Adopted by the Commission November 1, 2006

One Total Maximum Daily Load for Zinc in Oyster Tissue in Nueces Bay

For Segment 2482

Prepared by the:
Chief Engineer's Office, Water Programs, TMDL Section

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

printed on recycled paper

Distributed by the
Total Maximum Daily Load Program
Texas Commission on Environmental Quality
MC-203
P.O. Box 13087
Austin, Texas 78711-3087
512/239-4900
tmdl@tceq.state.tx.us

TMDL project reports are also available on the TCEQ web site at:
<www.tceq.state.tx.us/water/quality/tmdl>.

CONTENTS

Figures

Tables

One Total Maximum Daily Load for Zinc in Oyster Tissue in Nueces Bay

EXECUTIVE SUMMARY

This document describes a project developed by the Texas Commission on Environmental Quality (TCEQ) to address water quality impairments resulting in elevated levels of zinc in the tissue of oysters in Nueces Bay (Segment 2482). The oyster waters use was first identified as impaired in the *Texas Water Quality Inventory and 303(d) List* for 1998.

A water quality target for zinc of 29 micrograms per liter (µg/L) was calculated for this TMDL using a bioconcentration factor (BCF) of 23,820 liters per kilogram (L/kg) and the health-based assessment comparison (HAC) value of <700 milligrams per kilogram (mg/kg) established by the Texas Department of State Health Services.

Both nonpoint and point sources of zinc loadings to Nueces Bay were identified. Nonpoint sources of zinc include loads in runoff from the upper portion of the watershed at the rate of 4.27 kilograms per day (k/d), from the adjacent watershed at 3.69 kg/d, and from atmospheric deposition at 18.67 kg/d. Point sources of zinc include both municipal (1.57 kg/d) and industrial (15.9 kg/d) permitted sources. The total zinc load to Nueces Bay is estimated to be 44.1 kg/d.

A total maximum daily load of 65.9 kg/d was calculated from the zinc water quality target of 29 µg/L and the flow of 26.31 cubic meters per second (m^3/s) to Nueces Bay. The difference between the total zinc load (44.1 kg/d) and the TMDL (65.9 kg/d) represents excess capacity that is available to potential future point source dischargers.

The following allocation equation takes into account an implicit margin of safety and a 10 percent allowance for future growth (AFG). The excess capacity is accounted for in the waste load allocation (WLA) for point sources.

$$TMDL = \sum LA + \sum WLA + AFG, \text{ where}$$
$$TMDL = 26.6 \text{ kg/d} + 32.6 \text{ kg/d} + 6.7 \text{ kg/d}$$
$$TMDL = 65.9 \text{ kg/d}$$

Implementation of this TMDL will focus on maintaining loads from the controllable point sources of zinc to below regulatory targets. If necessary, implementation measures for reducing loads from nonpoint sources of zinc will be further investigated during development of the implementation plan.

INTRODUCTION

Section 303(d) of the Clean Water Act requires all states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. For each listed water body that does not meet a standard, states must develop a total maximum daily load (TMDL) for each pollutant that has been identified as contributing to the impairment of water quality in that water body. The Texas Commission on Environmental Quality (TCEQ) is responsible for ensuring that TMDLs are developed for impaired surface waters in Texas.

In simple terms, a TMDL is a quantitative plan that determines the amount of a particular pollutant that a water body can receive and still meet its applicable water quality standards. In other words, TMDLs are the best possible estimates of the assimilative capacity of the water body for a pollutant under consideration. A TMDL is commonly expressed as a load, with units of mass per time period, but may be expressed in other ways also. TMDLs must also estimate how much the pollutant load needs to be reduced from current levels in order to achieve water quality standards.

The TMDL Program, a major component of Texas' statewide watershed management approach, addresses impaired or threatened streams, reservoirs, lakes, bays, and estuaries (water bodies) in or bordering the state of Texas. The primary objective of the TMDL Program is to restore and maintain the beneficial uses (such as drinking water, recreation, support of aquatic life, fishing, or oyster waters) of impaired or threatened water bodies.

The goal of this TMDL is to reduce zinc in tissue of the Eastern or American Oyster (*Crassostrea virginica*) from Nueces Bay (Segment 2482) to levels that constitute an acceptable risk to consumers as defined by the Texas Department of State Health Services (DSHS), formerly the Texas Department of Health. Once the goal is achieved, the DSHS can lift the restriction for growing and harvesting shellfish from Nueces Bay resulting in the restoration of the beneficial use for oyster waters.

Section 303(d) of the Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (USEPA) implementing regulations (40 Code of Federal Regulations, Part 130) describe the statutory and regulatory requirements for acceptable TMDLs. The TCEQ guidance document, *Developing Total Maximum Daily Load Projects in Texas* (GI-250), further refines the process for Texas. Following these guidelines, this TMDL document describes eight elements which are summarized in the following sections:

- Problem Definition
- Endpoint Identification & Water Quality Standards
- Source Analysis
- Linkage Between Sources and Receiving Waters
- Margin of Safety
- Pollutant Load Allocation
- Implementation and Reasonable Assurance
- Public Participation

This TMDL was prepared by the TMDL Section, Water Programs Division, Chief Engineer's Office, Texas Commission on Environmental Quality with support from the:

- University of Texas, Center for Research in Water Resources (CRWR)
- DSHS, Seafood and Aquatic Life Group
- Center for Coastal Studies, Texas A&M University Corpus Christi
- Coastal Bend Bays and Estuaries Program (CBBEP)
- Texas General Land Office.

The TMDL described in this document was adopted by the TCEQ Commission on November 1, 2006. Upon EPA approval, the TMDL will become part of the Texas Water Quality Management Plan. The TCEQ will use the EPA-approved document and the Texas Water Quality Management Plan in reviewing and making determinations on applications for wastewater discharge permits and in its nonpoint source pollution abatement programs.

Based on the TMDL, an implementation plan will be developed. An implementation plan is a detailed description and schedule of the regulatory and voluntary management measures necessary to achieve the pollutant reductions identified in the TMDL. The plan is a flexible tool that governmental and non-governmental agencies involved in TMDL implementation will use to guide their program management. Actual implementation will be accomplished by the participating entities by rule, order, guidance, or other appropriate formal or informal action. The implementation plan, combined with the TMDL, provides local, regional, and state organizations with a comprehensive strategy for restoring and maintaining water quality in an impaired water body. The TCEQ has ultimate responsibility for ensuring that water quality standards are restored and maintained in impaired water bodies.

Background Information

Nueces Bay (Segment 2482) is a shallow, secondary bay that receives freshwater from the Nueces River (Segments 2101 tidal and 2102 above tidal) and exchanges saline water with Corpus Christi Bay (Segment 2481). The headwaters of the Nueces River originate in central Texas and flow approximately 315 miles before reaching Lake Corpus Christi (Segment 2103) and ultimately Nueces Bay. Principal tributaries of the Nueces River above Lake Corpus Christi include the Atascosa and Frio Rivers (Figure 1). Besides the western part of Corpus Christi, no major metropolitan areas lie within the Nueces River Basin boundaries. Other larger communities within the upper basin include Uvalde, Pleasanton, George West, and Three Rivers. Counties that border the bay include San Patricio and Nueces Counties.

Nueces Bay is of economic and ecologic importance to the surrounding region. Some economically important activities in and around the bay environment include petrochemical refining and production, agriculture, manufacturing and tourism. Ecologically, Nueces Bay provides a home and food for diverse populations of plants and animals, and plays a role in water purification, storm protection, recreation, education, and maritime commerce.

Historically, Nueces Bay was abundant with oyster reefs and served as a major source of edible oysters for early settlers to the area (Tunnell et al. 1996). Today, only small patch reefs are found in the Nueces-Corpus Christi Bay system with most live patch reefs occurring in Nueces Bay (Tunnell et al., 1996). Declines in Nueces Bay oysters have been attributed to such impacts as reduced freshwater inflows, extensive shell dredging activities that occurred prior to the 1970s, and drought conditions that cause elevated salinities not conducive to oyster growth and reproduction (Tunnell et al., 1996; Ward, 1997).

Figure 1. Nueces River Basin, Including Reservoirs, Tributaries, Rivers, and Adjacent Bays

Nueces Bay primarily drains the Nueces River Basin, but also drains adjacent portions of the San Antonio–Nueces Coastal Basin to the north and the Nueces Rio Grande Coastal Basin to the south. For this TMDL, the watershed has been delineated as depicted in Figure 2. Runoff from the drainage area upstream of Lake Corpus Christi (Segment 2103) is captured by the reservoir. Therefore, releases from the reservoir are assumed to be representative of upstream runoff. These releases flow down segments 2102 and 2101 of the Nueces River then into Nueces Bay (Segment 2482).

The Nueces Bay watershed is geographically characterized as transitional, lying between the chaparral brush country to the south and the coastal-plain grassland prairies to the north. The climate in this region is described as being arid most of the time, except when influenced by freshwater pulses resulting from high rainfall events due to seasonal and tropical storms which often result in flooding. Mrini et al. (2003) compiled a land cover grid and determined the percent land use categories in the delineated watershed. The major land use category in the watershed is planted/cultivated (53%), followed by water (10%), forested upland (10%), shrubland (10%), and wetlands (9%) (Figure 3). The remaining 8 percent is comprised of developed areas (3%), barren (1%), and herbaceous upland (4%).

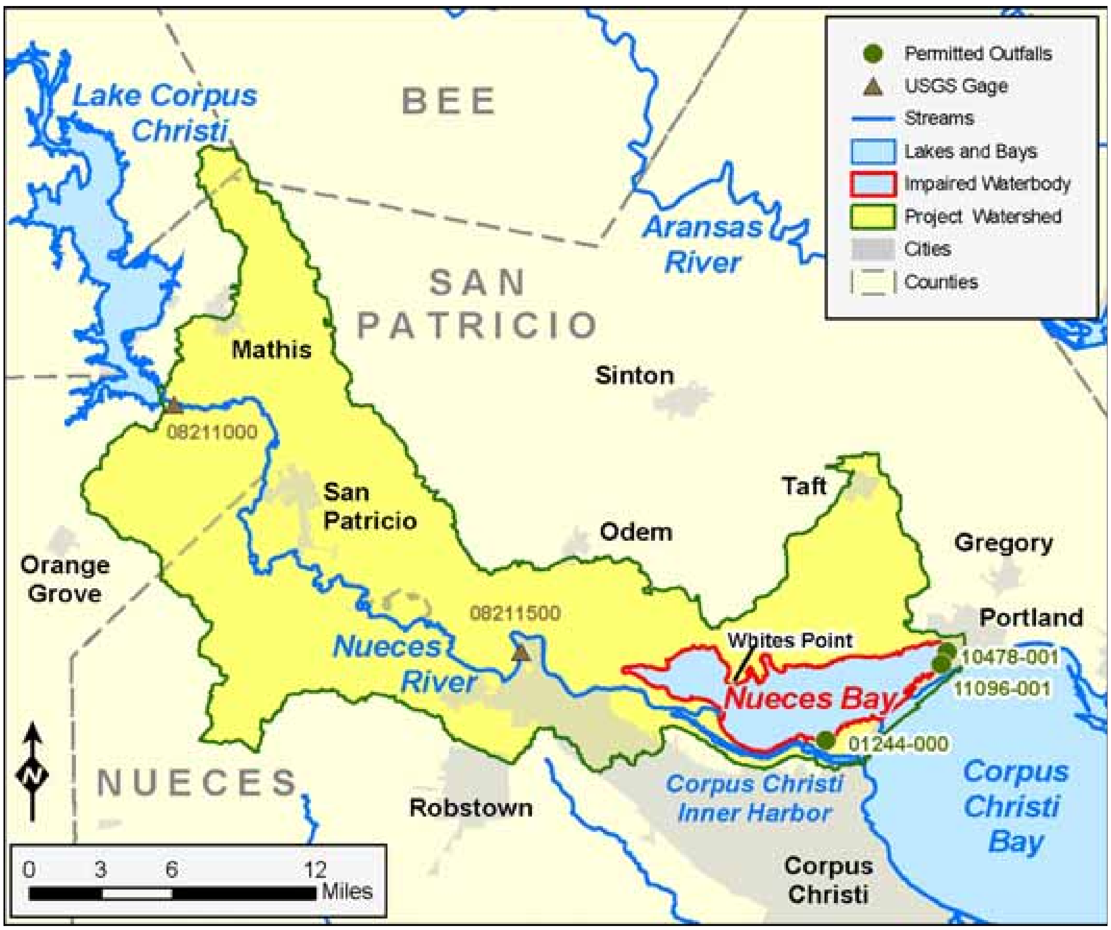


Figure 2. Delineated Watershed for the Nueces Bay TMDL for Zinc (Mrini et al., 2003)

In 1998, a four-year, community-based planning effort by the Corpus Christi Bay National Estuary Program culminated in the development of the *Coastal Bend Bays Plan* (referred to as the *Bays Plan*). The purpose of the planning effort was to convene a body of stakeholders comprised of local representatives from industry, commercial shrimping, agriculture, ranching, recreational activities, environmental organizations, municipal and county governments, scientists, and federal and state resource managers. The stakeholders were tasked with identifying the environmental issues of concern facing the bays and estuaries of the Coastal Bend and developing a management plan (e.g. the *Bays Plan*). One environmental issue of concern identified in the *Bays Plan* was the threat to public health from the consumption of oysters from Nueces Bay due to zinc contamination (TNRCC, 1998).

In 2002, the TCEQ initiated a TMDL project to address the zinc-contaminated oyster tissue in Nueces Bay. Part of the TMDL process includes stakeholder involvement. This component of the TMDL was achieved through stakeholder meetings with the CBBEP, formerly the Corpus Christi Bay National Estuary Program, and the Port Industries of Corpus Christi (PICC). Stakeholders of the CBBEP represented the public, environmental groups, municipalities, industry, agriculture, river authorities, and state and federal agencies. The PICC primarily consists of industry representatives associated with the Port of Corpus Christi. Input was received from the stakeholders and incorporated into the TMDL document.

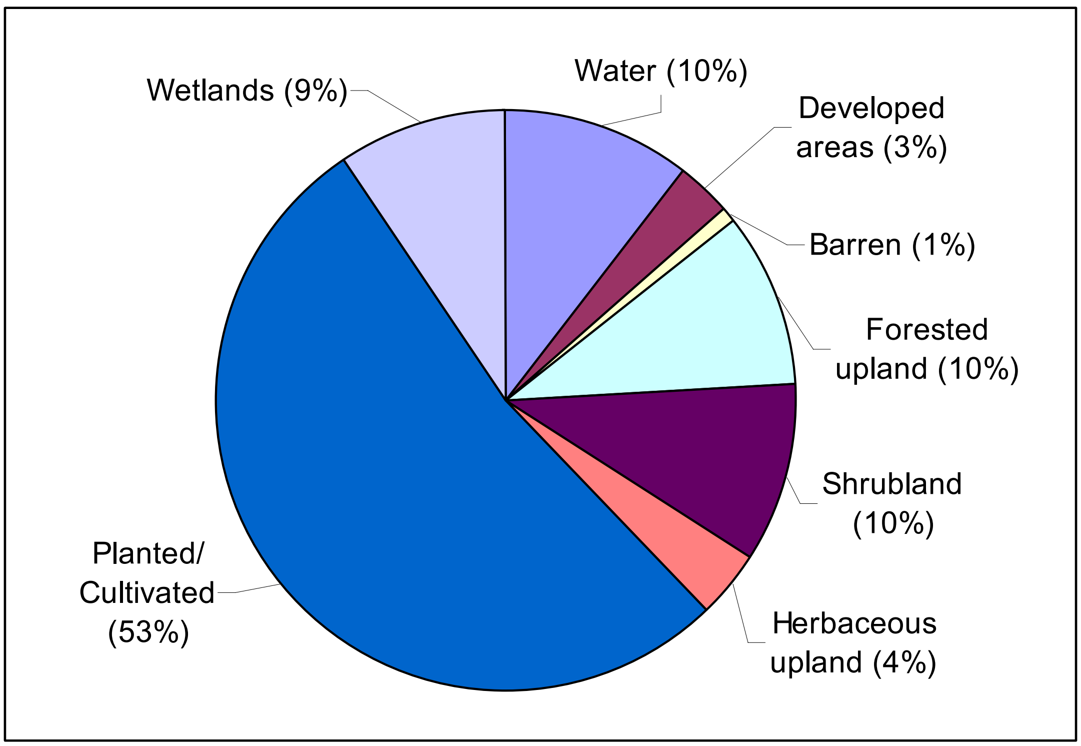


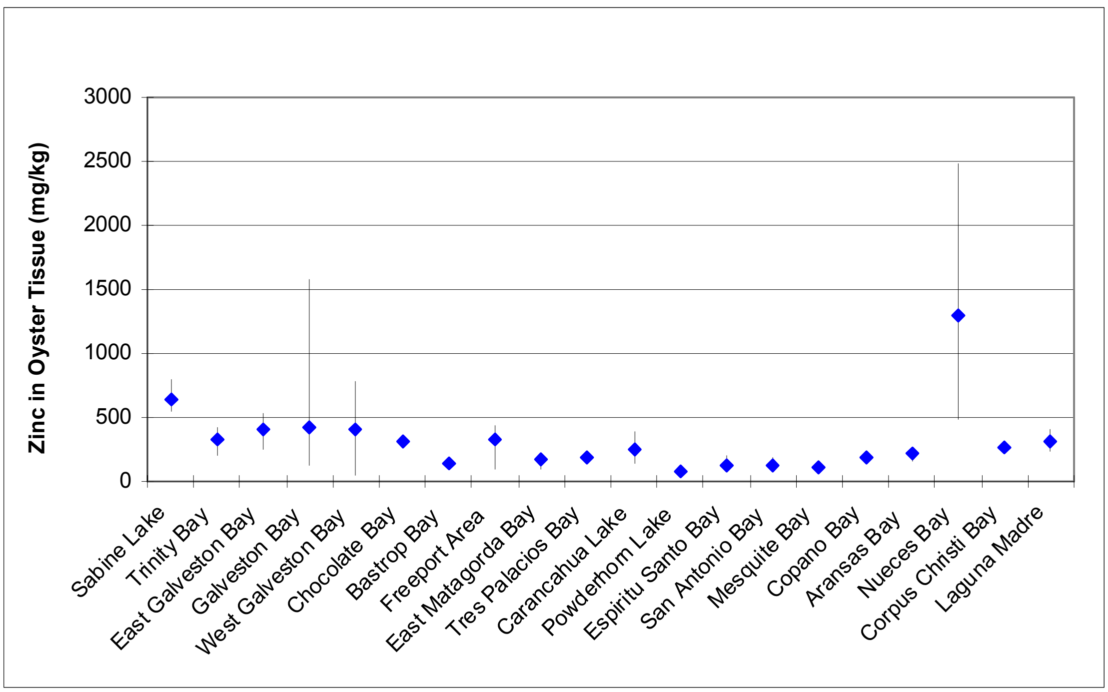
Figure 3. Land Uses in the Nueces Bay Watershed (Mrini et al. 2003)

PROBLEM DEFINITION

Nueces Bay was originally placed on the TCEQ's 303(d) List in 1998 for nonsupport of the oyster waters use in 100 percent of the bay (28.9 mi^2). The listing is based on the DSHS's shellfish classification maps, which restrict the growing and harvesting of shellfish from Nueces Bay for direct marketing due to excessive levels of zinc in oyster tissue.

Monitoring data (n=300) collected by DSHS for zinc in oyster tissue from all Texas bays was compiled dating back to 1969 for some bays (Figure 4). Results reveal that Nueces Bay has the highest level of zinc in oysters in the state.

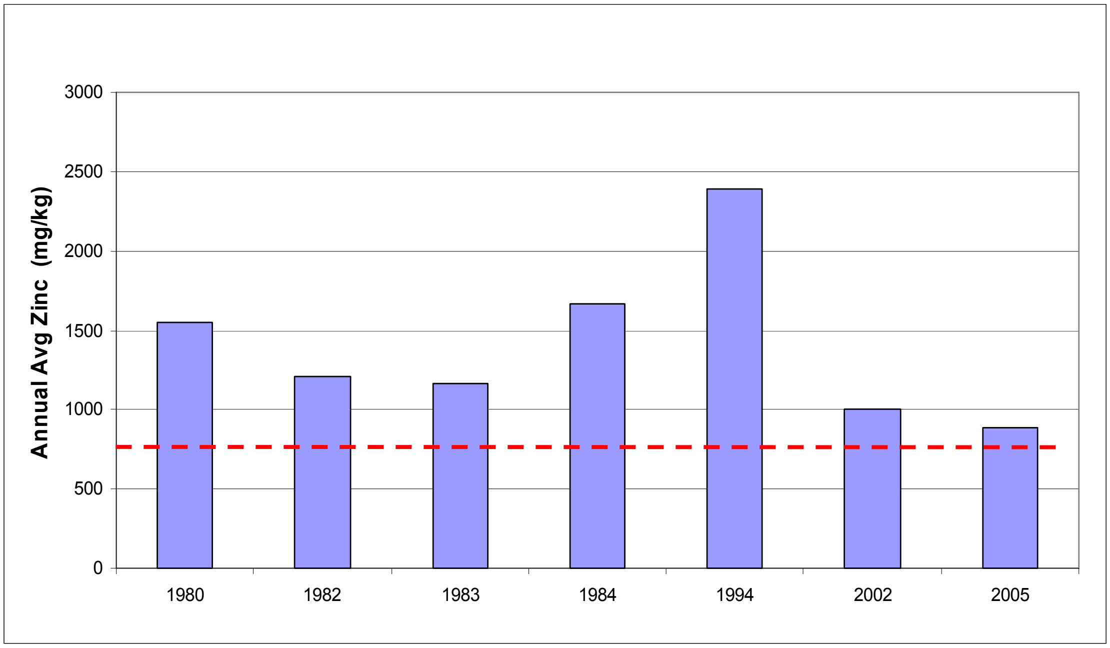
Oyster tissue monitoring data for Nueces Bay dates back to 1980. The average concentration of zinc in oyster tissue from 1980 to 2005 was 1,409 mg/kg (n=49) (Figure 5), more than the Health-based Assessment Comparison (HAC) value of <700 mg/kg. The HAC value is the target concentration for zinc in oyster tissue that must be achieved before the oyster harvesting restriction can be removed by DSHS. The risk-based HAC target value is determined assuming a human body weight of 70 kg (154 lbs), a consumption rate of 30 g/day (or 8 oz/wk), and a 30-year exposure rate.



High, average (♦) and low zinc values in oyster tissue in Texas bays.

Figure 4. Zinc in Oyster Tissue in Texas Bays, 1969 – 2002

In February and July 2002, the DSHS conducted a quantitative risk characterization and collected oyster tissue from two sites in Nueces Bay (Figure 6) (DSHS, 2003). One site was located along the eastern shore near the Nueces Bay Causeway and is referred to as the 'causeway' site. The other site was near the Nueces Bay Power Station (NBPS) discharge along the southern shore of Nueces Bay and is referred to as the 'NBPS' site. The average zinc concentration in oyster tissue collected in 2002 at the causeway and NBPS sites was 661 mg/kg (n=7) and 1,486 mg/kg (n=5), respectively. According to these results, the causeway site met the HAC target value, while the NBPS site did not. This finding led to further investigation of the zinc sources to Nueces Bay.



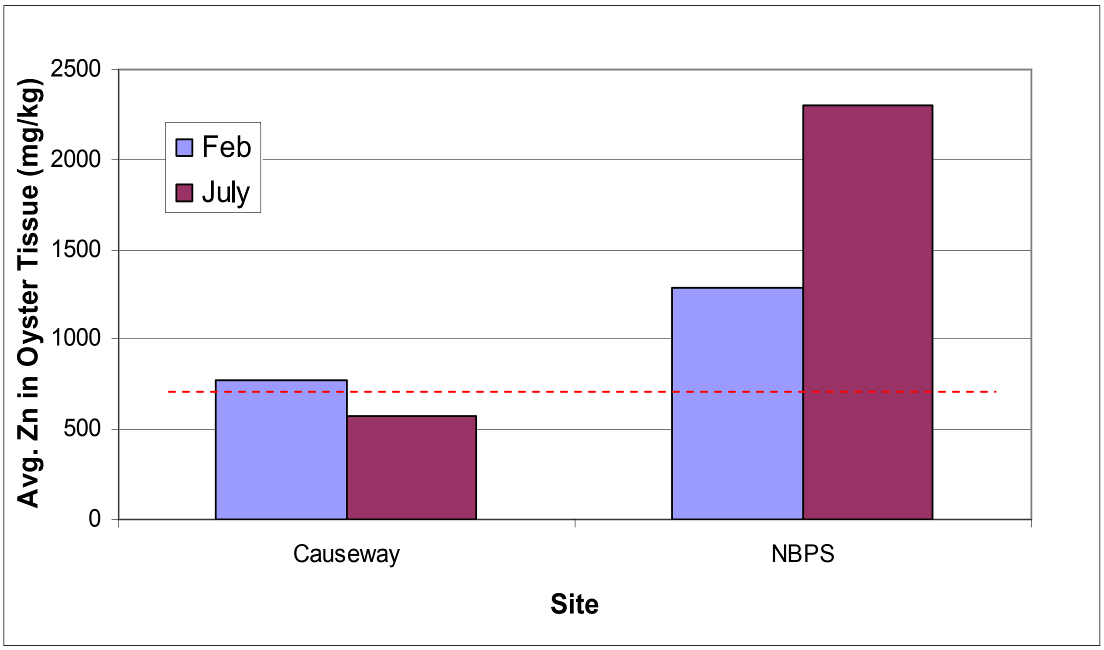
Dashed line depicts HAC value of <700 mg/kg. Figure 5. Average Annual Zinc in Oyster Tissue from Nueces Bay, 1980-2005

Zinc is widely used in metallurgical processes and causes undesirable effects for some aquatic species even at low concentrations (USEPA, 1987). From 1942 to 1985 the American Smelting and Refining Company operated a zinc smelting facility in the Nueces Bay area and discharged effluent along the southwestern shoreline of Nueces Bay and to the Corpus Christi Inner Harbor (CCIH). Several billion tons of zinc ore were processed during that time and is believed to be the cause of zinc that still remains today (Barrera et al., 1995; Armstrong and Ward, 1998).

Consumption of zinc-contaminated foods can affect human health when consumed regularly, over a long term, or in high doses (DSHS, 2003). According to the DSHS, regular or long-term consumption can cause a loss of copper from the body which can lead to a copper deficiency anemia. High zinc intake has also been known to reduce "good" HDL-cholesterol and increase "bad" LDL-cholesterol. Other possible short-term health effects resulting from consumption of oysters that exceed the HAC value as described by DSHS include dehydration, electrolyte imbalance, abdominal pain, nausea, vomiting, lethargy, dizziness, and lack of muscular coordination.

Oysters are filter feeding invertebrate molluscs typically found in estuarine environments that filter water, removing suspended particles for consumption as food. Because of their filter feeding mechanisms, they often bioaccumulate contaminants in their tissues. The bioaccumulation of contaminants in oyster tissue can cause the oysters to be unsafe for human consumption.

Metal concentrations in oyster tissue are highly variable and influenced by natural and human-induced changes in environmental conditions. For example, zinc concentrations in oysters on the Atlantic coast range from 300-13,000 mg/kg (Roesijadi, 1996), while zinc in oysters from Sarasota Bay in Florida range from 802 to 5,254 mg/kg (Dixon et. al, 1993). Factors that influence bioavailability and bio- accumulation of metals include water geochemistry, chemical speciation of metals, salinity, temperature, seasonal cycle, reproductive cycle, presence of organic matter and suspended particulate matter. Roesijadi (1996) noted that accumulated metals decline at a relatively slow rate in *C. virginica* even when the surrounding waters are free of metals.



Average zinc in oyster tissue from two sites in Nueces Bay. Dashed line depicts the HAC value of <700 mg/kg (DSHS, 2003).

Figure 6. Zinc in Oyster Tissue from 2002 DSHS Risk Characterization

ENDPOINT IDENTIFICATION AND WATER QUALITY STANDARDS

Texas Surface Water Quality Standards (TSWQS) are rules (Title 30, Texas Administrative Code, Chapter 307) adopted by the TCEQ to establish standards for water quality throughout the state and to provide a basis on which regulatory programs are carried out. Categories defined by TCEQ to describe the way that water bodies in the state are used include aquatic life, contact recreation, public water supply, fish consumption, and oyster waters. Each use category is associated with a suite of standards and criteria developed to protect the continued use of each water body. The designated uses assigned to Nueces Bay include exceptional aquatic life, contact recreation, fish consumption, general use, and oyster waters. This TMDL will address the impairment to the oyster waters use due to excessive levels of zinc in oyster tissue which could result in toxic effects on human health.

Statewide water quality criteria are applied to each segment for each assigned designated use unless the results of targeted studies support the development of segment-specific criteria. Zinc is measured as either total zinc in water or dissolved zinc in water. Total zinc in water accounts for both dissolved and particulate zinc, whereas dissolved zinc only includes the dissolved portion of zinc in water. Prior to 1988, zinc effluent limitations for permitted discharges to tidal waters were established using total zinc in water measurements. Therefore, the TCEQ monitored total zinc in water as part of the routine ambient water quality monitoring. However, since 1988 dissolved zinc standards have been established for the protection of aquatic life and, therefore, the TCEQ primarily monitors dissolved zinc in water. Both acute (92.7 μg/L) or short-term and chronic (84.7 μg/L) or long-term dissolved zinc criteria are established for the protection of the aquatic life use in salt water. No zinc criterion has been established specifically for the protection of the oyster waters use.

Using the total zinc standard is a more conservative approach for the development of a TMDL since it accounts for both dissolved and particulate zinc in water. Therefore, total zinc in water measurements were primarily used for the development of this TMDL. Total zinc in water data was only collected until 1988 as part of routine data collection; after that time, the TCEQ collected only dissolved zinc in water data. In 2004 the TMDL program initiated a project to collect total zinc, dissolved zinc, zinc in sediment and total suspended solids in Nueces Bay and the CCIH. This data is considered to be of higher quality since it was collected using the latest techniques and analytical methods. As a result, this data was used in the development of the TMDL.

The measured average dissolved zinc concentration in Nueces Bay from 1999 to 2005 (Figure 7) was substantially less than the current acute and chronic criteria established for the protection of the aquatic life use described above. This, coupled with the high levels of zinc in oyster tissue shown in Figure 5, indicates that the current dissolved zinc in water criteria for the aquatic life use is not protective of filter-feeding oysters. Furthermore, 30 TAC §307.7(b)(3)(B)(iii) in the Texas State Water Quality Standards indicates that oyster waters should be maintained so that concentrations of toxic materials do not cause edible species of oysters to exceed accepted guidelines for the protection of human health. Therefore, the target value for total zinc in water for this TMDL was determined using the HAC value for zinc in oyster tissue established by DSHS of <700 mg/kg or less as described below.

TMDLs must identify a quantifiable water quality target for each constituent appearing on the CWA Section 303(d) list. The water quality target for Nueces Bay is calculated using a zinc bioconcentration factor (BCF) for oysters.

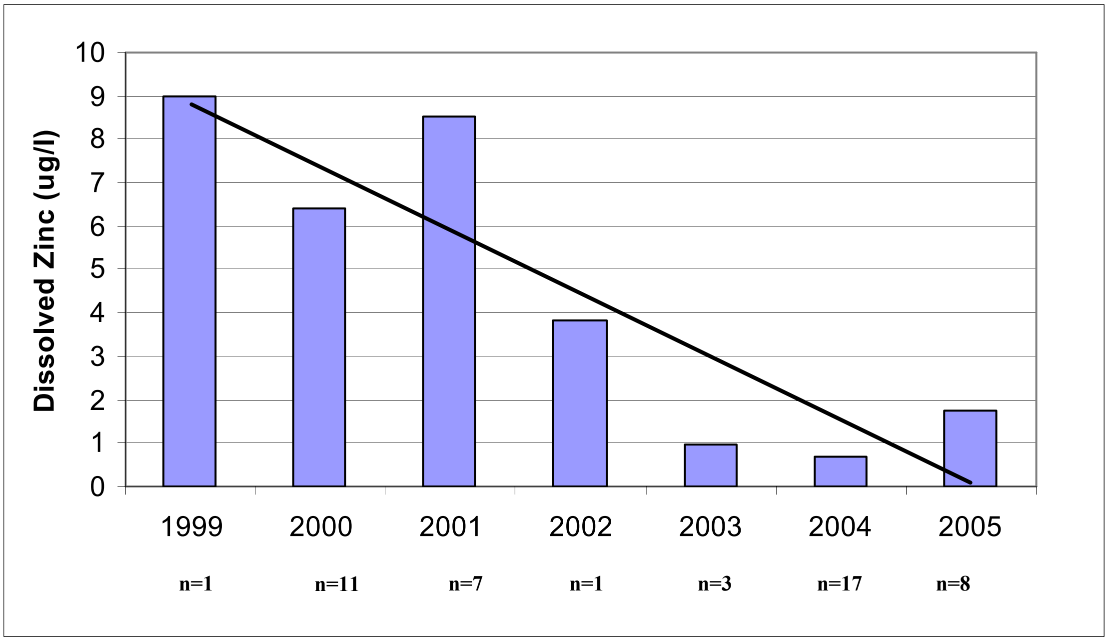


Figure 7. Annual Average Dissolved Zinc in Nueces Bay, 1999 – 2005

A bioconcentration factor is equal to the ratio of the concentration of zinc in oyster tissue to the concentration of total zinc in water. A range of BCF values have been reported in the scientific literature (Table 1). A BCF value of 23,400 L/kg was calculated by Mrini et al (2003) using the available measured zinc concentration values in water and oyster tissue from Nueces Bay. However, the measured values for zinc in water and tissue from Nueces Bay were not collected at the same locations, or on the same day. Therefore, a literature value was chosen for the calculation of the water quality target. The BCF value that more closely represents the measured BCF value in Nueces Bay for the American Oyster was 23,820 L/kg as reported by USEPA (1987). The target value for zinc in oyster tissue for this TMDL was calculated using the following equation, with a BCF of 23,820 L/kg and an HAC value of <700 mg/kg as established by DSHS:

BCF = concentration of zinc in oyster tissue / concentration of total zinc in water

When the BCF is 23,820 L/kg and the target concentration of zinc in oyster tissue is <700 mg/kg, then the concentration of zinc in water (C) is:

(a) 23,820 L/kg = 700 mg/kg / C
C = (700 mg/kg) (1kg/23,820 L)
C = .029 mg/L or 29 µg/L

Based on the above calculation, the concentration of total zinc in water in Nueces Bay must be 29 µg/L or less to support the target HAC value in oyster tissue for zinc.

Table 1. BCF Values for Zinc in Two Species of Oysters, from Literature

Reference	Oyster Species	BCF (L/kg)
Mrini et al. (2003)	*Crassostrea virginica*, American Oyster	23,400
Hwang et al. (1993)	*C. gigas*, Pacific Oyster	25,577
USEPA (1987)	*C. virginica*, American Oyster	17,640 and 23,820
Irwin et al. (1997)	*C. virginica*, American Oyster	16,700
Dixon et al. (1993)	*C. virginica*, American Oyster	1,000 - 10,000

SOURCE ANALYSIS

Several sources have been identified as contributing to the zinc load in Nueces Bay. Nonpoint sources of zinc include dry atmospheric deposition and land surface runoff. Point sources of zinc include industrial and municipal wastewater discharges. Zinc in sediments is another source of zinc which can contribute to elevated levels in oyster tissue.

In May 2002 the University of Texas CRWR was contracted by the TCEQ to develop a zinc loadings model for Nueces Bay (Mrini et al., 2003). The results from the zinc loadings model are presented below.

Nonpoint Sources (Load Allocations)

Nonpoint sources of zinc include all diffuse sources resulting from land surface runoff or direct deposition from the atmosphere. Nonpoint sources of zinc to Nueces Bay include:

- Loads in runoff from the upper portion of the watershed captured by Lake Corpus Christi and released into the Nueces River which flows into Nueces Bay,
- Loads in runoff that flow directly to Nueces Bay from the delineated watershed adjacent to Nueces Bay, and
- Dry deposition from the atmosphere deposited directly to the surface of the bay.

Land Surface Runoff

Zinc loads were derived for land surface runoff from the upper portion of the watershed that drains into Lake Corpus Christi by using the formula:

(b) $L_{LCC} = C * Q *$ conversion factor

where L_{LCC} is the load (kg/d), C is the total zinc concentration in water (µg/L), and Q is the flow (m^3/s). The conversion factor is used to cancel out the measurement units and is derived by the following calculation:

$(1{,}000\ L/m^3 * 86{,}400\ s/d * 1\ kg/1{,}000{,}000{,}000\ ug) = 0.0864\ L\text{-}s\text{-}kg/m^3\text{-}d\text{-}ug$.

Actual measurements of total zinc in water were not available to derive a zinc concentration value from Lake Corpus Christi; however, one measurement of total zinc in the Nueces River downstream of Lake Corpus Christi was located in the TCEQ Texas Regulatory and Compliance System (TRACS) database. The value from the Nueces River, taken in 1983 at TCEQ station 12960, was 21 µg/L. Mrini et al. (2003) researched literature values for zinc and identified values ranging from 0.5 to 45 µg/L for freshwater from rivers in Canada, the United States and worldwide. A value of 20 µg/L was chosen since Eckel and Jacob (1988) cited this value from ambient surface waters in the United States. Therefore, the concentration (C) of total zinc in water in Lake Corpus Christi was assumed to be 20 µg/L by Mrini et al. (2003). The mean stream flow (Q) (2.47 m^3/s) measured at a USGS gage (No. 08211500) in Calallen from 1991 to 2000 was also used to calculate the zinc load from land surface runoff from the upper portion of the watershed as follows:

(c) L_{LCC} = (zinc concentration µg/L) (mean stream flow) (conversion factor)
L_{LCC} = (20 µg/L) (2.47 m^3/s) (0.0864)
L_{LCC} = 4.27 kg/d

Land surface runoff from the delineated watershed adjacent to Nueces Bay (Figure 2) was determined using a GIS-based watershed model (Mrini et al., 2003). First, runoff was calculated from each land use type by developing a runoff equation using average annual precipitation data for Texas from the U.S. Department of Agriculture-Natural Resources Conservation Service and National Land Cover Data from the early to mid-1990s Landsat Thematic Mapper satellite data. Next, zinc event mean concentration (EMC) values from Baird et al. (1996) (Table 2) were applied to each land use type. The resulting watershed runoff coefficient (1.83 m^3/s) and EMC value (23.34 µg/L) as derived by Mrini et al. (2003) for each land use type were used to calculate the cumulative zinc load (3.69 kg/d) to Nueces Bay from the delineated watershed adjacent to Nueces Bay.

(d) L_{NB} = (EMC_{LU} µg/L) (runoff coefficient) (conversion factor)
L_{NB} = (23.34 µg/L) (1.83 m^3/s) (0.0864)
L_{NB} = 3.69 kg/d

Table 2. Zinc EMC Values for Land Use Classes (Baird et al., 1996)

Land Use Type	Zinc EMC (µg/L)
Residential	80
Commercial	180
Industrial	245
Transportation	60
Agriculture	16
Range	6
Mixed	141

Atmospheric Deposition

In 1997 the CBBEP funded a project to monitor atmospheric deposition in the Coastal Bend area (Wade et al., 2000). Monitoring occurred for one year beginning in June 1997. Results from that project were used to calculate the dry deposition of zinc to Nueces Bay. A value of 91 kg/km^2/yr of zinc was derived from a station at Whites Point located along the north shore of Nueces Bay. This value was multiplied by the area of Nueces Bay (75 km^2) to determine the zinc load to the bay from the atmosphere as follows:

(e) L_{ATM} = (measured dry deposition kg/km^2/yr) (Nueces Bay area km^2) (1 yr/365 d)
L_{ATM} = (91 kg/km^2/yr) (75 km^2) (1 yr/365 d)
L_{ATM} = 18.67 kg/d

Point Sources (Waste Load Allocations)

Point sources of zinc include all permitted industrial and municipal discharges to Nueces Bay. Zinc loads were calculated using both actual daily average flows and daily average permitted flows. The actual average flows were derived from self-reporting data, while the daily average permitted flows were derived from the permit limits established in the individual permits.

Three active permitted dischargers and one pending permit were identified as part of this TMDL (Table 3). The Nueces Bay Power Station (NBPS) is a steam electric generating facility that is permitted to discharge once through cooling water at an average daily flow of 500 million gallons per day (MGD) to Nueces Bay. The City of Portland, the City of Corpus Christi – Allison Plant, and Sublight Enterprises Inc. all discharge wastewater from sewage treatment. None of the permits have zinc limits nor are the dischargers required to self-monitor zinc in their effluent.

Table 3. Permitted Dischargers in Nueces Bay

Name	Permit No.	Permit type	Max permitted flow (MGD)
Nueces Bay Power Station	WQ0001244-000	Industrial	500
City of Corpus Christi – Allison Plant	WQ0010401-006	Municipal	7
City of Portland	WQ0010478-001	Municipal	2.5
Sublight Enterprises Inc.	WQ0011096-001	Municipal	0.009

Municipal Wastewater Discharges

Armstrong and Ward (1998) estimated the municipal zinc load (L_{MUN}) to Nueces Bay by using typical pollutant concentrations (TPC) and actual average municipal flows derived from self-reporting flow data. TPCs are values that approximate the pollutant concentrations in a discharge of a typical industrial or municipal facility. The TPC for municipal wastewater treatment facilities (Standard Industrial Classification 4952) was

0.165 mg/l. The resulting municipal total zinc load (L_{MUNA}) based on that study was estimated at 0.71 kg/day using the following equation:

(f) L_{MUNA} = (TPC) (actual avg. municipal flow) (conversion factor)
L_{MUNA} = (0.165 mg/l) (0.05 m^3/s) (86.4)
L_{MUNA} = 0.71 kg/day

Using a similar approach as Armstrong and Ward (1998), a value was calculated for the municipal zinc load (L_{MUNP}) to Nueces Bay using a TPC value and the permitted municipal flow derived from the permits in Table 3. The resulting municipal total zinc load based on the permitted flow was estimated at 1.57 kg/d using the following equation:

(g) L_{MUNP} = (TPC) (permitted municipal flow) (conversion factor)
L_{MUNP} = (0.165 mg/l) (0.11 m^3/s) (86.4)
L_{MUNP} = 1.57 kg/d

The TPC value used for the calculations described above was compared to values submitted as part of the permit application process by the municipal dischargers to ensure the municipal load was not underestimated. Results of this comparison indicate the TPC value was greater than the values submitted in the permit applications. This analysis infers an overestimation of load from municipal point sources.

Industrial Wastewater Discharges

The industrial zinc load (L_{IND}) was calculated by Mrini et al. (2003) by multiplying the ambient average total zinc concentration (C) in the Corpus Christi Inner Harbor from 2004-2006 (8.4 µg/L) and the actual average flow (Q) from 1995 to 2000 associated with the NBPS (16.55 m^3/s) based on self-reported data. The NBPS extracts water from the Corpus Christi Inner Harbor (Segment 2484), uses it for cooling water, then discharges the water into Nueces Bay. The resulting industrial zinc load (L_{INDA}) to Nueces Bay was calculated at 12.01 kg/d using the following equation:

(h) L_{INDA} = (C) (Q) (conversion factor)
L_{INDA} = (8.4 µg/L) (16.55 m^3/s) (0.0864)
L_{INDA} = 12.01 kg/d

The total permitted zinc load (L_{INDP}) was also calculated using the flow for the NBPS (500 MGD or 21.9 m^3/s). The resulting load was estimated to be 15.89 kg/d using the following:

(i) L_{INDP} = (C) (Q) (conversion factor)
L_{INDP} = (8.4 µg/L) (21.9 m^3/s) (0.0864)
L_{INDP} = 15.89 kg/d

Sediments

Sediments represent a significant reservoir for metals (including zinc) and can be a contributing source of contaminants to the water column (Jones et al, 1997). Several benchmarks or screening levels have been established to evaluate observed levels of sediment contaminants The National Oceanic and Atmospheric Administration (NOAA) and the Florida Department of Environmental Protection (FDEP) have developed several such screening levels for marine and estuarine sediments. These values were developed from data from several investigations throughout the United States (Jones et al, 1997).

The National Oceanic and Atmospheric Administration use screening levels developed by Long et al (1995). These levels are:

- The Effects Range–Low (ER–L): Level below which contaminants in sediment are not likely to have adverse effects on animals that live in sediment.
- Effects Range–Median (ER–M): Level above which contaminants in sediment probably have adverse effects on animals that live in sediment.

The Florida Department of Environmental Protection uses an approach developed by MacDonald et al. (1994) that is similar to the NOAA approach. The FDEP sediment screening levels are:

- The Threshold Effects Level (TEL): Represents the upper limit of the range of sediment contaminant concentrations dominated by no effects data.
- The Probable Effects Level (PEL): Represents the lower limit of the range of contaminant concentrations that are usually or always associated with adverse biological effects (Jones et al, 1997).

The values for each of these screening levels are presented in Table 4.

Table 4. Zinc Screening Values

Screening Value	Source	Value (mg\kg dry weight)
ER-L	NOAA	150
ER-M	NOAA	410
TEL	FDEP	124
PEL	FDEP	271

Levels of zinc in Nueces Bay and Inner Harbor sediments have been monitored for more than 30 years and a wide range of values have been measured. Since 1973, levels in both the Inner Harbor and Nueces Bay appear to have declined (Figure 8). The trend in zinc concentrations appears to moving towards values at or below the lowest screening levels previously described. The CCIH exhibits levels of sediment zinc higher than those in the

Bay primarily due to the effects of historic smelting operations and zinc processing facilities. These operations have since ceased, however, zinc in these sediments now becomes a legacy issue which will likely attenuate over time.

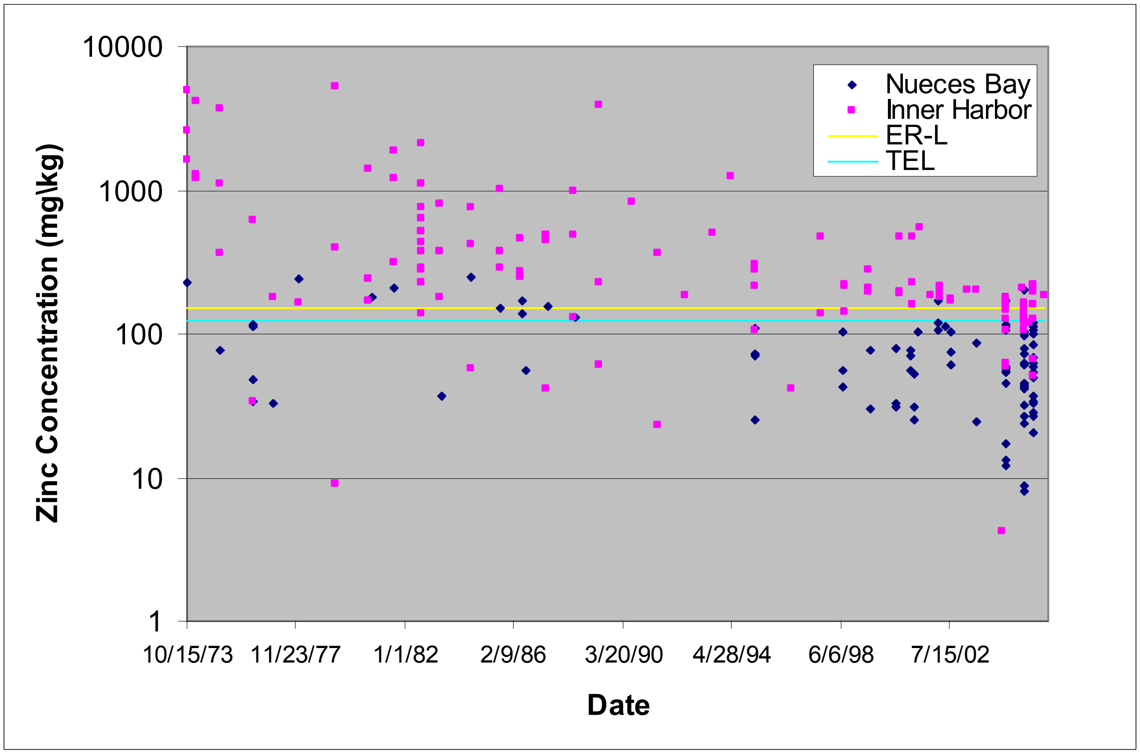


Figure 8. Zinc in Sediments Nueces Bay and the Inner Harbor

Total Zinc Loads

The estimated total zinc loads to Nueces Bay using actual average flow measurements and daily average permitted flow measurements are presented in Table 5. Although the total zinc load calculated from the permitted flows (44.12 kg/d) is slightly greater than the load calculated from the actual average flows (39.38 kg/d), the relative load contribution from the various sources remains the same. The majority of the zinc load is from atmospheric deposition sources, followed by industrial point sources, land surface runoff, then municipal point sources.

The loadings presented in Table 5 are not intended to be interim or final effluent limitations and/or specific loading allocations to categories of point sources. The TCEQ retains the ability to allocate specific loadings/effluent limitations among point sources through the TMDL implementation process so long as the overall assimilative capacity of the water body is not exceeded.

LINKAGE BETWEEN SOURCES AND RECEIVING WATER

Based on recent ambient data, levels of total zinc in Nueces Bay appear to be well below the threshold (29 µg/L) which would cause oyster tissue levels to exceed criteria to protect the oyster water use. The observed levels in water can be attributed to the well-mixed nature of Nueces Bay due to the effects of wind, tidal action, and hydrodynamic circulation. In addition, processes related to zinc in terms of sediment-water interaction are very important to the resulting concentrations in the water. Zinc has a tendency to bind with sediments thus potentially reducing levels in the water column.

Table 5. Estimate of Total Zinc Loads Using Actual Average Flow Measurements by Source for Nueces Bay

Source	Load (kg/d) Based on Actual Average Flows (%)	Load (kg/d) Based on Daily Average Permitted Flows (%)
Nonpoint		
Land Surface-above Lake Corpus Christi (L_{LCC})	4.27 (10.8)	4.27 (9.7)
Land Surface-adjacent to Nueces Bay (L_{NB})	3.69 (9.4)	3.69 (8.4)
Atmospheric Deposition (L_{ATM})	18.67 (47.5)	18.67 (42.4)
Subtotal	26.63 (67.7)	26.63 (60.4)
Point		
Municipal (L_{MUN})	0.71 (1.8)	1.57 (3.6)
Industrial (L_{IND})	12.01 (30.5)	15.89 (36.0)
Subtotal	12.72 (32.3)	17.46 (39.6)
TOTAL	39.38 (100)	44.12(100)

Estimated levels of zinc back calculated from the mass balance approach were compared to measured average total zinc values in Nueces Bay using data collected since 2004 (Figure 9, Appendix). The mean predicted total zinc concentration (19.4 µg/L) in Nueces Bay was higher than the mean measured total zinc concentration (8.7 µg/L). Based on this comparison, it is assumed that the mass balance approach approximates the major sources of zinc to Nueces Bay. Both the modeled and measured values are less than the target total zinc in water concentration value (29 µg/L) established to support oysters within the target HAC value (<700 mg/kg or less). Therefore, it is anticipated that if zinc concentrations are maintained at existing levels under the current conditions the oyster water use will be restored to Nueces Bay.

Seasonality

No seasonal trends were detected in the zinc monitoring data. Any seasonality that may have occurred naturally would have been ameliorated by the constant discharge of water

(500 MGD) from the NBPS during operation. Future monitoring will attempt to detect seasonal trends with more robust data set and the lack of constant discharge of water from the NBPS.

MARGIN OF SAFETY

A margin of safety is required in a TMDL to account for uncertainty in the pollutant load and its association with water quality. This TMDL includes an implicit margin of safety that is embodied in the conservative assumptions in the DSHS risk characterization which resulted in the target HAC values for zinc contaminated oyster tissue, and use of total zinc measurements. This implicit margin of safety is believed to be adequate for the protection of human health and the restoration of the oyster waters use in Nueces Bay.

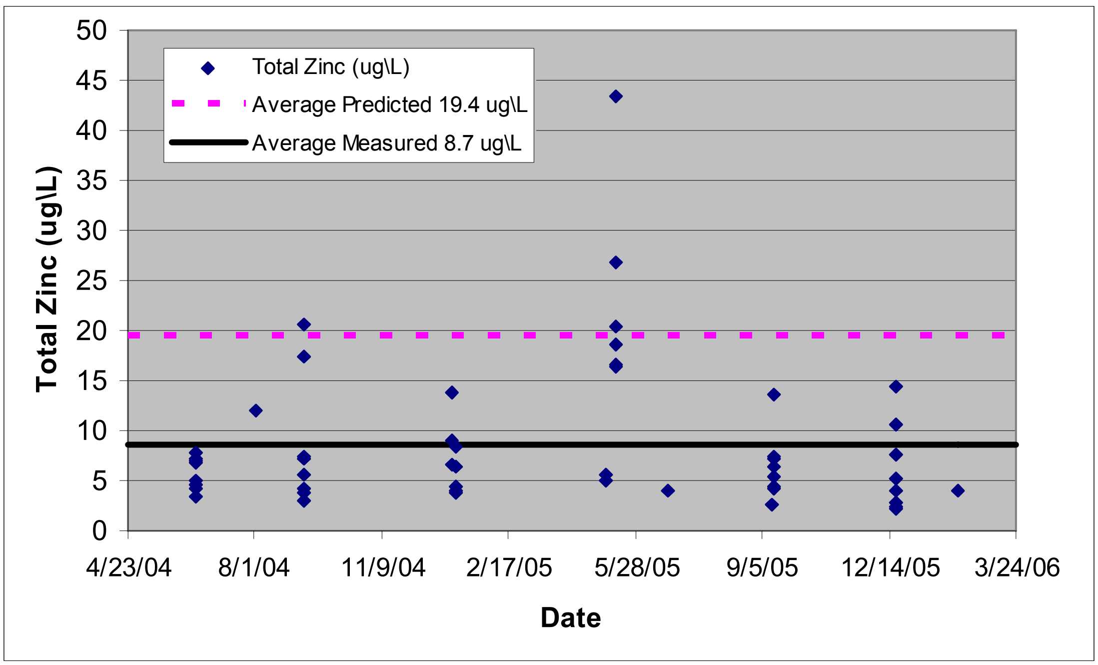


Figure 9. Total Zinc in Nueces Bay, 2004-2006. A Comparison of the Equilibrium Concentrations of Total Zinc Predicted with Mass Balance Approach and the Actual Average Measured Values in Nueces Bay

POLLUTANT LOAD ALLOCATION

A TMDL establishes the allowable pollutant loading for each water body and distributes the loading among the point and nonpoint source categories that contribute the pollutant. This TMDL will result in achievement of the target concentration of total zinc in water necessary to support the target HAC value for zinc in oyster tissue.

The load allocation in a TMDL allocates the target zinc load for the bay among the sources. The equation following shows a typical formulation of the load allocation equation.

(j) $TMDL = \sum LA + \sum WLA + AFG$

where LA is the sum of all existing nonpoint source loads, WLA is the sum of all existing point source loads, and AFG is the allowance for future growth.

In 2004, the Texas State Data Center predicted a population growth of 0.9 percent per year between 2005 and 2015 for the Coastal Bend, therefore, a 10 percent (6.7 kg/d) AFG was included as part of this TMDL.

Table 6 compares the load, concentration, and flow for the current and target scenarios calculated using existing (LA) and daily average (WLA) flows (26.31 m^3/s), and presents the excess capacity available to support the target HAC value in oyster tissue. There is an excess load of 21.8 kg/d available before the target total zinc concentration in water (29 µg/L) is exceeded. Therefore, the TMDL allocation equation will be:

(k) $TMDL = \sum LA + \sum WLA + AFG$, where
$TMDL = 26.6\ kg/d + 32.6\ kg/d + 6.7\ kg/d$
$TMDL = 65.9\ kg/d$

Table 6. Comparison of Load (L), Concentration (C), and Flow (Q) for the Current, Target, and Load Reduction Scenarios Necessary to Achieve the Target HAC Value in Oyster Tissue (<700 mg/kg)

Scenarios	Load[1] (L) (kg/d)	Concentration (C) (µg/L)	Flow (Q) (m^3/s)
Current	44.1	19.4	26.31
Target	65.9	29	26.31
Excess Capacity	21.80	---	---

[1]L (kg/d) = C (µg/L) * Q (m^3/s) * (Conversion Factor)

= C (µg/L) * Q (m^3/s) * [(1000L/m^3) (86,400 s/d) (1 kg/1,000,000,000 ug)]

= C * Q * 0.0864

IMPLEMENTATION AND REASONABLE ASSURANCE

Based on data presented in this TMDL, ambient zinc concentrations in Nueces Bay are well below criteria established to protect the designated oyster use. In addition, zinc concentrations in the water column in the CCIH do not represent a significant source of zinc which could result in exceedance of the 29 ug\L criteria necessary to achieve the target HAC value. Discharges from the Nueces Bay Power Station should not contribute to an impairment as long as ambient zinc levels in the CCIH are maintained below this established criteria.

Bay and harbor sediments represent a significant source of zinc which could cause exceedances of the criteria. Legacy zinc in sediment resulting from historic smelting activities along the Inner Harbor is the primary source of this pollutant. However, trends indicate that these concentrations are attenuating and approaching established screening levels (Figure 8). Sediment zinc concentrations should continue to decline provided that large-scale disturbances of sediments are minimized in the CCIH.

The cessation of the NBPS discharge will allow zinc levels to attenuate and ensure there is minimal transfer of zinc loads between the Inner Harbor and Nueces Bay. On January 21, 2003, a letter was submitted to TCEQ by the permit-holder at the time, American Electric Power, as notification that the "...Nueces Bay Power Station was placed on long-term mothball status..." and would not be on-line generating electricity. The letter also indicated that the wastewater permit would be kept in active status. Figure 10 depicts the average monthly flow from the NBPS from January 1998 to May 2005. Since December 2002 there has been a substantial decrease in discharge, with no discharge occurring for several months at a time.

The Nueces Bay Power Station is permitted to withdraw 500 MGD of water from the Corpus Christi Inner Harbor for use as once-through cooling water in an electric generating facility then discharge the water into Nueces Bay. Results of this TMDL indicate that the zinc in water from the Corpus Christi Inner Harbor is the second leading source of zinc loadings to Nueces Bay via the Nueces Bay Power Station. In essence the NBPS has the potential to act as a conduit for the transfer of large amounts of zinc from the CCIH to Nueces Bay. It is anticipated that as long as the total zinc concentrations in the water column remain well below the 29 ug\L criteria in the CCIH, zinc levels in oyster tissue in the Bay should attenuate to below the target HAC screening levels.

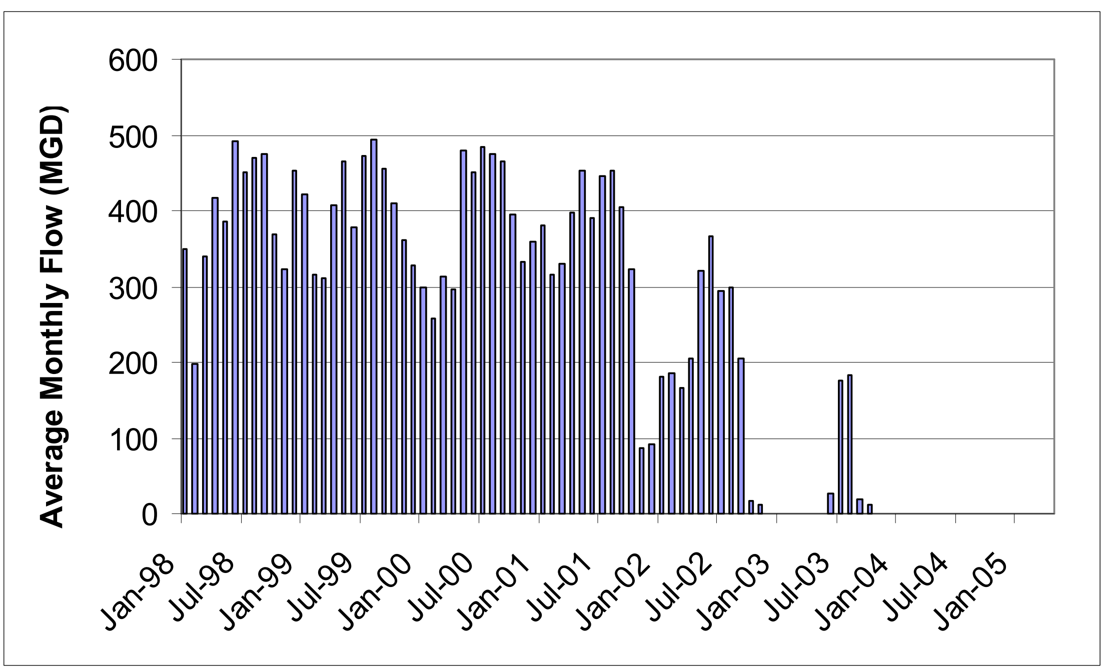


Figure 10. Average Monthly Flow from Nueces Bay Power Station, Permit Number WQ0001244000 (1998-2005)

In June 2004 TCEQ began a project to monitor water and sediment quality to track the effect of reduced zinc loadings to the bay from the NBPS. The average total zinc in water based on quarterly measurements taken between June 2004 and May 2005 in Nueces Bay was 8.7 µg/L, slightly less than was predicted by Mrini et al. (2003) without the NBPS flows, and less than the target zinc concentration of 29 µg/L established in this TMDL.

In 2005, the DSHS also completed a risk characterization and reexamined the zinc levels in oyster tissue from Nueces Bay after the NBPS was stopped. No oysters were found at the NBPS site that was sampled during the July 2002 quantitative risk characterization (DSHS, 2003), but the average zinc in oyster tissue collected from other sites in Nueces Bay (886 mg/kg) was slightly lower than the average of all sites in the 2002 study (1005 mg/kg).

Dissolved zinc data collected before and after the NBPS discharge had ceased is presented in Figure 7. Note that since December 2002 when the NBPS substantially reduced discharging to Nueces Bay, the average annual dissolved zinc in Nueces Bay decreased. Decreased dissolved zinc values may also be attributed to record high flows recorded at the USGS gage on the Nueces River at Calallen during July and September 2002 (Figure 11). The abnormally high rainfall events that occurred in 2002 may have had a flushing effect on Nueces Bay resulting in the lower dissolved zinc values in subsequent years. The Calallen USGS gage has been collecting flow data since 1940. During that 65 year period of record, only once (in 1971) has the flow been higher than it was in 2002.

Water and sediment quality implementation monitoring will continue in Nueces Bay. The objective is to continue to monitor the effect of flow from the NBPS on water quality and ultimately the effect on oyster tissue.

This TMDL presents a scenario where pollutant concentrations are reduced over time through attenuation of a legacy source. If it is found that this is not the case then one option for achieving TMDL load reductions that is becoming more common across the country is the use of pollutant or effluent trading. Pollutant or effluent trading is an innovative way of achieving water quality goals more efficiently by selling or trading pollutant allocations established by a TMDL among permitted dischargers. This has proven to be an effective tool when addressing load reductions in order to comply with federal air quality standards. For example, a large contributor such as the NBPS might choose to pay other permitted dischargers to reduce zinc loadings to the CCIH. These reductions in loadings from other permitted dischargers can in some cases allow relatively elevated loads from a large contributor while still achieving a net reduction that meets the water quality target. This scenario might be beneficial when the cost to pay other dischargers to reduce loadings is less than the cost associated with reducing loads from the permitted discharger who buys the extra load allocation.

TMDL projects undertaken by the TCEQ include two major components. These components are: (a) TMDL Development; and (b) TMDL Implementation. During TMDL development, the TCEQ determines the allowable pollutant load for each

impaired water body; the allowable load is then allocated among pollutant sources in the watershed. This information is described in a TMDL report such as this document.
During TMDL implementation, the TCEQ works with stakeholders to develop management strategies necessary to restore water quality in an impaired water body. This information is summarized in a TMDL Implementation Plan (TMDL IP) which references, but is separate from, the TMDL document. The TMDL IP report details load reductions and other management measures planned to restore water quality in an impaired water body. TMDL IP report preparation is critical to ensure water quality standards are restored and maintained. A TMDL IP will be prepared for Nueces Bay upon TCEQ approval of the TMDL.

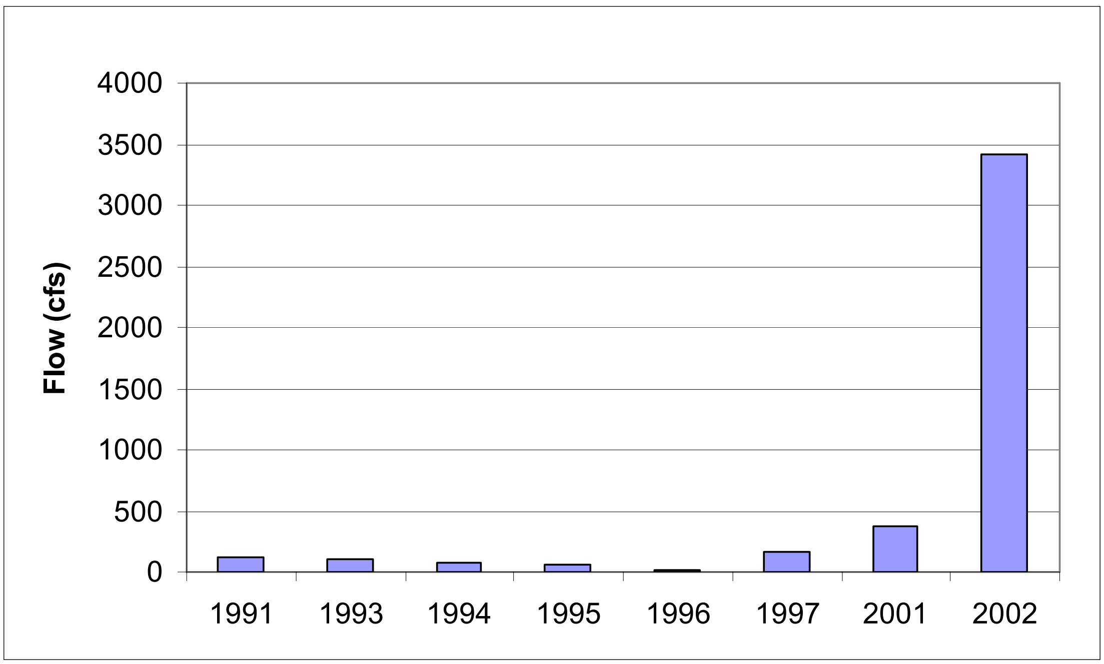


Figure 11. Average Annual Flow (cubic feet per second or cfs) from USGS Gauge 08211500 on the Nueces River at Calallen, Texas

PUBLIC PARTICIPATION

The public and stakeholder participation process in TMDL development is described in the TCEQ general information document titled *Developing Total Maximum Daily Load Projects in Texas: A Guide for Lead Organizations* (GI-250, June, 1999).

Public notice was published in the *Texas Register* and area newspapers in Corpus Christi stating the dates of the public comment period and the public meeting date, time, and place. The public meeting was held in Corpus Christi on July 27, 2006, at the Harte Research Institute Building, Room 127, on the Texas A&M University Corpus Christi campus located at 6300 Ocean Drive. Attendees did make comments. After the meeting, time was given for an informal question and answer period. Some public comments were submitted during the public comment period.

More information about the public stakeholder participation process in TMDL development and implementation can be found on the TCEQ's website at <www.tceq.state.tx.us/water/quality/tmdl/tmdl_guidance.html.www.tceq.state.tx.us/water /quality/tmdl/tmdl_guidance.html>.

REFERENCES

Armstrong, N.E., and G.H. Ward. 1998. Analysis of Point Source Discharges (including oil field brine discharges) in the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, TX. CCBNEP-30.

Barrera, T.A., L.R. Gamble, G. Jackson, T. Maurer, S.M. Robertson, and M.C. Lee. 1995. Contaminants Assessment of the Corpus Christi Bay Complex, Texas 1988-1989. U.S. Fish and Wildlife Services Field Office, Corpus Christi, TX.

Baird, C.F., T.J. Dybala, M.E. Jennings, and D.J. Ockerman. 1996. Characterization of Nonpoint Sources and Loadings to the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, TX. CCBNEP-05.

Dixon, L.K., J.M. Sprinkel, N.J. Blake, G.E. Rodrick, and R.H. Pierce. 1993. Bivalved Shellfish Contamination Assessment. Mote Marine Laboratory Technical Report No. 244. Sarasota Bay National Estuary Program.

Eckel, W.P. and T.A. Jacob. 1988. Ambient Levels of 24 Dissolved Metals in US Surface and Ground Waters. *Am. Chem. Soc. Div. Env. Chem.* 28(2):25-30.

Hwang, G., K. Song, C. Wi, J. Park, and S. Kim. 1993. Heavy Metal Concentration of Sea Water and Shellfish in Charanman-Saryangdo and Mirukdo Area. *Bull. Nat. Fish. Res. Dev. Agency* 48:217-225.

Irwin, R.J., M. Van Mouwerik, L. Stevens, M.D. Seese, and W. Basham. 1997. Environmental Contaminants Encyclopedia: Zinc Entry. National Park Service, Water Resources Division, Fort Collins, CO.

Jones, D.S., G.W. Suter II, and R.N. Hull. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Sediment-Associated Biota: 1997 Revision. ES/ER/TM-95/R3. <www.hsrd.ornl.gov/ecorisk/tm95r4.pdf> Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Mrini, I., J. Goodall, D. Maidment, and L. Katz. 2003. Nueces Bay TMDL Project for Zinc in Oyster Tissue. Online Report 03-04. University of Texas, Center for Research in Water Resources, Austin, TX.

Nicolau, B.A. and A.X. Nunez. 2005. Nueces Bay Total Maximum Daily Load Project – Phase I Interim Implementation Monitoring Data Report. Center for Coastal Studies, Texas A&M University at Corpus Christi, TX.

Roesijadi, G.1996. Environmental Factors: Response to Metals in V.S. Kennedy, R. I. E. Newell, and A.F. Eble (eds.), The Eastern Oyster *Crassostrea virginica*, pp. 515-537.. Maryland Sea Grant College, College Park, MD.

Texas Commission on Environmental Quality. 2003. Procedures to Implement the Texas Surface Water Quality Standards. Texas Commission on Environmental Quality, Water Quality Division, Austin, TX. RG-194.

Texas Department of Health (currently Texas Department of State Health Services). 2003. Quantitative Risk Characterization, Nueces Bay, Nueces County, Texas. Texas Department of Health, Seafood Safety Division, Environmental Epidemiology and Toxicology Division, Austin, TX.

Texas Department of State Health Services. 2005. Characterization of Potential Health Risks Associated with Consumption of Fish and Shellfish from Nueces Bay, Nueces County, TX. Texas Department of State Health Services, Seafood and Aquatic Life Group, Division for Regulatory Services, and Environmental and Injury Epidemiology and Toxicology Branch, Austin, TX.

Texas Natural Resource Conservation Commission. 1998. Coastal Bend Bays Plan. Texas Natural Resource Conservation Commission, Austin, TX. SFR-59/CBBEP-1.

Tunnell, J. W., Q.R. Dokken, E.H. Smith, and K. Withers. 1996. Current Status and Historical Trends of the Estuarine Living Resources within the Corpus Christi Bay National Estuary Program Study Area, Vol. 1 of 4. Texas Natural Resource Conservation Commission, Austin, TX. CCBNEP-06A.

USEPA. 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. USEPA, Office of Water. EPA-822-R-02-012.

USEPA. 1987. Ambient Aquatic Life Water Quality Criteria for Zinc. Office of Research and Development, Environmental Research Laboratory, Narragansett, RI.

Wade, T.L., S. Sweet, J. Park, N. Tindale, P. Michaud, and C.W. Sweet. 2000. Atmospheric Deposition Monitoring Program within the Corpus Christi Bay National Estuary Program Study Area. Unpublished final report. Corpus Christi Bay National Estuary Program, Corpus Christi, TX.

Ward, G.H. 1997. Processes and Trends of Circulation within the Corpus Christi Bay National Estuary Program Study Area. Texas Natural Resource Conservation Commission, Austin, TX. CCBNEP-21.

APPENDIX

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2482	Nueces Bay	13422	1/27/2004	01090	Dissolved Zinc (ug\L)		2.47
2482	Nueces Bay	13425	6/15/2004	01090	Dissolved Zinc (ug\L)		0.43
2482	Nueces Bay	18365	6/15/2004	01090	Dissolved Zinc (ug\L)		0.53
2482	Nueces Bay	14833	6/15/2004	01090	Dissolved Zinc (ug\L)		0.55
2482	Nueces Bay	13422	6/15/2004	01090	Dissolved Zinc (ug\L)		0.54
2482	Nueces Bay	13424	6/15/2004	01090	Dissolved Zinc (ug\L)		0.64
2482	Nueces Bay	13423	6/15/2004	01090	Dissolved Zinc (ug\L)		0.74
2482	Nueces Bay	13420	6/15/2004	01090	Dissolved Zinc (ug\L)		0.64
2482	Nueces Bay	13421	6/15/2004	01090	Dissolved Zinc (ug\L)		0.84
2482	Nueces Bay	13425	6/15/2004	01092	Total Zinc (ug\L)		4.51
2482	Nueces Bay	18365	6/15/2004	01092	Total Zinc (ug\L)		7.78
2482	Nueces Bay	14833	6/15/2004	01092	Total Zinc (ug\L)		6.95
2482	Nueces Bay	13422	6/15/2004	01092	Total Zinc (ug\L)		5
2482	Nueces Bay	13424	6/15/2004	01092	Total Zinc (ug\L)		6.81
2482	Nueces Bay	13423	6/15/2004	01092	Total Zinc (ug\L)		4.18
2482	Nueces Bay	13420	6/15/2004	01092	Total Zinc (ug\L)		7.11
2482	Nueces Bay	13421	6/15/2004	01092	Total Zinc (ug\L)		3.5
2482	Nueces Bay	13422	8/2/2004	01092	Total Zinc (ug\L)	<	12
2482	Nueces Bay	18365	9/8/2004	01090	Dissolved Zinc (ug\L)		0.34
2482	Nueces Bay	18365	9/8/2004	01092	Total Zinc (ug\L)		17.5
2482	Nueces Bay	18365	9/8/2004	01093	Zinc in Sediment (mg\Kg)		115.8
2482	Nueces Bay	18365	9/8/2004	01093	Zinc in Sediment (mg\Kg)		168.7
2482	Nueces Bay	13422	9/9/2004	01090	Dissolved Zinc (ug\L)		0.64
2482	Nueces Bay	14833	9/9/2004	01090	Dissolved Zinc (ug\L)		0.44
2482	Nueces Bay	13425	9/9/2004	01090	Dissolved Zinc (ug\L)		0.38
2482	Nueces Bay	13424	9/9/2004	01090	Dissolved Zinc (ug\L)		0.35
2482	Nueces Bay	13423	9/9/2004	01090	Dissolved Zinc (ug\L)		1.02
2482	Nueces Bay	13420	9/9/2004	01090	Dissolved Zinc (ug\L)		0.57
2482	Nueces Bay	13421	9/9/2004	01090	Dissolved Zinc (ug\L)		0.83
2482	Nueces Bay	13422	9/9/2004	01092	Total Zinc (ug\L)		3
2482	Nueces Bay	14833	9/9/2004	01092	Total Zinc (ug\L)		20.7
2482	Nueces Bay	13425	9/9/2004	01092	Total Zinc (ug\L)		7.47
2482	Nueces Bay	13424	9/9/2004	01092	Total Zinc (ug\L)		4.18
2482	Nueces Bay	13423	9/9/2004	01092	Total Zinc (ug\L)		3.82
2482	Nueces Bay	13420	9/9/2004	01092	Total Zinc (ug\L)		7.29
2482	Nueces Bay	13421	9/9/2004	01092	Total Zinc (ug\L)		5.69
2482	Nueces Bay	13420	9/9/2004	01093	Zinc in Sediment (mg\Kg)		53.9
2482	Nueces Bay	13420	9/9/2004	01093	Zinc in Sediment (mg\Kg)		45.7
2482	Nueces Bay	13422	9/9/2004	01093	Zinc in Sediment (mg\Kg)		55.3
2482	Nueces Bay	14833	9/9/2004	01093	Zinc in Sediment (mg\Kg)		17
2482	Nueces Bay	13422	9/9/2004	01093	Zinc in Sediment (mg\Kg)		59
2482	Nueces Bay	14833	9/9/2004	01093	Zinc in Sediment (mg\Kg)		17.4
2482	Nueces Bay	13425	9/9/2004	01093	Zinc in Sediment (mg\Kg)		106.6
2482	Nueces Bay	13425	9/9/2004	01093	Zinc in Sediment (mg\Kg)		112.4
2482	Nueces Bay	13423	9/9/2004	01093	Zinc in Sediment (mg\Kg)		57.1
2482	Nueces Bay	13423	9/9/2004	01093	Zinc in Sediment (mg\Kg)		54.2
2482	Nueces Bay	13424	9/9/2004	01093	Zinc in Sediment (mg\Kg)		53.4

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2482	Nueces Bay	13424	9/9/2004	01093	Zinc in Sediment (mg\Kg)		58.9
2482	Nueces Bay	13421	9/9/2004	01093	Zinc in Sediment (mg\Kg)		13.2
2482	Nueces Bay	13421	9/9/2004	01093	Zinc in Sediment (mg\Kg)		12
2482	Nueces Bay	13425	1/4/2005	01090	Dissolved Zinc (ug\L)		1.31
2482	Nueces Bay	18365	1/4/2005	01090	Dissolved Zinc (ug\L)		2.26
2482	Nueces Bay	14833	1/4/2005	01090	Dissolved Zinc (ug\L)		1.84
2482	Nueces Bay	13425	1/4/2005	01092	Total Zinc (ug\L)		9.05
2482	Nueces Bay	18365	1/4/2005	01092	Total Zinc (ug\L)		13.9
2482	Nueces Bay	14833	1/4/2005	01092	Total Zinc (ug\L)		6.52
2482	Nueces Bay	13424	1/7/2005	01090	Dissolved Zinc (ug\L)		2.4
2482	Nueces Bay	13422	1/7/2005	01090	Dissolved Zinc (ug\L)		1.76
2482	Nueces Bay	13423	1/7/2005	01090	Dissolved Zinc (ug\L)		1.85
2482	Nueces Bay	13420	1/7/2005	01090	Dissolved Zinc (ug\L)		1.08
2482	Nueces Bay	13421	1/7/2005	01090	Dissolved Zinc (ug\L)		1.44
2482	Nueces Bay	13424	1/7/2005	01092	Total Zinc (ug\L)		6.37
2482	Nueces Bay	13422	1/7/2005	01092	Total Zinc (ug\L)		4.39
2482	Nueces Bay	13423	1/7/2005	01092	Total Zinc (ug\L)		4
2482	Nueces Bay	13420	1/7/2005	01092	Total Zinc (ug\L)		8.34
2482	Nueces Bay	13421	1/7/2005	01092	Total Zinc (ug\L)		3.8
2482	Nueces Bay	13425	5/5/2005	01090	Dissolved Zinc (ug\L)		1.42
2482	Nueces Bay	18365	5/5/2005	01090	Dissolved Zinc (ug\L)		1.61
2482	Nueces Bay	13425	5/5/2005	01092	Total Zinc (ug\L)		5.68
2482	Nueces Bay	18365	5/5/2005	01092	Total Zinc (ug\L)		4.92
2482	Nueces Bay	13425	5/5/2005	01093	Zinc in Sediment (mg\Kg)		42.1
2482	Nueces Bay	13425	5/5/2005	01093	Zinc in Sediment (mg\Kg)		41.8
2482	Nueces Bay	18365	5/5/2005	01093	Zinc in Sediment (mg\Kg)		102.5
2482	Nueces Bay	18365	5/5/2005	01093	Zinc in Sediment (mg\Kg)		200.7
2482	Nueces Bay	13421	5/13/2005	01090	Dissolved Zinc (ug\L)		1.79
2482	Nueces Bay	13420	5/13/2005	01090	Dissolved Zinc (ug\L)		1.06
2482	Nueces Bay	13423	5/13/2005	01090	Dissolved Zinc (ug\L)		1.68
2482	Nueces Bay	13424	5/13/2005	01090	Dissolved Zinc (ug\L)		1.48
2482	Nueces Bay	14833	5/13/2005	01090	Dissolved Zinc (ug\L)		1.57
2482	Nueces Bay	13422	5/13/2005	01090	Dissolved Zinc (ug\L)		1.56
2482	Nueces Bay	13421	5/13/2005	01092	Total Zinc (ug\L)		20.5
2482	Nueces Bay	13420	5/13/2005	01092	Total Zinc (ug\L)		16.6
2482	Nueces Bay	13423	5/13/2005	01092	Total Zinc (ug\L)		43.4
2482	Nueces Bay	13424	5/13/2005	01092	Total Zinc (ug\L)		16.4
2482	Nueces Bay	14833	5/13/2005	01092	Total Zinc (ug\L)		18.7
2482	Nueces Bay	13422	5/13/2005	01092	Total Zinc (ug\L)		26.8
2482	Nueces Bay	13420	5/13/2005	01093	Zinc in Sediment (mg\Kg)		45.5
2482	Nueces Bay	13420	5/13/2005	01093	Zinc in Sediment (mg\Kg)		44.1
2482	Nueces Bay	14833	5/13/2005	01093	Zinc in Sediment (mg\Kg)		31.8
2482	Nueces Bay	14833	5/13/2005	01093	Zinc in Sediment (mg\Kg)		27.1
2482	Nueces Bay	13422	5/13/2005	01093	Zinc in Sediment (mg\Kg)		60.1
2482	Nueces Bay	13422	5/13/2005	01093	Zinc in Sediment (mg\Kg)		72.9
2482	Nueces Bay	13423	5/13/2005	01093	Zinc in Sediment (mg\Kg)		23.8
2482	Nueces Bay	13424	5/13/2005	01093	Zinc in Sediment (mg\Kg)		98.5

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2482	Nueces Bay	13423	5/13/2005	01093	Zinc in Sediment (mg\Kg)		61.7
2482	Nueces Bay	13424	5/13/2005	01093	Zinc in Sediment (mg\Kg)		79.9
2482	Nueces Bay	13421	5/13/2005	01093	Zinc in Sediment (mg\Kg)		8
2482	Nueces Bay	13421	5/13/2005	01093	Zinc in Sediment (mg\Kg)		8.8
2482	Nueces Bay	13422	6/23/2005	01090	Dissolved Zinc (ug\L)	<	4
2482	Nueces Bay	13422	6/23/2005	01092	Total Zinc (ug\L)	<	4
2482	Nueces Bay	13425	9/13/2005	01090	Dissolved Zinc (ug\L)		1.32
2482	Nueces Bay	13425	9/13/2005	01092	Total Zinc (ug\L)		2.51
2482	Nueces Bay	13425	9/13/2005	01093	Zinc in Sediment (mg\Kg)		61.7
2482	Nueces Bay	13425	9/13/2005	01093	Zinc in Sediment (mg\Kg)		58.5
2482	Nueces Bay	13424	9/14/2005	01090	Dissolved Zinc (ug\L)		1.48
2482	Nueces Bay	18365	9/14/2005	01090	Dissolved Zinc (ug\L)		1.29
2482	Nueces Bay	14833	9/14/2005	01090	Dissolved Zinc (ug\L)		1.26
2482	Nueces Bay	13424	9/14/2005	01092	Total Zinc (ug\L)		4.3
2482	Nueces Bay	18365	9/14/2005	01092	Total Zinc (ug\L)		7.29
2482	Nueces Bay	14833	9/14/2005	01092	Total Zinc (ug\L)		6.35
2482	Nueces Bay	14833	9/14/2005	01093	Zinc in Sediment (mg\Kg)		28.2
2482	Nueces Bay	14833	9/14/2005	01093	Zinc in Sediment (mg\Kg)		26.7
2482	Nueces Bay	18365	9/14/2005	01093	Zinc in Sediment (mg\Kg)		114
2482	Nueces Bay	18365	9/14/2005	01093	Zinc in Sediment (mg\Kg)		101.4
2482	Nueces Bay	13424	9/14/2005	01093	Zinc in Sediment (mg\Kg)		120.8
2482	Nueces Bay	13424	9/14/2005	01093	Zinc in Sediment (mg\Kg)		107.4
2482	Nueces Bay	13421	9/15/2005	01090	Dissolved Zinc (ug\L)		1.49
2482	Nueces Bay	13422	9/15/2005	01090	Dissolved Zinc (ug\L)		1.68
2482	Nueces Bay	13423	9/15/2005	01090	Dissolved Zinc (ug\L)		1.94
2482	Nueces Bay	13420	9/15/2005	01090	Dissolved Zinc (ug\L)		0.85
2482	Nueces Bay	13421	9/15/2005	01092	Total Zinc (ug\L)		5.44
2482	Nueces Bay	13422	9/15/2005	01092	Total Zinc (ug\L)		4.45
2482	Nueces Bay	13423	9/15/2005	01092	Total Zinc (ug\L)		13.7
2482	Nueces Bay	13420	9/15/2005	01092	Total Zinc (ug\L)		7.49
2482	Nueces Bay	13420	9/15/2005	01093	Zinc in Sediment (mg\Kg)		33.1
2482	Nueces Bay	13420	9/15/2005	01093	Zinc in Sediment (mg\Kg)		36.7
2482	Nueces Bay	13422	9/15/2005	01093	Zinc in Sediment (mg\Kg)		83.3
2482	Nueces Bay	13422	9/15/2005	01093	Zinc in Sediment (mg\Kg)		54.5
2482	Nueces Bay	13423	9/15/2005	01093	Zinc in Sediment (mg\Kg)		49.3
2482	Nueces Bay	13423	9/15/2005	01093	Zinc in Sediment (mg\Kg)		67.8
2482	Nueces Bay	13421	9/15/2005	01093	Zinc in Sediment (mg\Kg)		20.4
2482	Nueces Bay	13421	9/15/2005	01093	Zinc in Sediment (mg\Kg)		33.8
2482	Nueces Bay	13425	12/19/2005	01090	Dissolved Zinc (ug\L)		1.74
2482	Nueces Bay	18365	12/19/2005	01090	Dissolved Zinc (ug\L)		4.35
2482	Nueces Bay	14833	12/19/2005	01090	Dissolved Zinc (ug\L)		2
2482	Nueces Bay	13422	12/19/2005	01090	Dissolved Zinc (ug\L)		2.56
2482	Nueces Bay	13424	12/19/2005	01090	Dissolved Zinc (ug\L)		3.06
2482	Nueces Bay	13423	12/19/2005	01090	Dissolved Zinc (ug\L)		2.57
2482	Nueces Bay	13420	12/19/2005	01090	Dissolved Zinc (ug\L)		1.57
2482	Nueces Bay	13421	12/19/2005	01090	Dissolved Zinc (ug\L)		2.05
2482	Nueces Bay	13425	12/19/2005	01092	Total Zinc (ug\L)		2.16

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2482	Nueces Bay	18365	12/19/2005	01092	Total Zinc (ug\L)		14.4
2482	Nueces Bay	14833	12/19/2005	01092	Total Zinc (ug\L)		2.86
2482	Nueces Bay	13422	12/19/2005	01092	Total Zinc (ug\L)		10.6
2482	Nueces Bay	13424	12/19/2005	01092	Total Zinc (ug\L)		4.04
2482	Nueces Bay	13423	12/19/2005	01092	Total Zinc (ug\L)		5.14
2482	Nueces Bay	13420	12/19/2005	01092	Total Zinc (ug\L)		2.4
2482	Nueces Bay	13421	12/19/2005	01092	Total Zinc (ug\L)		7.62
2482	Nueces Bay	13422	2/7/2006	01090	Dissolved Zinc (ug\L)	<	4
2482	Nueces Bay	13422	2/7/2006	01092	Total Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13430	1/21/2004	01090	Dissolved Zinc (ug\L)		4.63
2484	Corpus Christi Inner Harbor	13439	1/21/2004	01090	Dissolved Zinc (ug\L)		4.96
2484	Corpus Christi Inner Harbor	13439	6/16/2004	01090	Dissolved Zinc (ug\L)		1.94
2484	Corpus Christi Inner Harbor	13436	6/16/2004	01090	Dissolved Zinc (ug\L)		4.48
2484	Corpus Christi Inner Harbor	13432	6/16/2004	01090	Dissolved Zinc (ug\L)		2
2484	Corpus Christi Inner Harbor	13430	6/16/2004	01090	Dissolved Zinc (ug\L)		1.67
2484	Corpus Christi Inner Harbor	13439	6/16/2004	01092	Total Zinc (ug\L)		6.12
2484	Corpus Christi Inner Harbor	13436	6/16/2004	01092	Total Zinc (ug\L)		7.59
2484	Corpus Christi Inner Harbor	13432	6/16/2004	01092	Total Zinc (ug\L)		4.15
2484	Corpus Christi Inner Harbor	13430	6/16/2004	01092	Total Zinc (ug\L)		3.68
2484	Corpus Christi Inner Harbor	13430	6/30/2004	01090	Dissolved Zinc (ug\L)	<	8
2484	Corpus Christi Inner Harbor	13439	6/30/2004	01090	Dissolved Zinc (ug\L)	<	8.2
2484	Corpus Christi Inner Harbor	13430	6/30/2004	01090	Dissolved Zinc (ug\L)	<	8.2
2484	Corpus Christi Inner Harbor	13430	6/30/2004	01092	Total Zinc (ug\L)	<	12
2484	Corpus Christi Inner Harbor	13439	6/30/2004	01092	Total Zinc (ug\L)	<	12
2484	Corpus Christi Inner Harbor	13430	6/30/2004	01092	Total Zinc (ug\L)	<	12
2484	Corpus Christi Inner Harbor	13430	6/30/2004	01093	Zinc in Sediment (mg\Kg)		4.2
2484	Corpus Christi Inner Harbor	13439	9/7/2004	01090	Dissolved Zinc (ug\L)		5.46
2484	Corpus Christi Inner Harbor	13436	9/7/2004	01090	Dissolved Zinc (ug\L)		6.29

One TMDL for Zinc in Oyster Tissue in Nueces Bay

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2484	Corpus Christi Inner Harbor	13432	9/7/2004	01090	Dissolved Zinc (ug\L)		6.69
2484	Corpus Christi Inner Harbor	13430	9/7/2004	01090	Dissolved Zinc (ug\L)		4.93
2484	Corpus Christi Inner Harbor	13439	9/7/2004	01092	Total Zinc (ug\L)		7.75
2484	Corpus Christi Inner Harbor	13436	9/7/2004	01092	Total Zinc (ug\L)		9.55
2484	Corpus Christi Inner Harbor	13432	9/7/2004	01092	Total Zinc (ug\L)		11.7
2484	Corpus Christi Inner Harbor	13430	9/7/2004	01092	Total Zinc (ug\L)		8.12
2484	Corpus Christi Inner Harbor	13432	9/7/2004	01093	Zinc in Sediment (mg\Kg)		63.4
2484	Corpus Christi Inner Harbor	13432	9/7/2004	01093	Zinc in Sediment (mg\Kg)		58.7
2484	Corpus Christi Inner Harbor	13436	9/7/2004	01093	Zinc in Sediment (mg\Kg)		144.7
2484	Corpus Christi Inner Harbor	13430	9/7/2004	01093	Zinc in Sediment (mg\Kg)		125.4
2484	Corpus Christi Inner Harbor	13436	9/7/2004	01093	Zinc in Sediment (mg\Kg)		178.6
2484	Corpus Christi Inner Harbor	13430	9/7/2004	01093	Zinc in Sediment (mg\Kg)		107.4
2484	Corpus Christi Inner Harbor	13439	9/7/2004	01093	Zinc in Sediment (mg\Kg)		161.8
2484	Corpus Christi Inner Harbor	13439	9/7/2004	01093	Zinc in Sediment (mg\Kg)		169.4
2484	Corpus Christi Inner Harbor	13439	1/13/2005	01090	Dissolved Zinc (ug\L)		10.1
2484	Corpus Christi Inner Harbor	13436	1/13/2005	01090	Dissolved Zinc (ug\L)		10.4
2484	Corpus Christi Inner Harbor	13432	1/13/2005	01090	Dissolved Zinc (ug\L)		10.8
2484	Corpus Christi Inner Harbor	13430	1/13/2005	01090	Dissolved Zinc (ug\L)		6.33
2484	Corpus Christi Inner Harbor	13439	1/13/2005	01092	Total Zinc (ug\L)		11
2484	Corpus Christi Inner Harbor	13436	1/13/2005	01092	Total Zinc (ug\L)		10.2
2484	Corpus Christi Inner Harbor	13432	1/13/2005	01092	Total Zinc (ug\L)		12.4
2484	Corpus Christi Inner Harbor	13430	1/13/2005	01092	Total Zinc (ug\L)		7.83
2484	Corpus Christi Inner Harbor	13439	4/11/2005	01090	Dissolved Zinc (ug\L)	<	4

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2484	Corpus Christi Inner Harbor	13430	4/11/2005	01090	Dissolved Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13430	4/11/2005	01090	Dissolved Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13439	4/11/2005	01090	Dissolved Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13439	4/11/2005	01092	Total Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13430	4/11/2005	01092	Total Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13430	4/11/2005	01093	Zinc in Sediment (mg\Kg)		206
2484	Corpus Christi Inner Harbor	13439	5/3/2005	01090	Dissolved Zinc (ug\L)		2.07
2484	Corpus Christi Inner Harbor	13436	5/3/2005	01090	Dissolved Zinc (ug\L)		3.17
2484	Corpus Christi Inner Harbor	13432	5/3/2005	01090	Dissolved Zinc (ug\L)		2.87
2484	Corpus Christi Inner Harbor	13430	5/3/2005	01090	Dissolved Zinc (ug\L)		2.74
2484	Corpus Christi Inner Harbor	13439	5/3/2005	01092	Total Zinc (ug\L)		3.86
2484	Corpus Christi Inner Harbor	13436	5/3/2005	01092	Total Zinc (ug\L)		7.48
2484	Corpus Christi Inner Harbor	13432	5/3/2005	01092	Total Zinc (ug\L)		8.18
2484	Corpus Christi Inner Harbor	13430	5/3/2005	01092	Total Zinc (ug\L)		7.25
2484	Corpus Christi Inner Harbor	13432	5/3/2005	01093	Zinc in Sediment (mg\Kg)		164.8
2484	Corpus Christi Inner Harbor	13432	5/3/2005	01093	Zinc in Sediment (mg\Kg)		155.1
2484	Corpus Christi Inner Harbor	13430	5/3/2005	01093	Zinc in Sediment (mg\Kg)		107.6
2484	Corpus Christi Inner Harbor	13430	5/3/2005	01093	Zinc in Sediment (mg\Kg)		123.33
2484	Corpus Christi Inner Harbor	13436	5/3/2005	01093	Zinc in Sediment (mg\Kg)		141
2484	Corpus Christi Inner Harbor	13436	5/3/2005	01093	Zinc in Sediment (mg\Kg)		129.9
2484	Corpus Christi Inner Harbor	13439	5/3/2005	01093	Zinc in Sediment (mg\Kg)		129.5
2484	Corpus Christi Inner Harbor	13439	5/3/2005	01093	Zinc in Sediment (mg\Kg)		109.3
2484	Corpus Christi Inner Harbor	13430	8/3/2005	01090	Dissolved Zinc (ug\L)	<	4

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2484	Corpus Christi Inner Harbor	13439	8/3/2005	01090	Dissolved Zinc (ug\L)	<	4
2484	Corpus Christi Inner Harbor	13430	8/3/2005	01092	Total Zinc (ug\L)		7.25
2484	Corpus Christi Inner Harbor	13430	8/3/2005	01093	Zinc in Sediment (mg\Kg)		120
2484	Corpus Christi Inner Harbor	13439	9/19/2005	01090	Dissolved Zinc (ug\L)		4.57
2484	Corpus Christi Inner Harbor	13436	9/19/2005	01090	Dissolved Zinc (ug\L)		8.48
2484	Corpus Christi Inner Harbor	13432	9/19/2005	01090	Dissolved Zinc (ug\L)		10.9
2484	Corpus Christi Inner Harbor	13430	9/19/2005	01090	Dissolved Zinc (ug\L)		6.56
2484	Corpus Christi Inner Harbor	13439	9/19/2005	01092	Total Zinc (ug\L)		5.72
2484	Corpus Christi Inner Harbor	13436	9/19/2005	01092	Total Zinc (ug\L)		10.2
2484	Corpus Christi Inner Harbor	13432	9/19/2005	01092	Total Zinc (ug\L)		23.4
2484	Corpus Christi Inner Harbor	13430	9/19/2005	01092	Total Zinc (ug\L)		7.83
2484	Corpus Christi Inner Harbor	13436	9/19/2005	01093	Zinc in Sediment (mg\Kg)		125.4
2484	Corpus Christi Inner Harbor	13436	9/19/2005	01093	Zinc in Sediment (mg\Kg)		67.1
2484	Corpus Christi Inner Harbor	13430	9/19/2005	01093	Zinc in Sediment (mg\Kg)		51.1
2484	Corpus Christi Inner Harbor	13430	9/19/2005	01093	Zinc in Sediment (mg\Kg)		159.3
2484	Corpus Christi Inner Harbor	13432	9/19/2005	01093	Zinc in Sediment (mg\Kg)		221.4
2484	Corpus Christi Inner Harbor	13432	9/19/2005	01093	Zinc in Sediment (mg\Kg)		196.9
2484	Corpus Christi Inner Harbor	13439	9/19/2005	01093	Zinc in Sediment (mg\Kg)		205.3
2484	Corpus Christi Inner Harbor	13439	9/19/2005	01093	Zinc in Sediment (mg\Kg)		215.7
2484	Corpus Christi Inner Harbor	13439	12/20/2005	01090	Dissolved Zinc (ug\L)		4.42
2484	Corpus Christi Inner Harbor	13436	12/20/2005	01090	Dissolved Zinc (ug\L)		7.17
2484	Corpus Christi Inner Harbor	13432	12/20/2005	01090	Dissolved Zinc (ug\L)		7.76
2484	Corpus Christi Inner Harbor	13430	12/20/2005	01090	Dissolved Zinc (ug\L)		4.95

Segment Number	Segment Name	Station	Date	Parameter Code	Parameter	<>	Value
2484	Corpus Christi Inner Harbor	13439	12/20/2005	01092	Total Zinc (ug\L)		5.86
2484	Corpus Christi Inner Harbor	13436	12/20/2005	01092	Total Zinc (ug\L)		11
2484	Corpus Christi Inner Harbor	13432	12/20/2005	01092	Total Zinc (ug\L)		9.82
2484	Corpus Christi Inner Harbor	13430	12/20/2005	01092	Total Zinc (ug\L)		5.57
2484	Corpus Christi Inner Harbor	13430	2/23/2006	01090	Dissolved Zinc (ug\L)		4.95
2484	Corpus Christi Inner Harbor	13439	2/23/2006	01090	Dissolved Zinc (ug\L)		4.42
2484	Corpus Christi Inner Harbor	13430	2/23/2006	01092	Total Zinc (ug\L)		5.57
2484	Corpus Christi Inner Harbor	13439	2/23/2006	01092	Total Zinc (ug\L)		5.86
2484	Corpus Christi Inner Harbor	13430	2/23/2006	01093	Zinc in Sediment (mg\Kg)		184