

<http://www.hwea.org/cleanwtr.htm>

On October 18, 1997, the Clean Water Act (CWA) celebrated its twenty-fifth anniversary as a landmark piece of legislation which spawned tremendous changes and improvements to the water environment in our country.

The Federal government's involvement in prevention of pollution of interstate waters actually began over 100 years ago with the enactment of the Rivers and Harbors Act of 1890, which prohibited discharges of filth and pollutants that could impede navigation into such waters. In 1899, however, the act exempted "refuse flowing from streets and sewers" in a liquid state.

Although there were increasing pollution problems as the country grew and developed, little else was done from then until the 1940s. During the industrial boom that followed World War II, the country prospered and Americans enjoyed a higher standard of living, but this was not achieved without sacrifices. As much as 7 million tons of untreated or inadequately treated wastes were dumped daily into our waterways which turned many rivers into sewers and lakes into stagnant pools. Many water bodies had become too dirty for fishing and swimming or too polluted for aquatic and wild life. From 1948 to 1970, Congress enacted six principal bills which not only toughened the controls over discharges, but also included inducements in the form of authorizations for loans and grants to states to develop comprehensive plans and standards to control the discharge of pollutants and for the construction of projects that conformed to such plans and standards.

Pollution was not, however, being effectively controlled primarily because of an unmanageable system of setting discharge limits for each individual discharger based on the impacts of its discharge on the receiving water quality. With increasing closures of beaches and fishing beds and incidents like the Cuyahoga River in Ohio catching fire, public indignation turned to outrage and Congress was spurred to action. Changes to the environmental strategy of the nation such as the establishment of the U.S. EPA (the Environmental Protection Agency) culminated in the enactment of the 1972 amendments to the Federal Water Pollution Control Act of 1948. These amendments and subsequent amendments constitute what is called the CWA. The primary goals of the CWA were to have all waters of the U.S. clean enough to be fishable and swimmable and to end all discharges of pollutants into waters.

With this act, a new era of pollution control began. The act required all dischargers to the Nation's waters, industrial as well as municipal, to have discharge permits. It also set national uniform minimum treatment requirements which were technology based for discharges. The requirements for municipal discharges were for a minimum of secondary treatment, except for discharges into marine waters for which lower levels of treatment could be allowed if there were no impacts.

Higher levels of treatment of the effluent being discharged could be required if water quality dictated a need. Senator Edmund Muskie, one of the prime authors of this historic piece of legislation, described it as offering "Uniformity, Enforceability, and Finality".

## **CONSTRUCTION GRANTS PROGRAM**

The act, however, was not only a big stick. There was a carrot in the form of federal financial assistance to build municipal wastewater treatment plants under a Construction Grants Program. Grants of 75% of the total eligible project costs could be obtained. Since 1990 federal assistance to states have been grants to establish State Revolving Funds from which low-interest loans could be made to municipalities.

In Hawai'i, the federal grant funds were supplemented with 10% grants from the state. Thus, the net cost to the counties was down to 15% of the cost of the facilities built. Of all the counties, the City and County of Honolulu, which had the greatest needs, benefited the most from the grants program. Great improvements to the water quality of O'ahu have resulted from the projects that were made possible by the financial assistance.

## **WATER QUALITY PROGRAM FOR O'AHU (WQPO)**

Honolulu's efforts to resolve its water quality problems began in 1969, before the CWA, with the implementation of the WQPO. This was a study to:

- Identify the water quality problems on O'ahu;

- Identify the wastes contributing to the problems and their characteristics and quantities;
- Recommend alternative wastewater management systems to meet existing and future needs; and
- Establish priorities and a plan of action.

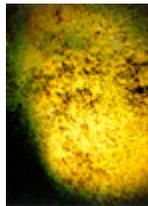
The final product of this effort was a report, the Water Quality Program for O‘ahu with Special Emphasis on Waste Disposal, which was completed, coincidentally, in February 1972, the year of the CWA. The conclusion was that the design of water quality control systems should be directed toward the conservation of corals and other indigenous aquatic organisms, the protection of the aesthetic qualities of the water environment, and the protection of the various recreational uses of the waters. This was the plan that Honolulu has used to guide the course it took to alleviate the water quality problems that needed correction.

A major priority of the plan was to abate the problems associated with sewage discharges. These were discharges in Mamala Bay in the vicinity of the Sand Island, in the southeast portion of Kane‘ohe Bay, and in Pearl Harbor. The plan, however, not only covered the impacts of sewage discharges but also identified water quality problems in areas such as Honolulu Harbor, Ke‘ehi Lagoon, Kewalo Basin and Ala Wai Yacht Harbor where there were no sewage discharges and the problems were due to other contributing factors such as suspended solids, nutrients, and pesticides in non-point source discharges from agricultural and urban areas.

### **SAND ISLAND DISCHARGE**

In 1972, the sewage from the entire urban Honolulu corridor extending from Red Hill to Niu Valley, amounting to about 62 million gallons per day (mgd), was being discharged off Sand Island through a 60-inch diameter outfall pipe about 3,700 feet offshore and at a depth of 38 feet. The discharge was raw sewage, totally untreated. It was an end-of-pipe discharge with no diffusers to spread the sewage to minimize the impact.

With no treatment preceding the discharge and all of the wastewater discharged at one single point, the debris in the sewage settled to the ocean floor. There were thick sludge deposits in the vicinity of the outfall and measurable impacts to the reef community as far away as where the Reef Runway is today. Polychaete worms and filter feeders, indicators of pollution, were abundant.



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*Polychaete worms in a mound of debris near the old Sand Island outfall discharge*

The aesthetics of our receiving water were marred by an ever present thick, grayish-brown plume on the ocean surface, usually heading in the direction of ‘Ewa Beach and Barbers Point. As the plume spread it impacted the Ke‘ehi Lagoon area where the nutrients in the sewage stimulated growth of seaweed. Ogo, a favored seaweed, was especially abundant in the area.



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*Slick caused by surfacing plume from old Sand*

### *Island outfall discharging into shallow waters*

During times when the trade winds were not blowing, debris from the sewage was carried toward the shore and could be found at distant recreational areas like Ala Moana Beach Park. Studies by University of Hawai'i scientists, who had developed methods to recover viruses from seawater and to culture them, revealed that viruses from the discharge were being carried to the recreational waters.

By 1976, Honolulu had a new 78-inch diameter outfall which extended to about 1-1/2 miles offshore where the ocean was about 225 to 240 feet deep. The new outfall was designed to incorporate state-of-the-art technology that had been developed at the California Institute of Technology. The design reduced the impact of the discharge on receiving waters. Instead of discharging the sewage in one big mass from the end of the pipe, the outfall was designed with a 3400-foot long diffuser section which had 282 openings, ranging from 3 to 3.5-inches in diameter and spaced 24 feet apart. In this way the sewage was discharged in small amounts from each port and spread out over the length of the diffuser. The outfall was designed to keep the sewage from impacting the ocean bottom and nearshore recreational areas. The new outfall also kept sewage from reaching the ocean surface most of the time so that it would not be visible.

The Sand Island Wastewater Treatment Plant was not completed until 1981 and therefore raw sewage was discharged through the new outfall from 1976 until the Sand Island Wastewater Treatment Plant was operational. With the start of operation of the new outfall in 1976, even with a raw sewage discharge there was dramatic improvement to the water quality, demonstrating the efficacy of the design of the new outfall. There no longer was a visible plume on the water surface and without navigational tools a boat would not be able to locate the outfall.



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*The deep, blue waters show no evidence of the discharge from the new Sand Island outfall*

Analyses of samples of the sands at the ocean bottom in the area of the new outfall diffuser, collected by lowering a sampler from a boat, indicated that the solids in the sewage were not settling and creating deposits. It was not, however, until about 1982 when the University of Hawai'i's research submarine, the Makali'i, came back with pictures of the clean white sand right at the discharge ports that all doubts about the outfall design were erased. Other pictures also showed that the rocks that are used to anchor and protect the outfall provide relief and habitats on an otherwise barren sand bottom and attracted a new and more diverse population of aquatic biota.



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*Clean bottom at the new Sand Island outfall (photo taken by Makali'i)*

In follow-up virus studies conducted in 1977–1978 the University of Hawai'i researchers were not able to isolate viruses from the seawater samples taken in the same areas that were sampled in their initial study. Even doubling of the amount of seawater filtered for each sample did not result in positive readings. The only sample that tested positive was collected directly over the new outfall site.

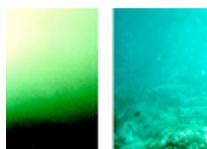
A dramatic demonstration that the discharge was no longer affecting the areas close to the shore where recreational activities

occur was the decline of the ogo that had abounded in the Ke'ehi Lagoon area. With the nutrients in the sewage no longer available to the ogo after the new outfall went into operation, the ogo has to rely on the nutrients in runoff and while still growing in the area, it is no longer plentiful.

The CWA applied to all discharges, not only the municipal discharges. An example of a major discharge that was eliminated was the discharge of approximately 10 mgd of pineapple wastes into Kapalama Canal. With such discharges no longer permitted, it was diverted into the City and County of Honolulu's sewer system in the mid-70's. This discharge had caused gross pollution of the canal waters which resulted in a horrendous stench on Nimitz Highway. With the elimination of the discharge, the odors eventually disappeared.

## **KANE'OHE BAY**

Kane'ohe Bay contains some of O'ahu's finest reefs and a rich and diverse aquatic ecosystem. As the Kane'ohe area developed, runoff transported increasingly greater silt and nutrient loads from disturbed lands. In addition there were discharges from two secondary wastewater treatment plants, the Kane'ohe Marine Corps Base wastewater treatment plant (WWTP) and City and County of Honolulu's Kane'ohe WWTP. These plants discharged into the southern end of the bay which is quite sheltered and has poor water circulation. The treatment plants added additional organic matter, suspended solids, and more importantly, nutrients into the bay. These imposed stresses resulted in high turbidity in the water column making the water murky. Excessive algal growth, deposition of solids, and the activities of bottom organisms such as filter feeders and burrowing worms were killing the coral reefs.



[Click here for a larger image](#)

*Murky, turbid waters of Kane'ohe Bay prior to diversion (left)  
compared with clear, post-diversion water (right)*

Diversion of the sewage discharges to a new outfall that discharged to the open ocean off Mokapu Peninsula was recommended to correct the problems. By December 1977, the Mokapu outfall and the diversion lines from the two treatment plants to the outfall were completed and the diversion began. An extensive study of Kane'ohe Bay was conducted from January 1976 through August 1979 and thus covered the pre- and post-diversion periods. The study showed that after the sewage diversion, clarity of the bay's waters improved more rapidly than would have been predicted and, within a year, the water was very clear. Although the algal masses that had been smothering the coral also decreased quickly, the coral community had a more gradual recovery. Later studies about 5 years after the diversion showed the corals were recovering nicely.

## **PEARL HARBOR**

There were several major sewage discharges into Pearl Harbor. Two were the City and County of Honolulu's Pearl City WWTP primary treated discharge and Waipahu WWTP secondary treated discharge. The Navy was discharging untreated, raw sewage into the harbor as well as secondary treated effluent from its Fort Kamehameha and Iroquois WWTPs near the mouth of the harbor. There were also indirect wastewater discharges from inland treatment plants into the harbor via streams that eventually emptied into the harbor. These treatment plants were the City and County of Honolulu's Mililani and Palisades (Pearl City) plants and the Army's Schofield plant. O'ahu Sugar Company was discharging some of its soil laden sugar mill wastewaters into the harbor. All of these discharges had caused the harbor waters to deteriorate to such a state that in the late 1960's, the Federal Water Pollution Control Administration, the forerunner of the EPA, decided to conduct a study to evaluate what needed to be done to rectify the situation.

Diversion of the City and County of Honolulu's sewage discharges to a deep ocean outfall extending about 1-1/2 miles offshore from One'ula Beach Park in 'Ewa Beach was required. The Navy was required to terminate its raw sewage discharge and send the sewage to the Fort Kamehameha WWTP for treatment. O'ahu Sugar Company was required to recycle its wastewater for cane irrigation. Although no studies have been performed on Pearl Harbor to document its recovery

anecdotal information from federal employees indicate that there have been significant improvements.

## **WAIVERS FROM SECONDARY TREATMENT REQUIREMENTS**

Under the CWA, waivers from secondary treatment requirements can be granted by the EPA for discharges from municipal wastewater treatment plants that are into the deep ocean. The municipality must demonstrate that its discharge of the less than secondary treated effluent has no adverse impacts on the marine environment and on public health. The City and County of Honolulu has been granted waivers for its discharges from its Honouliuli and Sand Island WWTPs. Its on-going studies have continued to show that primary treatment is adequate for the discharges. A more recent \$8 million study by the Mamala Bay Commission, an independent board established as a result of settlement of a lawsuit by the Sierra Club and Hawaii's Thousand Friends against the City and County of Honolulu confirmed the results of the on-going studies. Even the State's bacterial standards for recreational waters, the most stringent in the country were shown not to be exceeded.

## **CLEAR SUCCESSES**

The CWA established requirements for all dischargers to clean up or eliminate their discharges. While the private sector had to fund its improvements, the Construction Grants Program of the CWA assisted and enabled the City and County of Honolulu and other municipalities across the country to implement many of the necessary pollution prevention and control projects that they otherwise may not have been able to afford. The federal construction grant funds which were made available to the State of Hawai'i amounted to about \$360 million dollars, of which the City and County of Honolulu received an estimated \$260 million. Since the grant funds represented 75% of the total eligible costs of the projects, it means the total costs of Honolulu's projects were at least \$347 million. With the State contributing 10% of these project costs or about \$35 million, the City and County of Honolulu's share of the costs was only the remaining 15% or \$52 million. The documented improvements in the water quality of O'ahu that resulted from these projects have been tremendous and the CWA can be considered a clear success here in Hawai'i as well as throughout the rest of the country.

## **FUTURE CHALLENGES**

In the first 25 years of the CWA, the emphasis has been on the cleanup of known pollutant sources or point sources. These were easy targets and also easier to control. The Water Quality Plan for O'ahu (WQPO) indicated that while gross pollution effects were being caused by point sources, primarily ocean or estuary discharges from the City and County of Honolulu's wastewater treatment plants, there were other sources of pollutants. Noted were runoffs from streams and agricultural discharges. With the major point sources on O'ahu now improved to an extent that further improvement will not provide significant benefits, it is necessary to reassess where expenditures of limited public funds should be directed.

The State Department of Health has designated several areas of O'ahu as Water Quality Limited Segments (WQLS). These are areas where the water quality chronically does not meet the State's Water Quality Standards and include Ala Wai Canal, Honolulu Harbor, Kahana Bay, Kane'ohe Bay, Ke'ehi Lagoon, Kewalo Basin, Pearl Harbor, and Waialua-Kaiaka Bay. It is noted that, except for Pearl Harbor, sewage is not being discharged in these areas and cannot be blamed for the problem. Rather, these are areas that are affected by high mass emissions of pollutants by non-point sources. Further, after intense rainstorms our coastal waters are often colored brown by sediments carried by the runoff. During these periods, although the bacterial counts are often higher than the State standards, the State Department of Health does not normally close beaches unless a sewage spill has occurred at the same time.

Water quality managers are focusing on an approach called watershed planning where all of the pollutant sources in a watershed are evaluated instead of concentrating on specific sources. By taking this comprehensive approach, water quality problems can be prioritized so that limited resources are directed where the returns will be the greatest. While this approach may seem to be logical, it can require a great deal of effort to develop a consensus on the priorities. This is a challenge that faces us all if we are to make significant future strides in water quality improvements.

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