for these waste management units. The construction standards include requirements for double lining, leachate collection and removal systems, and precipitation and drainage control facilities, or their equivalent. Kesterson Reservoir does not comply with the Subchapter 15 requirements for a Class I surface impoundment. The Bureau must, therefore, discontinue use of the facility as a waste disposal unit, retrofit to meet the Subchapter 15 requirements, or close the facility in

accordance with the requirements for closure and post-closure of a surface impoundment in Subchapter 15.

19. Because the wastewater in Kesterson Reservoir is a hazardous waste, the facility is subject to the requirements of the Toxic Pits Cleanup Act of 1984 (Toxic Pits Act). The Toxic Pits Act prohibits the discharge of liquid hazardous wastes into a surface impoundment after June 30, 1988, if the surface impoundment contains hazardous wastes and is within one-half mile upgradient from a potential source of drinking water, unless the surface impoundment is exempted by the Regional Board. In general, a facility must be equipped with a double liner and a leachate collection system in order for the Regional Board to issue an exemption. Kesterson Reservoir contains hazardous waste and is located within one-half mile upgradient of a drinking water source. Therefore, the Bureau is subject to the discharge prohibition contained in the Toxic Pits Act.

20. Adoption of this enforcement order is exempt from the provisions of the California Environmental Quality Act, Public Resources Code, Sections 21000 et seq., pursuant to 14 C.A.C. Section 15321.

21. In the adoption of this order, the State Board has considered the costs of compliance with the Order and alternative sources of funding.

22. On January 8, 1985, the State Board held an evidentiary hearing to specifically consider adoption of this Order.

IT IS HEREBY ORDERED, that pursuant to California Water Code Section 13304:

1. The Bureau shall take appropriate action to minimize seepage at Kesterson Reservoir. Appropriate action shall include: (a) closure of Kesterson Reservoir, in accordance with the closure requirements of Subchapter 15, and implementation of an acceptable waste disposal alternative; (b) upgrading Kesterson Reservoir to meet the applicable requirements of Subchapter 15 and the Toxic Pits Act; (c) discontinuing use of the reservoir as a waste management facility, including appropriate cleanup measures or (d) any other acceptable alternative. The Bureau shall submit a plan to the State Board for its approval within five months of the date of this Order specifying the measures the Bureau will undertake to comply with this section. The plan shall include a detailed time schedule for implementation of the measures to achieve full compliance with this section. The Bureau shall achieve full compliance with this section no later than three years from the date of this order, unless compliance by an earlier date is required under the Toxic Pits Act.

2. The Bureau shall take appropriate action to alleviate the threat of future surface discharges from Kesterson Reservoir due to inadequate capacity. At a minimum, the Bureau must comply with the provisions of Section 2548 of Subchapter 15. The Bureau shall submit a plan to the State Board for its approval within five months of the date of this Order detailing the measures the Bureau will undertake to comply with this paragraph. The plan shall include information on operation levels and waste input quantities permitted each month based on anticipated precipitation and on past precipitation conditions for the year. The plan shall include a detailed time schedule for implementation of measures to achieve full compliance with this paragraph. The Bureau shall achieve full compliance with this

paragraph no later than three years from the date of this Order, unless compliance by an earlier date is required under the Toxic Pits Act.

3. The Bureau shall take appropriate action to mitigate the nuisance conditions caused by the operation of Kesterson Reservoir. The Bureau shall submit a plan to the State Board for its approval within three months of the date of this Order detailing the measures the Bureau will undertake to comply with this section. Measures which must be considered by the Bureau include, but are not limited to, the following: Continuation of the present hazing program until implementation of the plan to mitigate the nuisance conditions, providing a buffer zone around Kesterson Reservoir, and providing alternative wildfowl habitat to replace Kesterson Reservoir. The Bureau shall continue in effect, as of the date of this Order, the hazing program currently underway and shall begin implementation of other measures identified in the plan within one month after approval by the State Board.

4. A revised Report of Waste Discharge shall be submitted to the Executive Officer of the Central Valley Regional Board and the Executive Director of the State Board for Kesterson Reservoir within 6 months of the effective date of this Order. The revised report shall reflect the measures undertaken by the Bureau to comply with the terms of this Order and shall, at a minimum, contain the information detailed in Article 9 of Subchapter 15. Alternatively, a closure and post-closure maintenance plan for the reservoir shall be submitted within this time period.

5. By no later than May 27, 1985, the Bureau shall submit a monitoring program to the Executive Officer of the Central Valley Regional Board and to the Executive Director of the State Board, which complies with the requirements of Article 5 of Subchapter 15.

6. The Bureau shall provide the Executive Officer of the Central Valley Regional Board and the Executive Director of the State Board with a status report on compliance with the terms of this Order every two months starting with the effective date of this Order. The report shall include all surface and subsurface water quality monitoring conducted by the Bureau in the Kesterson Reservoir area. These reports shall continue until compliance with this Order is achieved.

CERTIFICATION

The undersigned, Executive Director of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on February 5, 1985.

Aye: Carole A. Onorato
Warren D. Noteware
Kenneth W. Willis
Darlene E. Ruiz
Edwin H. "Ted" Finster

No: None

Absent:

Abstain:

Michael A. Campos
Executive Director

Attachment 1

TRACE ELEMENT CONCENTRATION ENTERING KESTERSON RESERVOIR[a]

Element	Entry point (SLDEP1) Kesterson Pond 1	Entry point (SLDEP2) Kesterson Pond 2
Arsenic	< 1	< 1
Boron	15,000	14,000
Cadmium	< 1	< 1
Chromium	16	14
Copper	4	4
Iron	110	25
Lead	< 1	< 1
Manganese	130	30
Mercury	< 0.1	< 0.1
Molybdenum	100	130
Nickel	12	54
Selenium	385	430
Silver	< 1	< 1
Zinc	15	50

[a] Average concentration in ug/L of monthly samples collected March-June 1984.

ELECTRICAL CONDUCTIVITY[a] AND TRACE ELEMENT CONCENTRATION[b] AT KESTERSON RESERVOIR PONDS[c]
(Revised December 17, 1984)

Pond or weir	EC	As	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	Zn
Weir between ponds 1 and 2	11,697	<1	14,000	<1	8	3	53	1	27	<0.1	113	8	323	<1	20
Weir between ponds 2 and 5	12,690	<1	14,500	<1	13	3	55	<1	35	<0.1	145	23	370	<1	30
Pond 3	14,675	<1	17,500	<1	3	3	95	1	30	0.1	155	12	139	<1	25
Weir between ponds 5 and 6	13,970	<1	15,500	<1	4	2	35	<1	23	<0.1	151	10	330	<1	30
Weir between ponds 5 and 7	14,820	<1	18,000	<1	5	2	50	<1	40	<0.1	160	15	390	<1	10
Pond 6	19,110	<1	24,000	<1	1	3	50	<1	40	<0.1	160	21	270	<1	20
Weir between ponds 6 and 8	15,520	<1	18,000	<1	<2	4	50	<1	30	<0.1	170	67	200	<1	30
Pond 8	15,920	<1	20,000	<1	2	2	60	3	130	0.1	140	36	140	<1	40
Pond 9	13,600	<1	17,000	<1	3	4	110	1	80	0.2	75	<1	130	<1	160
Pond 12	17,317	1	22,000	<1	3	3	220	<1	63	<0.1	123	45	61	<1	33

[a] Concentration in umhos/cm.
[b] Concentration in ug/L.
[c] Average concentration of monthly samples collected during March-June 1984.

Attachment 2

Average trace element concentrations of Kesterson Reservoir surface water samples[a]

(Previous data to develop Attachment 2 of SWRCB staff report 11/29/84 was based on 19 samples)

Element	Average (ug/L)	Number of samples
Ag	<1	29
As	<1	29
B	21,931	29
Cd	<1	29
Cr	<5	29
Cu	<3	19[b]
Fe	<91	29
Hg	<0.1	29
Mn	<39	29
Mo	157	29
Ni	<22	29
Pb	<2	29
Se	228	28[c]
Zn	24	28[c]

[a] Averages calculated from data in Revised Exhibit BOR-6. Values below detection limit were included and set to detection limit in calculations.

[b] Twenty-nine samples analyzed but ten (10) were below detection limit of 20 ug/L and not included in calculation of average copper concentration.

[c] One (1) of the 29 samples is currently being reanalyzed for quality control reasons.

Attachment 4

USEPA 1980 Adopted [1] Water Quality Criteria
for Protection of Freshwater Aquatic Life [2]

Element and Form		24 Hour Average (ug/l)	Maximum (ug/l)
Arsenic	total (+3)	-	440
Boron		-	-
Cadium	total	0.051 (0.58)	6.3 (70)
Chromium	total (+6)	0.29	21
Chromium	total (+3)	-	9,900 (119,000)
Copper	total	5.6	43 (370)
Iron		-	-
Lead	total	20 (4370)	400 (6650)
Manganese		-	-
Mercury	total	0.2	4.1
Molybdenum		-	-
Nickel	total	160 (930)	3100 (17,970)
Selenium	total selenite	35	260
Silver	total	-	13 (700)
Zinc		47	570 (3860)

1 Adopted Criteria: Federal Register, Volume 45, No. 231, November 28, 1984.

2 All criteria that are based on water hardness have been calculated for hardnesses of 200 mg/l and 2,000 mg/l. The criteria in parenthesis are for a hardness of 2,000 mg/l. All concentrations have units of micrograms/liter (ug/l).

USEPA 1984 Proposed [1] Water Quality Criteria
for Protection of Freshwater Aquatic Life [2]

Element and Form		30 Day Average (ug/l)	Maximum (ug/l)
Arsenic	dissolved (+3)	72	140
Cadmium	dissolved	-	10 (145)
Chromium	dissolved (+6)	7.2	11
Chromium	dissolved (+3)	130 (864)	2700 (17,910)
Copper	dissolved	20 (163)	29 (236)
Lead	dissolved	6.4	160 (3540)
Mercury	dissolved	0.2	1.1

1 Proposed Criteria: Federal Register, Volume 49, No. 26, February 7, 1984.

2 All criteria that are based on water hardness have been calculated for hardnesses of 200 mg/l and 2,000 mg/l. The criteria in parenthesis are for a hardness of 2,000 mg/l. All concentrations have units of micrograms/liter (ug/l).

USEPA Drinking Water Standards and Criteria [1]
for the Protection of Human Health [2]

Element and Form	Primary Drinking Water Standard (ug/l)	Ambient Water Criterion (ug/l)
Arsenic (+3)	50	.022 [3]
Boron	-	-
Cadmium	10	10
Chromium (+6)	50	50
Chromium (+3)		170,000
Copper	-	-
Iron	-	-
Lead	50	50
Manganese	-	-
Mercury	2	0.144
Molybdenum	-	-
Nickel	-	13.4
Selenium	10	10
Silver	50	50
Zinc	-	-

1 Ambient water criteria for the protection of human health from toxic properties of the element ingested through water and contaminated aquatic organisms (Federal Register, Volume 45, No. 231, November 28, 1980).

2 All concentrations are in units of micrograms/liter (ug/l).

3 From the Federal Register (November 28, 1980, see [1])
"For the maximum protection of human health from the potential carcinogenic effects...the ambient water concentration should be zero based on the non-threshold assumption for this chemical.....[T]he levels which may result in incremental increase of cancer risk over the lifetime are estimated at 10^{-5}, 10^{-6}, and 10^{-7}. The corresponding criteria are 0.022 ug/l, 0.0022 ug/l and 0.00022 ug/l respectively."

Attachment 7

MAXIMUM IMPACT[a] OF SURFACE DISCHARGE OF RECEIVING WATERS

	EC[b]	As	B	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	Zn
Kesterson Reservoir	10,000	1	22,000	1	16	4	300	3	130	.2	170	67	430	1	160
Mud Slough	4,760[c]	.35	7,700	.35	5.6	1.4	105	1.05	46	.07	59.5	23	150	.35	56
San Joaquin River	210[c]	.007	148.5	.007	.11	.03	2	.02	.9	.001	1.15	.45	2.9	.007	1.06

a. The following assumptions are made in this calculation: (1) the maximum Kesterson Reservoir trace element concentrations are the highest levels found in either Attachment 1 or 2; (2) the flow rate of the San Joaquin River is 20,000 cubic feet per second, the maximum flow rate of Kesterson Reservoir discharge is 135 cubic feet per second and the flow rate of Mud Slough before it passes the reservoir is 250 cubic feet per second; (3) the trace elements are not present in the receiving waters before Kesterson Reservoir water are discharged into them; (4) the waters are completely mixed.

b. Concentration in umhos/cm; all other concentrations in ug/1.

c. Maximum final concentrations; Mud Slough EC before discharge is 1830 umhos. San Joaquin River EC before discharge is 125 umhos.

Attachment 8

Well Data From Kesterson Area Before Reservoir Construction

Well No.	Date	Depth (ft)	EC(umhos/cm)	B(ug/l)
8S/10E-09F02 M	3/10/66	94	8400	400
8S/10E-18R01 M	7/11/56	-	3741	2900
*8S/10E-20A01 M	4/20/67	35	9710	3000
*8S/10E-21C02 M	7/15/65	-	3180	600
*8S/10E-21D01 M	7/66	100	4980	1300
8S/9E-08E01 M	10/66	60	945	400
8S/9E-14H01 M	10/6/66	70	8320	3600
8S/9E-21A01 M	5/1/68	16	3590	2600

*These wells were situated directly over the present site of Kesterson Reservoir

1984 USBR KESTERSON RESERVOIR TRACE ELEMENTS ANALYSIS
GROUNDWATER SITES

SITE NAME	DATE	WELL DEPTH (Ft.)	AG ug/L	AS ug/L	BORON ug/L	CD ug/L	CR ug/L	CU ug/L	FE ug/L	HG ug/L	MN ug/L	MO ug/L	NI ug/L	PB ug/L	SE ug/L	ZN ug/L	EC umhos cm
AP122	84/05/18	20.0	1	14	14000	<1	32	18	15000	0.1	2500	150	60	11	<1	80	44550
AP122	84/06/14	20.0	<1	15	12000	<1	14	11	6900	0.1	2300	130	28	<1	<1	40	44160
AP122	84/07/11	20.0	<1	15	21000	<1	3	<20	4600	0.1	2800	170	28	<1	<1	20	*
D2W1	84/06/13	39.9	<1	8	10000	<1	2	5	270	<.1	270	30	21	<1	2	<10	12850
D2W1	84/07/11	10.6	<1	12	16000	<1	4	<20	3600	0.1	1200	43	29	<1	6	10	15400
D2W2	84/06/14	16.6	<1	<1	17000	3	5	8	1500	<.1	7100	59	36	16	3	60	13570
D2W3	84/06/14	19.8	<1	<1	13000	<1	3	6	1000	<.1	410	74	35	<1	7	40	14320
D2W4	84/06/13	10.6	<1	1	12000	6	14	12	24000	<.1	6900	55	33	60	<1	12000	10770
D2W4	84/07/12	39.9	<1	<1	12000	2	4	<20	9500	<.1	6900	61	24	18	1	3300	10620
D9W1	84/06/14	14.6	<1	6	20000	<1	5	3	12000	<.1	21000	22	45	<1	1	20	16990
D9W2	84/06/13	24.2	<1	<1	17000	<1	2	7	54000	-	8500	4	41	26	2	7100	15220
D9W3	84/06/13	33.4	<1	2	22000	2	4	10	39000	0.1	9800	6	51	8	3	4800	17470
D9W4	84/06/13	43.5	<1	4	14000	3	6	21	140000	0.1	9200	7	51	74	<1	11000	14140
DH760	84/06/14	21.3	<1	<1	7000	<1	2	2	3300	<.1	2800	12	11	4	<1	<10	13790
HA2	84/06/14	12.0	<1	21	980	<1	27	12	11000	<.1	530	9	31	2	<1	30	17300
KR12	84/06/14	8.7	<1	5	23000	<1	14	8	3800	0.1	1300	170	40	<1	<1	30	22020
KR13	84/05/18	9.7	<1	1	3400	<1	6	3	1500	<.1	980	190	37	<1	<1	30	7430
KR13	84/06/14	9.7	1	<1	3200	5	6	4	1400	<.1	920	160	31	1	<1	<10	7310
KR13	84/07/11	9.7	<1	3	3300	<1	18	<20	10000	0.1	1400	220	41	3	<1	30	*
KR14	84/05/18	11.5	<1	3	7100	<1	8	12	2100	<.1	390	180	35	5	<1	100	22680
KR14	84/06/14	11.5	<1	4	7100	6	10	20	2300	<.1	340	150	28	10	<1	50	23400
KR14	84/07/10	11.5	<1	7	7600	<1	13	30	5200	<.1	450	210	29	17	<1	90	*
KR15	84/05/18	8.0	<1	3	21000	<1	2	6	1300	<.1	2800	250	71	<1	<1	-	17170
KR15	84/06/14	8.0	<1	3	20000	<1	6	3	1600	<.1	2500	220	38	7	<1	40	16850
KR15	84/07/11	8.0	<1	5	21000	<1	2	<20	2000	<.1	2300	230	35	<1	<1	5	*
KR17	84/05/18	12.8	<1	2	3900	<1	2	8	210	<.1	780	14	110	<1	<1	20	3650
KR17	84/06/12	12.8	<1	2	3700	<1	32	11	11000	0.2	1400	20	32	<1	<1	40	3310
KR18	84/05/18	15.5	<1	<1	13000	2	6	6	1200	<.1	5200	8	53	<1	<1	70	12880
KR18	84/06/12	15.5	<1	<1	16000	<1	6	7	2200	<.1	6200	4	75	<1	1	30	13900
KR18	84/07/10	15.5	<1	<1	17000	<1	10	<20	4200	<.1	7500	8	71	2	1	20	13840
KR19	84/05/18	10.3	<1	1	14000	1	2	34	1200	<.1	3500	50	15	2	<1	-	13320
KR19	84/06/12	10.3	<1	<1	15000	<1	2	8	720	<.1	4900	48	32	<1	2	160	13080
KR20	84/05/18	12.9	<1	3	13000	<1	52	18	24000	<.1	4500	58	62	<1	<1	-	12390
KR20	84/06/12	12.9	<1	2	13000	<1	31	23	17000	0.1	4300	40	61	<1	1	50	11520
KR20	84/07/09	12.9	<1	2	13000	<1	12	<20	6200	<.1	5000	49	33	<1	<1	40	12380
KR7	84/06/14	7.3	<1	4	18000	<1	3	4	3200	<.1	17000	86	21	<1	<1	10	14920
KR7	84/07/12	7.3	<1	4	19000	<1	1	<20	3700	<.1	20000	99	27	<1	<1	<5	14640
KR8	84/06/15	8.5	<1	3	21000	<1	3	2	1300	<.1	8900	84	21	<1	1	20	15580
KR8	84/07/12	8.5	<1	5	21000	<1	1	<20	1800	<.1	8300	82	27	2	2	<5	15020
KR9	84/06/15	3.7	<1	6	2500	<1	27	9	11000	0.1	1100	38	36	<1	<1	50	3600

Attachment 9

1984 USBR KESTERSON RESERVOIR TRACE ELEMENTS ANALYSIS
GROUNDWATER SITES

DATE	WELL DEPTH (Ft.)	AG ug/L	AS ug/L	BORON ug/L	CD ug/L	CR ug/L	CU ug/L	FE ug/L	HG ug/L	MN ug/L	MO ug/L	NI ug/L	PB ug/L	SE ug/L	ZN ug/L	EC umhos/cm
84/07/10	3.7	<1	7	2400	<1	4	<20	3600	0.1	1200	43	28	10	<1	10	3190
84/06/11	10.2	<1	10	13000	<1	30	9	7600	0.2	730	120	34	<1	1	60	-
84/07/11	9.5	<1	12	12000	<1	26	<20	7500	0.2	500	220	29	<1	<1	20	*
84/06/12	21.9	<1	18	21000	<1	3	7	40000	0.1	6300	81	17	11	2	1700	19150
84/06/12	8.0	<1	2	20000	<1	9	10	2100	<.1	410	99	36	<1	2	20	20200
84/07/12	9.5	<1	2	21000	<1	1	<20	340	<.1	260	130	27	<1	2	5	*
84/06/12	9.5	<1	<1	24000	<1	11	8	2500	<.1	330	17	34	<1	1	20	24630
84/07/12	9.5	<1	3	25000	<1	23	<20	2500	0.1	360	20	49	3	1	9	25020
84/07/12	-	<1	<1	3600	<1	<1	<20	1600	<.1	290	9	32	<1	<1	20	9270
84/07/10	-	<1	6	3300	1	4	<20	7300	<.1	3900	19	25	<1	<1	20	4760

Attachment 9 (cont.)

Water Quality Objectives and Monitoring Data[1] at the San Joaquin River at Vernalis

Component	Objective	Mean Conc.	Max. Conc.	No. of Samples
TDS	500[2]	432	1337	485
Arsenic	0.01	0.014	0.086	58
Barium	0.1	0.108	0.2	12
Boron	0.5	0.216	0.8	612
Cadmium	0.01	0.002	0.02	16
Chromium[3]	0.05	0.012	0.03	15
Copper	0.01	0.111	2.3	26
Iron	0.3	2.88	8.5	39
Lead	0.05	0.021	0.2	18
Manganese	0.05	0.22	1.1	39
Selenium[4]	0.01	0.001	0.005	25
Silver	0.01	0.0003	0.003	14
Zinc	0.1	0.042	0.120	37

1. All concentrations are in mg/l

2. Mean average concentration over any 30 day period.

3. The Basin Plan objective specifies hexavalent chromium; however, the monitoring data is for total chromium.

4. It has recently been determined that the previous analytical technique used to determine selenium concentrations is not accurate. However, using the new analytical technique, similar results are being obtained.