

## FOCUS QUESTION 6:

Are freshwater inflows adequate to maintain a healthy bay system?

**What was measured:** Freshwater inflows and Corpus Christi Bay system salinity levels



**Answer:** Maybe, because the freshwater inflows have been altered and managed. Studies are underway to determine the health of the bays and estuaries based on inflows and salinity.

**INDICATOR #18: Quantity and timing of freshwater inflows.**

**Condition/Trend:** Good/Stable

Good



### I. BACKGROUND

The flow of freshwater into a bay system from its watershed (drainage areas to a particular body of water) helps to ensure that necessary salinity, nutrient, and sediment loading are adequate in order to maintain productivity of economically and ecologically important species. Sources of freshwater inflows entering into the bays and estuaries consist of rain, groundwater, and the largest contributor, surface water from rivers and streams. The characteristic natural community living in and around the Texas Coastal Bend bay system is largely defined by the volume, timing, location, and quality of freshwater inflows.

The Nueces River is one of the largest contributors of freshwater into our local bays and estuaries. Because of the altered freshwater inflows into Nueces Bay due to the Choke Canyon and Lake Corpus Christi Reservoirs, it is necessary to regulate inflows with “pass through” requirements that allow a certain amount of freshwater flow into the Nueces River each month.

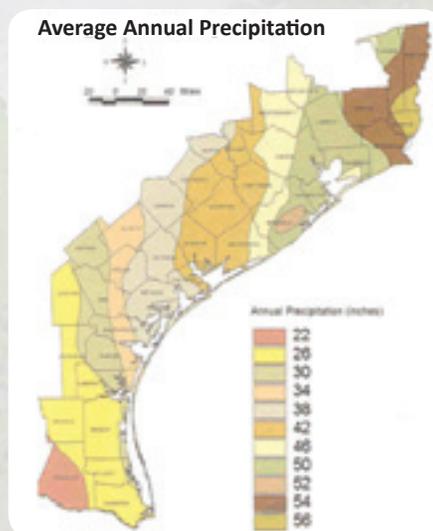
The City of Corpus Christi is responsible for distributing water to all necessary users and consumers, as well as ensuring all target pass through requirements to the Nueces Estuary are met. The Nueces River Authority (NRA), a governmental organization created in 1935, works closely with the City of Corpus Christi to preserve, protect, and develop surface water resources including flood control, irrigation, navigation, water supply, wastewater treatment, and water quality control within the Nueces River Basin.

### II. CONCERNS

Natural fluctuations in freshwater inflows into the bay can have an immense impact on organisms within the bay system. For example, if a long drought persists and creates a situation of very little freshwater inflow into the bay, it may cause hypersaline (high salt) conditions that in turn affect bay shrimp catches which need a certain salinity range in order to mature in healthy numbers. On the other extreme, there may be an abundance of freshwater inflow after an extended heavy rain event that causes eutrophication (high nutrient conditions), triggers large algal blooms that deplete oxygen and light within the water column, and negatively effects fish and plants living in the bays.



Nueces River Watershed

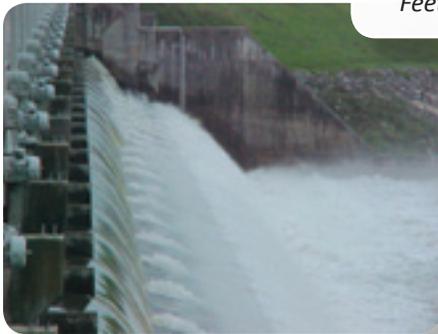


### III. LOCAL FRESHWATER INFLOW LEVELS

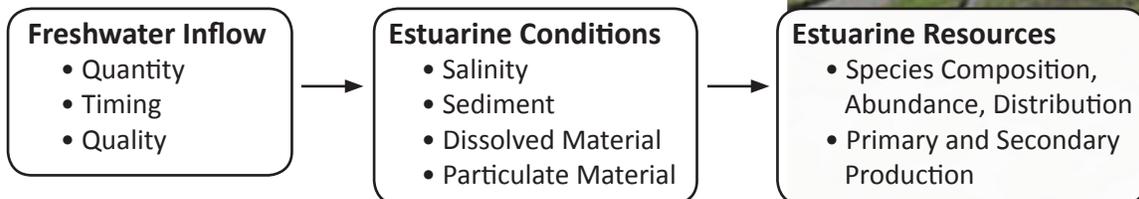
When looking at the distribution of freshwater inflow into the Coastal Bend bays, there is a definite trend of less rain from north to south. While scientific work continues to determine the amount and location of monthly inflows needed, recommendations were made in 1991 that developed the current target levels of annual freshwater inflows to the bay system. Since the “pass through targets” attempt to mimic the natural freshwater inflow cycle into the Corpus Christi Bay system, there is a greater chance of maintaining a healthy estuary for fish and wildlife, as well as its human inhabitants.

Pass Through Targets (AcFt)				
Month	Capacity<=70%	40%<= Capacity<=70%	30%<= Capacity<=40%	Capacity<=30%
January	2,500	2,500	1,200	0
February	2,500	2,500	1,200	0
March	3,500	3,500	1,200	0
April	3,500	3,500	1,200	0
May	25,500	23,500	1,200	0
June	25,500	23,000	1,200	0
July	6,500	4,500	1,200	0
August	6,500	5,000	1,200	0
September	28,500	11,500	1,200	0
October	20,000	9,000	1,200	0
November	9,000	4,000	1,200	0
December	4,500	4,500	1,200	0

*Choke Canyon/Lake Corpus Christi Reservoirs pass through targets measured in Acre Feet for the Nueces River which the City of Corpus Christi is required to follow:*



*Wesley Seale Dam*



*Freshwater Inflow cause and effect diagram.*

### IV. REFERENCES

- Asquith, W. H., Mosier, J.G., and P.W. Bush. 1997. Status, Trends, and Changes in Freshwater Inflows to Bays Systems in the Corpus Christi Bay National Estuary Program Study Area. Corpus Christi Bay National Estuary Program. 48 pp.
- City of Corpus Christi. 2007. Frequently Asked Questions About Water Related Issues In Corpus Christi. <http://www.cctexas.com/?fuseaction=main.view&page=2841>
- Nueces River Authority. 2007. Basin highlights report. Report prepared in cooperation with the Texas Commission on Environmental Quality Clean Rivers Program. Corpus Christi, 82 pp.

## INDICATOR #19: Bay salinity levels (within desired target ranges).

Condition/Trend: Good/Stable

Improvement  
Needed



### I. BACKGROUND

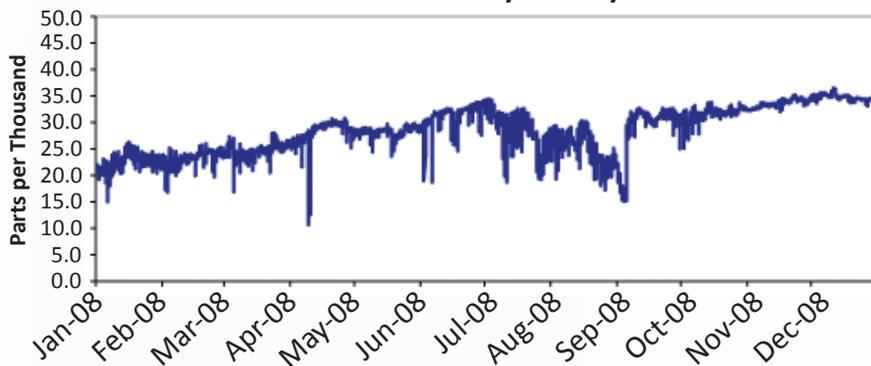
Salinity is a measure of how much sea salt is contained in a unit of water. The Gulf of Mexico coastal seawater is relatively constant at about 35 parts sea salt per thousand parts water by weight. Salinity of freshwater is near zero. Therefore, most of the salinity variations in the estuary are responses to river inflow, evaporation and mixing by winds and ocean tides.

The ability of resource agencies to manage fish, wildlife and freshwater supplies to the Corpus Christi Bay estuary requires an integrated knowledge of the relations between the organisms and their environment. The salinity of the water, and particularly its seasonality patterns, affect which aquatic species can survive. In short, salinity is a fundamental property of the estuary that determines its biological characteristics.

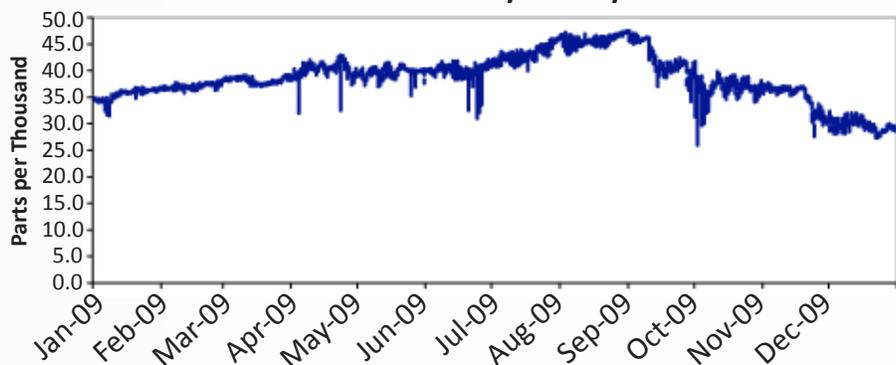
The Texas Water Development Board has been recording salinity levels since 1987 for the various bays around the Coastal Bend. The Conrad Blucher Institute's Division of Nearshore Research at Texas A&M

University-Corpus Christi maintains salinity monitoring stations within the Corpus Christi Bay system and posts a salinity relief check page that is updated daily. The site can be accessed at <http://lighthouse.tamucc.edu/Salinity/HomePage>.

#### 2008 Nueces Bay Salinity Levels



#### 2009 Nueces Bay Salinity Levels



### II. CONCERNS

Management of the freshwater supply is complicated in part because Lake Corpus Christi's freshwater supply serves two major purposes: human consumption and salinity control. When freshwater runoff from the Nueces Watershed is scarce, as in dry years, a proportionally greater amount of available freshwater from the estuary is needed for human use as well as for salinity control.

In order to relieve some salinity stress from within the estuary, salinity pass through targets were developed, based on historical salinity levels, in attempts to mimic natural salinity levels within the bay system. In simple terms, if salinity is too high, freshwater is released to lower salinity levels. When salinity is too low, the City of Corpus Christi gets a Salinity Relief Credit which allows for less freshwater pass through entering into the bay system, allowing salinity levels a chance to increase back to normal levels.

### III. LOCAL LEVELS

Salinity gradients along the Texas Coastal Bend bays from the upper to lower regions are a normal feature. Salinity measured within each bay system such as the San Antonio Bay may be as low as zero parts per thousand (ppt), while values as high as 70 ppt may occur in Baffin Bay and the Upper Laguna Madre.

The Corpus Christi Bay system, which receives runoff from urban areas in addition to Nueces River inflow, experiences lower average salinities than the southern region of the Coastal Bend area with an average salinity in 2008 of around 28 ppt compared to an average salinity of 39 ppt in 2009 for Nueces Bay. Optimum salinity ranges vary for the Corpus Christi Bay system depending on proximity to the river and season, but in general, salinities can be between 1 to 30 ppt. By keeping salinities within this target range, fish, wildlife, and plants will be less stressed and more productive.

The City of Corpus Christi receives 500 acre feet per month return flow credit for all return flows into Nueces Bay and possibly one of the following: up to half of the monthly target from flows exceeding the freshwater inflow requirement of the previous month or the salinity relief credit when the salinity in Nueces Bay is low.

**Salinity Relief Credit Chart**

Months	Salinity Lower Bounds	Salinity Upper Bounds	Reduction for Average Salinity		
			5 psu below SUB	10 psu below SUB	15 psu below SUB
January	5	30	25%	50%	75%
February	5	30	25%	50%	75%
March	5	30	25%	50%	75%
April	5	30	25%	50%	75%
May	1	20	0%	25%	75%
June	1	20	0%	25%	75%
July	2	25	25%	50%	75%
August	2	25	25%	50%	75%
September	5	20	0%	25%	75%
October	5	30	0%	25%	75%
November	5	30	25%	50%	75%
December	5	30	25%	50%	75%



*Measuring salinity using a refractometer.*

### IV. REFERENCES

- City of Corpus Christi. 2007. Frequently Asked Questions About Water Related Issues In Corpus Christi. <http://www.cctexas.com/?fuseaction=main.view&page=2841>
- Conrad Blucher Institute – Division of Nearshore Research. 2010. Nueces Bay Salinity. <http://lighthouse.tamucc.edu/Salinity/HomePage>