Nueces River Authority

2018 BASIN SUMMARY REPORT

San Antonio-Nueces Coastal Basin

Nueces River Basin

Nueces-Rio Grande Coastal Basin

This document was prepared in cooperation with the
Texas Commission on Environmental Quality
under authorization of the
Clean Rivers Act.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

In 1991, the Texas Legislature passed the Texas Clean Rivers Act (Senate Bill 818) requiring basin-wide water quality assessments to be conducted for each river basin in Texas. Under this act, the Clean Rivers Program (CRP) developed an effective partnership involving the Texas Commission on Environmental Quality (TCEQ), other state agencies, river authorities, local governments, industry, and citizens. CRP was originally funded by dedicated fees paid by municipal and industrial dischargers and water rights holders. These fees are now combined with other fees collected by TCEQ. This larger pool of money funds a number of different water programs administered by TCEQ.

Using a watershed management approach, the Nueces River Authority (NRA) and TCEQ work together to identify and evaluate surface water quality issues and to establish priorities for corrective action. Under CRP, NRA is responsible for the San Antonio – Nueces Coastal Basin, the Nueces River Basin, the Nueces – Rio Grande Coastal Basin, and the adjacent bays and estuaries, an area roughly 30,500 square miles, ranging from the hill country in Edwards County to San Antonio Bay in Refugio County to the Brownsville Ship Channel in Cameron County.

Sixteen CRP partners collect data from over 1,800 water monitoring sites throughout the state. Data are used in the development of Texas Surface Water Quality Standards, for modeling water quality trends, providing baseline data for water quality projects, and to help establish wastewater permit limits. Steering Committees, made up of fee payers, elected officials, and the public, are created to help guide CRP efforts by providing input on local water quality concerns.

The long term goals of the CRP are to:

- Provide quality assured data to TCEQ for use in water quality decision-making
- Identify and evaluate water quality issues
- Promote cooperative watershed planning
- Inform and engage stakeholders
- Maintain efficient use of public funds
- Adapt to emerging water quality issues

To accomplish the goals set forth by the CRP, funding is allocated on a biennial cycle to CRP partners. During this reporting period, CRP partners including NRA, TCEQ Region 13 (San Antonio), Region 14 (Corpus Christi), Region 15 (Harlingen), and Region 16 (Laredo) provided water quality data for this report. Additional water quality data collected under approved Quality Assurance Project Plans and included in the Surface Water Quality Monitoring Information Systems (SWQMIS) database are used for water quality assessments.

The water quality data are compiled from the SWQMIS database. The *Texas Integrated Report of Surface Water Quality* is prepared and submitted to the U.S. Environmental Protection Agency (EPA) every two years in even numbered years, as required by law. This report satisfies the requirements of the federal Clean Water Act Sections 305(b) and 303(d). The 303(d) List of impaired water bodies must be approved by EPA before it becomes final.

The 2014 Texas 303(d) List was adopted by the TCEQ on June 3, 2015. It was approved by the EPA on November 19, 2015. The Draft 2016 Integrated Report is being finalized by TCEQ prior to submittal to EPA.

Significant Findings

The water quality analysis for this report reviewed 16 parameters for assessment units (AU) on 48 segments in the San Antonio – Nueces Coastal Basin, the Nueces River Basin, the Nueces – Rio Grande Coastal Basin, and the adjacent bays and estuaries.

The tables in the following water quality overviews, by basin, summarize the findings for each segment as of the Draft 2016 Integrated Report. More detailed information is found in the individual segment write-ups beginning on Page 9. The criteria used to designate a concern or impairment is found in the Water Quality Analysis – Terminology and Methodology Section beginning on Page 2.

San Antonio – Nueces Coastal Basin

Water quality in Aransas River, located in the western portion of the basin, typically has elevated levels of bacteria and nutrients (nitrogen and phosphorus) and low DO. Water in the Mission River, located in the central portion of the basin, meets the standards set for water quality much of the time. In the tidally influenced reaches of the basin, water in the Aransas and Mission River Tidal both have elevated bacteria concentrations that do not meet water quality standards.

These issues are being addressed by a Copano Bay TMDL that was initiated in 2004. The TMDL and Implementation Plan were completed in 2011, and accepted by the US Environmental Protection Agency (EPA) in May 2016, to address the bacteria impairment in Copano Bay, the tidal portions of the Mission River and both segments of the Aransas River. Best Management Practices (BMP) to address the issue include improvements and upgrades to wastewater treatment plants (WWTP) and the development and implementation of conservation plans in priority areas of the watershed. From 2011 through 2017, 126 Water Quality Management Plans (WQMP) have been written for 69,142 acres in the Mission River watershed, which could be the reason for the decreasing trends in alkalinity, nitrate, and TSS.

Segment	Concerns	Impairments
Segment 2001 – Mission River Tidal	None	Bacteria
Segment 2002 – Mission River Above Tidal	None	None
Segment 2003 – Aransas River Tidal	None	Bacteria
Segment 2004 – Aransas River Above Tidal	Nitrate, total phosphorus	Bacteria
Segment 2004A – Aransas Creek	None	Bacteria
Segment 2004B – Poesta Creek	Low dissolved oxygen (DO)	Bacteria

Nueces River Basin

In the lower basin, a WPP has been developed for the Lower Nueces River below Lake Corpus Christi. Management measures to address a TDS impairment, a chlorophyll-*a* concern, and increasing trends in bacteria, chloride, alkalinity, and TOC include repair and replacement of failing OSSFs, pet waste stations, large debris removal, and annual river cleanups. The installation of the pet waste stations and the large debris removal have been completed. An OSSF repair and replacement program is underway. The WPP and additional information is available at www.nuecesriverpartnership.org.

Several RUAAs have been conducted in the basin to evaluate the appropriate contact recreation for the segments. For the Atascosa River and San Miguel Creek, the RUAAs determined that no primary contact recreation is occurring on the river, but there were instances of secondary contact recreation occurring. Stakeholders for each segment expressed an interest in wanting to see the river and creek reclassified as secondary contact recreation. For the Leona River, although no contact recreation was confirmed, in large part due to the drought, the stakeholders have expressed interest in being able to use the river for recreational purposes when there is sufficient flow. Therefore, they are not in favor of changing the standard from primary contact recreation to secondary contact recreation.

A TMDL to address the nitrate concern in the Lower Sabinal River resulted in a new WWTP for the City of Sabinal. The old plant was periodically inundated during flood events. The nitrate levels since 2011 when the new plant went online, have decreased slightly.

The upper basin experienced a rapid increase in the invasive giant cane (*Arundo donax*). *Arundo* is very similar in appearance to common reed (*Phragmites*) or bamboo. *Arundo* is a vigorous plant that, once established, can create dense patches that out compete native vegetation in both wet and dry areas. In response to the rapid colonization of Arundo, NRA staff and landowners banded together and formed an alliance know as Pull.Kill.Plant. The project's aim is to stop the spread of the plant while restoring native riparian plant communities. The process includes the physical removal the plants and aerial application of a herbicide. The project has aligned landowners with state and federal agencies under a common cause.

Segment	Concerns	Impairments
Segment 2101 – Nueces River Tidal	Chlorophyll-*a*	None
Segment 2102 – Nueces River Below Lake Corpus Christi	Chlorophyll-*a*	Total Dissolved Solids (TDS)
Segment 2103 – Lake Corpus Christi	None	TDS
Segment 2104 – Nueces River Above Frio River	Low DO, chlorophyll-*a,* nitrate, total phosphorus, impaired fish community, impaired macrobenthic community	None
Segment 2105 – Nueces River Above Holland Dam	Low DO, chlorophyll-*a*	Low DO
Segment 2106 – Nueces River / Lower Frio River	Chlorophyll-*a*	TDS, bacteria
Segment 2107 – Atascosa River	Chlorophyll-*a,* nitrate, total phosphorus, impaired habitat	Low DO, bacteria, impaired macrobenthic community, impaired fish community
Segment 2108 – San Miguel River	Low DO	Bacteria
Segment 2109 – Leona River	Nitrate	Bacteria
Segment 2110 – Lower Sabinal River	Nitrate	None
Segment 2111 – Upper Sabinal River	None	None
Segment 2112 – Upper Nueces River	None	None
Segment 2113 – Upper Frio River	Impaired habitat, impaired fish community	Impaired macrobenthic community, impaired fish community
Segment 2113 – Upper Frio River	Impaired habitat, impaired fish community	Impaired macrobenthic community, impaired fish community
Segment 2114 – Hondo Creek	Nitrate	Chloride
Segment 2115 – Seco Creek	None	None
Segment 2116 – Choke Canyon Reservoir	Nutrients – excessive algal growth	None
Segment 2117 – Frio River Above Choke Canyon Reservoir	Low DO, chlorophyll-*a,* nitrate	Bacteria, chloride, TDS

Nueces – Rio Grande Coastal Basin

Water in the Arroyo Colorado originates from the numerous effluent flows from the surrounding communities including wastewater effluent and irrigation return flows. The Arroyo Colorado also receives water diverted from the Rio Grande during flood events. Water quality issues in the Arroyo Colorado include the following: elevated nutrient (nitrogen and phosphorus) and bacteria loads, instances of low DO, high levels of chlorophyll-*a,* and legacy pollutants resulting in fish consumption advisories (the above tidal portion). In 2007, Phase I BMPs of the Arroyo Colorado WPP were initiated. Projects include improved wastewater infrastructure, large and small scale habitat restoration projects, implementation of agricultural BMPs on irrigated crop land, and a comprehensive education and outreach program. The WPP was updated in 2017. While the impairments and concerns continue on both the tidal and above tidal segments, there does seem to be some improvement in the above tidal segment.

Petronila creek is a shallow gradient coastal creek that begins near Banquete and flows approximately 49 miles into Kleberg County and Alazan Bay. The upper half of the watershed is more ephemeral in nature, only flowing in conjunction with rain events. There is an earthen impoundment just west of US 77 near the Lost Creek Colonia that maintains water on a perennial basis. Reports of water quality issues including fish kills have been reported and are usually attributed to pollution associated with runoff from rain events. Water flowing in the lower half of watershed is generally brackish in nature with extremely high concentrations of chloride, sulfate, and TDS associated with historical oil and gas operations in which brine water was discharged into tributaries and drainage ditches that drain into the creek. Brine discharges to the creek were suspended in 1987 but elevated levels of TDS, chloride, and sulfate remain. NRA has been monitoring on the tributaries to the creek to try and pinpoint the

source areas. The chloride, sulfate, and TDS concentrations are inversely correlated with the three-week antecedent rainfall amounts. The concentrations rise quickly from groundwater seepage during low flow periods.

Segment	Concerns	Impairments
Segment 2201 – Arroyo Colorado Tidal	Low DO, chlorophyll-*a,* nitrate	Low DO, bacteria, Mercury in edible tissue, Polychorinated byphenyls (PCBs) in edible tissue
Segment 2202 – Arroyo Colorado Above Tidal	Chlorophyll-*a,* nitrate, total phosphorus	Bacteria, mercury in longnose gar, PCBs in edible tissue
Segment 2203 – Petronila Creek Tidal	Chlorophyll-*a,* pH	Bacteria
Segment 2204 – Petronila Creek Above Tidal	Chlorophyll-*a*	Bacteria, chloride, sulfate, TDS

Bays and Estuaries

Low DO, nitrate, and chlorophyll-*a* are the most common concerns in the bays, and low DO and bacteria are the most common impairments. Four of the bays, Mesquite Bay, Aransas Bay, Redfish Bay, and South Bay, do not have any concerns or impairments.

The low DO, based on current standards, in Oso Bay and the Laguna Madre, are naturally occurring and do not appear to negatively affect aquatic life. Many studies have been conducted and proposed changes to the standards are being evaluated.

A TMDL and Implementation Plan to address the bacteria impairment in Oso Creek is under development. Management measures include creating habitat away from the creek for birds and wildlife, addressing failing OSSFs, and how the maintenance of the drainage ditches from the City of Corpus Christi to the creek can be improved to reduce loadings from rainfall runoff events.

Although not an assessed concern, local fishermen and women are concerned about nitrate and the health of Baffin Bay fisheries. Local scientists have conducted studies that concluded that the nitrogen levels are from organic nitrogen. A Baffin Bay work group has been formed and is working towards the development of a WPP for the bay. The tributaries to the bay, Petronila Creek, San Fernando Creek, and Los Olmos Creek will be included in the WPP. Additional monitoring is being planned on these creeks to better understand their contributions to pollutant loadings to the bay.

Segment	Concerns	Impairments
Segment 2462 - San Antonio Bay / Hynes Bay	Chlorophyll-*a*	Bacteria in oyster waters
Segment 2463 - Mesquite Bay	None	None
Segment 2471 - Aransas Bay	None	None
Segment 2471A - Little Bay	chlorophyll-*a*	None
Segment 2472 - Copano Bay & Port Bay	None	Bacteria in oyster waters
Segment 2473 – St. Charles Bay	Low DO	None
Segment 2481 – Corpus Christi Bay	None	Bacteria at recreational beaches
Segment 2482 – Nueces Bay	Chlorophyll-*a*	Zinc in edible tissue, copper in water
Segment 2483 – Redfish Bay	None	None
Segment 2483A – Conn Brown Harbor	Copper in water	None
Segment 2484 – Corpus Christi Inner Harbor	Ammonia, nitrate	Copper in water
Segment 2485 – Oso Bay	Chlorophyll-*a*, total phosphorus	Low DO, bacteria, bacteria in oyster waters
Segment 2485A – Oso Creek	Chlorophyll-*a*, nitrate, total phosphorus	Bacteria
Segment 2491 – Laguna Madre	Low DO, bacteria, chlorophyll-*a,* nitrate	Low DO, bacteria, bacteria in oyster waters
Segment 2491B – North Floodway	Chlorophyll-*a,* nitrate	None
Segment 2492 – Baffin Bay / Alazan Bay / Cayo Del Grullo / Laguna Salada	Chlorophyll-*a*	None
Segment 2492A – San Fernando Creek	Chlorophyll-*a,* nitrate, total phosphorus	Bacteria
Segment 2493 – South Bay	None	None
Segment 2494 – Brownsville Ship Channel	Low DO	Bacteria
Segment 2494A – Port Isabel Fishing Harbor	None	Bacteria
Segment 2501 – Gulf of Mexico	None	Mercury in offshore sport fishes

List of Acronyms

AU	Assessment Unit
BCRAGD	Bandera County River Authority and Groundwater District
BMP	Best Management Practice
CBBEP	Coastal Bend Bays and Estuaries Program
CCSC	Corpus Christi Ship Channel
CM	Channel Marker
CMP	Coastal Management Program
CN	Use Concern
CR	County Road
CRP	Clean Rivers Program
CS	Screening Level Concern
DDE	Dichlorodiphenylethylene
DO	Dissolved Oxygen
DOD	Dissolved Oxygen Demand
DOJ	Department of Justice
DSHS	Department of State Health Services
EPA	Environmental Protection Agency
FM	Farm-to-Market
FS	Fully Supporting
FY	Fiscal Year
ICWW	Intracoastal Waterway
LP	Limited Partnership
LLC	Limited Liability Corporation
MSL	Mean Sea Level
MUD	Municipal Utility District
N/A	Not Applicable, Not Assessed
NAS	Naval Air Station
NC	No Concern
NRA	Nueces River Authority
NS	Non-Supporting
OSSF	On-Site Sewager Facility
PCBs	Polychorinated byphenyls
RRC	Railroad Commission
RUAA	Recreational Use Attainability Analysis
SH	State Highway
SWQMIS	Surface Water Quality Monitoring Information System
TAMUCC	Texas A&M University – Corpus Christi
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TGLO	Texas General Land Office
TIAER	Texas Institute for Applied Environmental Research
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TPWD	Texas Parks and Wildlife Department
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TxDOT	Texas Department of Transportation
WCID	Water Control and Improvement District
WPP	Watershed Protection Plan
WQMP	Water Quality Management Plan
WSC	Water Supply Corporation
WWTP	Wastewater Treatment Plant

Unit Abbreviations

°C	Degrees Celsius
AF	Acre-Feet
cfs	Cubic Feet per Second
cfu	Colony Forming Units
gpd	Gallons Per Day
Hr	Hour
km	Kilometers
m	Meters
mg/l	Milligrams Per Liter
ml	Milliliters
NTU	Nephelometric Turbidity Unit
su	Standard Units
µg/l	Micrograms Per Liter

PUBLIC INVOLVEMENT

Nueces River Authority (NRA) participates in many Clean Rivers Program (CRP) related activities that are intended to increase awareness of the value and function of our water resources. The following paragraphs describe activities and functions that NRA coordinates and/or participates in this effort.

CRP Steering Committee

NRA's Steering Committee members are vital in providing input on projects and programs for the CRP. The Steering Committee is composed of individuals representing a wide variety of interests including: landowners, federal, state and local government agencies, farmers, ranchers and the general public. The diversity of the Steering Committee helps to ensure that varying interests, concerns, and priorities are represented. Since basin-wide meetings take up valuable time and travel resources, one Steering Committee meeting is held prior to development of the next biannual contract period, as required by statute. The Steering Committee members, and all stakeholders, are kept informed on activities with NRA's area of responsibility throughout the contract period via quarterly updates via email and posting to the website.

CRP Quarterly Stakeholder Update

NRA sends out a quarterly report updating Steering Committee Members and Stakeholders about CRP field and outreach activities, river observations, lake levels, meeting summaries, and updates on water projects in the area. If you are interested in receiving the quarterly update via e-mail, please contact Sam Sugarek at ssugarek@nueces-ra.org.

Stakeholder Meetings

NRA is also involved in a number of CRP related projects including Total Maximum Daily Loads (TMDL), the development of Watershed Protection Plans (WPP) and recreation use attainability analysis (RUAA). A TMDL is designed to address a single pollutant on a specific water body. An Implementation Plan for a TMDL is developed to identify specific measures to reduce the pollutant loading. These measures are often regulatory in nature. WPPs are designed to address all issues within a watershed, are stakeholder driven, and consist of voluntary measures that can be taken to reduce pollutant loadings. The benefit of having one of these plans developed is that the management measures and projects identified in the plans are eligible for funding opportunities that, otherwise, would not be available. An RUAA is a study consisting of field surveys and stakeholder interviews to determine if primary contact recreation is the appropriate designation for a specific water body. Many water bodies are listed as being impaired for bacteria for contact recreation, but contact recreation may not be feasible due to accessibility and / or lack of flow except during extreme rain events. In these cases, higher bacteria concentrations would be acceptable. NRA coordinates and / or attends as many of these stakeholder meetings as possible.

Outreach and Education

NRA's Education and Outreach Program is dedicated to preserving and protecting the natural resources and function of river systems through public awareness activities and environmental education and outreach. NRA has multiple environmental education tools including the custom made topographic watershed model, a rainfall runoff model, and a water collection model. NRA utilizes these tools at education events such as Earth Day Bay Day, World of Water Day, agriculture fairs, science fairs, education fairs, and through numerous scheduled events at dozens of schools and functions throughout NRA's jurisdiction. These tools provide a way for the community to visualize how pollution occurs and offers ways to protect our natural resources.

WATER QUALITY ANALYSIS – TERMINOLOGY AND METHODOLOGY

For this Basin Summary Report, each segment within the San Antonio – Nueces Coastal Basin, Nueces River Basin, Nueces – Rio Grande Coastal Basin, and the adjacent Bays and Estuaries is discussed in detail. For each segment, there is:

- a description of the segment and its watershed;
- a land use / land cover map of the watershed which includes the location of the sampling sites used for the data analysis in this report and / or is currently being monitored;
- references to any special studies that have been done within the watershed;
- descriptions of the stations used in the water quality analysis;
- summaries of the Draft 2016 Integrated Report assessment;
- results of the statistical water quality analysis (see below for the parameter list); and
- graphs of concerns, impairments, and trends along with possible explanations.

The Draft 2016 Integrated Report assesses all Surface Water Quality Monitoring Information System (SWQMIS) database data for a 7-year period. Assessments are done every two years. In most cases, a minimum of 10 samples is required to conduct the assessment. In some cases, the 10 samples are obtained by using a slightly longer period of time. The 2016 Assessment included data from December 1, 2007 through November 30, 2014.

The statistical water quality analysis for this report includes analysis of available data from December 1, 2009 through November 30, 2016 for a representative station of each Assessment Unit (AU) of the segment. The most downstream station of each AU, when appropriate, was used. Data from multiple stations were used when needed to obtain a long enough data record. If there were not enough data points for the statistical analysis, the associated discussion will state that there is insufficient data for the analysis. Because of the different time periods used for the Draft 2016 Integrated Report and this report, the number of samples, number of exceedances, means, and averages do not necessarily match. However, the statistical analysis, in all but a few instances, resulted in the same findings as the Draft 2016 Integrated Report. For those few instances, the differences are explained.

Trend analysis was conducted on available data from January 1, 2000 through November 30, 2016. In most cases, the analysis was only conducted when there was at least 9 years of data, without significant gaps, and at least 19 data records. If there were not enough data points for the trend analysis, the associated discussion will state that there is insufficient data for the analysis. Significant trends (t-ratio => |2| and p-value <0.1) are plotted. The t-ratio is related to the change of the measured values over time. The p-value is the probability that a calculated test statistic occurred by chance alone. Therefore, the combination of a high t-ratio and a low p-value is indicative of a significant trend.

Trend analysis was also conducted for the fresh water segments for the parameters with respect to flow for datasets with sufficient flow data. Trend analysis with respect to water level was conducted for Lake Corpus Christi and Choke Canyon Reservoir. The plots for these trends only include the data points for which there is an associated flow or water level value. Therefore, in some instances, the number of data points and possible range of values may differ between the plots of the data over time and the ones with respect to flow. All the data from the reservoirs have associated water level data.

The water body uses and corresponding parameters analyzed for this report include:

- Aquatic Life Use
  - Dissolved Oxygen (DO)
- Recreation Use
  - Bacteria: *E.coli* for fresh water segments or Enterococcus for tidal and marine segments
- General Use
  - water temperature
  - pH
  - alkalinity
  - ammonia
  - chlorophyll-*a*
  - nitrate
  - total phosphorus
  - Total Kjeldahl Nitrogen (TKN)
  - total suspended solids (TSS)
  - total organic carbon (TOC)
  - chloride – fresh water segments only
  - sulfate – fresh water segments only
  - total dissolved solids (TDS) – fresh water segments only

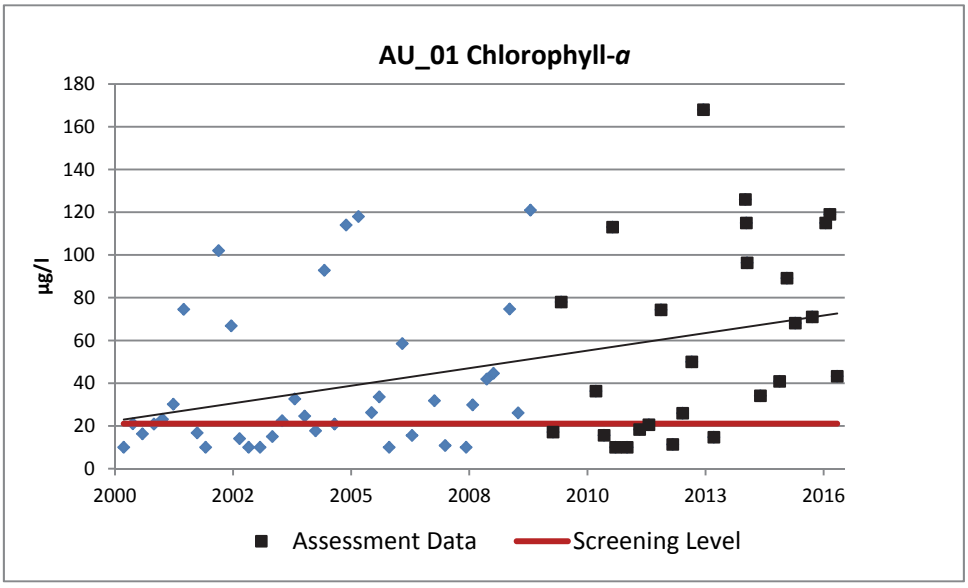
The results of the statistical analysis are presented in tables, which vary slightly based on the parameter. The following table explains the data and information represented in the data analysis tables.

Data Analysis Result Tables Explanation								
Parameter Name		**Status**	**# samples**	**Min**	**Max**	**Median Geomean Average**	**ND < #**	**>#**
AU	Water quality standard* or screening level criteria*	Draft 2016 Integrated Report assessment result**	Total number of samples in the dataset	The minimum value in the dataset. If preceded by "<", this is minimum value in the dataset reported below the detection limit	The maximum value in the dataset.	Median of all values or Geomean of bacteria or Average value for chloride, sulfate, and TDS	# of non-detects or values below the criteria value	# of values above the criteria value

* See the list of acronyms for unit explanations
**NC – No concern, FS – Fully supporting, CS – Screening level concern, CN – Use concern, NS – Non-supporting (Impairment)

The following graph is used to explain how the data are shown to reflect the statistical and trend analysis:

- The title includes the AU and the parameter. AU_01 is used for segments with a single AU.
- The blue diamonds plus the black squares represent the entire data set from January 1, 2000 through November 30, 2016 for which the trend analysis was run.
- The black squares represent the data from December 1, 2009 through November 30, 2016 for which the statistical analysis was run.
- The red line represents the standard or screening level for the parameter.
- The black line represents the trend direction.



Possible explanations for concerns, impairments, and trends are included if known or for which an educated assumption can be made. The following table explains the potential impacts when the water quality standards are not met along with an explanation of the most common causes for the standards not to be met.

Impacts and Causes of Water Quality Concerns and Impairments		
Parameter	**Impact**	**Cause**
DO	Organisms that live in water need oxygen to survive. In segments where DO is low, organisms may not have sufficient oxygen to survive.	Modifications to the riparian zone, human activity that causes water temperatures to increase, and increases in organic matter and bacteria, and over abundant algae.
pH	Most aquatic life is adapted to live within a narrow pH range. Different organisms can live and adjust to differing pH ranges, but all fish die if pH is below 4 (the acidity of orange juice) or above 12 (the pH of ammonia).	Industrial and wastewater discharge, runoff from quarry operations, and accidental spills.
Ammonia	Elevated levels of ammonia in the environment can adversely affect fish and invertebrate reproductive capacity and reduce growth of the young.	Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots.
Nutrients: Nitrate and Total phosphorus	These nutrients increase plant and algae growth. When plants and algae die, the bacteria that decompose them use oxygen so that it is no longer available for fish and other living aquatic life. The more dead plants in the water, the more bacteria are produced to decompose the dead leaves. High levels of nitrate and nitrites can produce Nitrite Toxicity, or "brown blood disease," in fish. This disease reduces the ability of blood to transport oxygen throughout the body.	Nutrients are found in effluent released from wastewater treatment plants (WWTP), fertilizers, and agricultural runoff carrying animal waste from farms and ranches. Soil erosion and runoff from farms, lawns, and gardens can add nutrients to the water.
Chlorophyll-*a*	Chlorophyll-*a* is the photosynthetic pigment found in all green plants, algae, and cyanobacteria. Elevated levels indicate abundant plant growth which could lead to reduced DO levels.	Modifications to the riparian zone, human activity that causes increased organic matter and bacteria, and over abundant algae.
Chloride Sulfate TDS	High levels of these parameters may affect the aesthetic quality of water, interfering with washing clothes and corroding plumbing fixtures. They can also affect the permeability of ions in aquatic organisms.	Mineral springs, carbonate deposits, salt deposits, and sea water intrusion are natural sources of these parameters. Other sources can be attributed to oil exploration, drinking water treatment chemicals, storm water and agricultural runoff, and wastewater discharges.

Impairments are identified when parameters do not meet the water quality standards. The calculations to determine impairments depend on the parameter:

- DO – 10% of the samples are below the minimum for grab samples, 24-Hr minimum, or 24-Hr average
- pH – 10% of the samples are below or above the criteria
- *E. coli* and Enterococcus – geometric mean is greater than the criteria or 25% of samples are above the grab sample criteria
- Chloride, sulfate, and TDS – average of samples are above the criteria

Concerns for ammonia, nitrates, total phosphorus, and chlorophyll-*a* are identified when 20% of the samples are above the screening level criteria. This is a numeric reference for those parameters, primarily nutrients, that only have a narrative criteria. These levels were developed by the State by calculating the 85th percentile for all water quality data in the TCEQ's water quality database over a 10 year period. DO concerns are identified when 10% of the samples are below the grab screening level.

TKN, TSS, and TOC do not have numeric screening level criteria and are not assessed for concerns or impairments. These data are usually collected during routine monitoring and are used to enhance the overall assessment of water quality.

Data for the analyses were extracted from the SQWMIS database using the TCEQ's Data Tool (https://www80.tceq.texas.gov/SwqmisWeb/public/crpweb.faces). The SQWMIS database consists of data that has been collected under approved Quality Assurance Project Plans and have been screened for accuracy.

Parameters are represented in SWQMIS by five-digit numeric codes. A parameter may be represented by multiple codes depending on the analysis method under which a water quality sample was analyzed. The parameter codes, in order of priority, used for this analysis are:

DO: 00300
E. coli: 31699, 31700, 31648
Enterococcus: 31701, 31649
Water temperature: 00010
pH: 00400
Ammonia: 00610, 00608
Chlorophyll-*a*: 70953, 32211
Nitrate: 00620, 00621, 00630, 00593, 00631
Total Phosphorus: 00665
Chloride: 00940, 00941
Sulfate: 00945
TDS: 70300, 70294, 47004, 70301, 00094, 00095 (00094 and 00095 are conductivity readings and multiplied by 0.65 to calculate TDS.)

The data for each parameter reviewed were imported into an Excel spreadsheet. The data were scanned and same-day measurements were removed. Data recorded as a "<" value indicated that the parameter was not present in concentrations greater than the detection limit for that analysis. This < value differs based on the lab doing the analysis and the detection limits at that time. It does not necessarily mean that it is not present at a lower concentration. But for review purposes, all of these values are considered "non-detects." For analysis and graphing, all of these values were reduced to the lowest non-detect value of the data set. Data reported below the lowest non-detect value were changed to the lowest non-detect value.

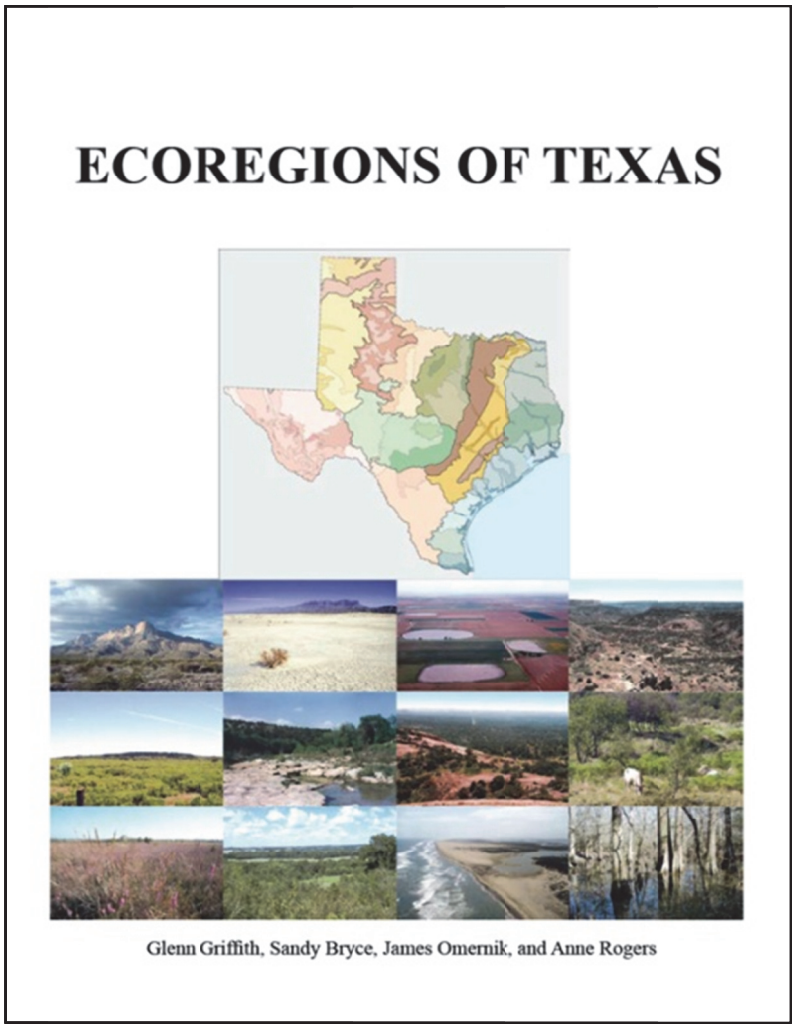
The trend analysis was conducted using an Excel spreadsheet developed by Dave Bass at the Lower Colorado River Authority. The calculations within the spreadsheet returned the t-ratio and p-value results for each parameter over time and with respect to flow or water level. The analysis indicated a trend if the t-ratio => |2| and the p-value < 0.1.

ECOREGIONS

Ecoregions (ecological regions) denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance (Bryce and others, 1999). These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas. Information used to compile ecoregion maps includes information about geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. Ecoregions are classified using a hierarchical level using Roman numerals. Level I is the coarsest level with each level higher indicating a refinement of the previous level (Omernik and others, 2000).

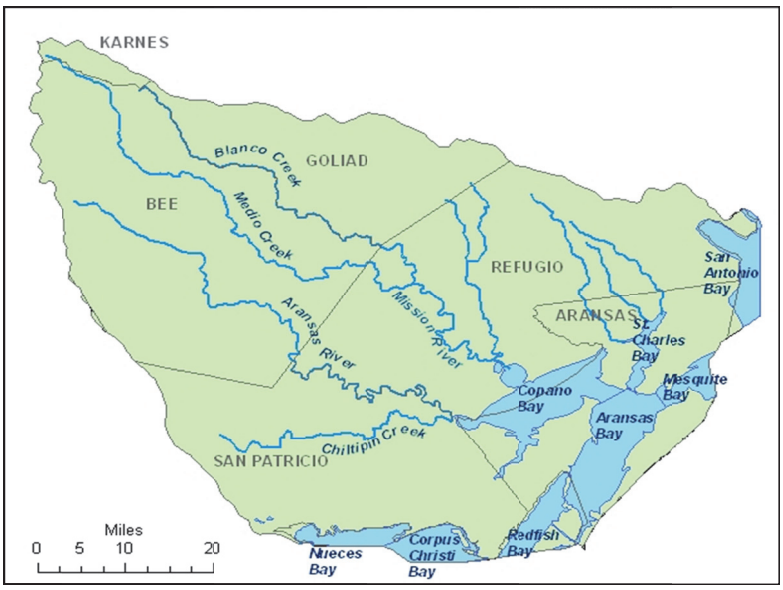
In Texas, there are a total of 12 Level III ecoregions. The Nueces-San Antonio Coastal Basin, Nueces River Basin, and the Nueces-Rio Grande Coastal Basin flows through five of these Level III ecoregions including: Edwards Plateau in the Upper Nueces River Basin, South Texas Plains in the western portion of the Nueces River Basin, Texas Blackland Prairie in the Nueces River Basin near the Atascosa River, East Central Texas Plains in the Nueces and Nueces- San Antonio River Basin, and the Western Gulf Coastal Plains in the Nueces-Rio Grande Coastal Basin.

The maps included in this report are Level IV ecoregion maps and are located in the Watershed Summary section. Level IV ecoregion maps are available for the Nueces-San Antonio Coastal Basin, Nueces River Basin, and the Nueces-Rio Grande Coastal Basin.



WATERSHED SUMMARIES OF THE SAN ANTONIO – NUECES COASTAL BASIN

The San Antonio – Nueces Coastal Basin is approximately 3,100 square miles, covering all or part of seven counties including: Aransas, Bee, Goliad, Karnes, Live Oak, Refugio, and San Patricio. The basin is bordered by: the San Antonio River Basin to the north; the Lavaca-Guadalupe Coastal Basin to the northeast; bays, estuaries, and the Gulf of Mexico to the east; the Nueces-Rio Grande Coastal Basin to the south; and the Nueces River Basin to the northwest. There are two minor rivers in the watershed, the Mission River and the Aransas River, but no watercourses that maintain significant stream flow. Runoff from the basin drains into Nueces Bay, Port Bay, Mission Bay, Copano Bay, St. Charles Bay, Aransas Bay, and Hynes Bay.



Being a coastal area, the basin is naturally host to several state-operated recreational areas. These include Goose Island State Park near Rockport, Copano Bay State Fishing Pier along SH 35 north of Fulton, Fulton Mansion State Historic Park in Fulton, and the Aransas National Wildlife Refuge in Aransas County.

Water Quality Overview

The headwaters for the San Antonio – Nueces coastal basin arise in Southern Post Oak Savannah/Claypan of the East Central Texas Plains ecoregion. Terrain consists of flat to rolling irregular hills becoming increasingly more flat to the southeast towards the coast. In the upper reaches of the basin, creeks are largely ephemeral, only flowing in conjunction with a storm event. Streams are often very turbid and have elevated concentrations of nutrients (nitrogen and phosphorus) and bacteria when flowing. In the central portion of the watershed, creeks travel through the Western Gulf Coastal Plains ecoregion. Perennial pools capable of sustaining aquatic life become more frequent. During wet years, stream flow is more consistent and waterways are capable of maintaining sufficient flow between rain events.

Water quality in Aransas River, located in the western portion of the basin, typically has elevated levels of bacteria and nutrients (nitrogen and phosphorus) and low DO. Water in the Mission River, located in the central portion of the basin, meets the standards set for water quality much of the time. In the tidally influenced reaches of the basin, water in the Aransas and Mission River Tidal both have elevated bacteria concentrations that do not meet water quality standards.

These issues are being addressed by a Copano Bay TMDL that was initiated in 2004. The TMDL and Implementation Plan were completed in 2011, and accepted by the US Environmental Protection Agency (EPA) in May 2016, to address the bacteria impairment in Copano Bay, the tidal portions of the Mission River and both segments of the Aransas River. Best Management Practices (BMP) to address the issue include improvements and upgrades to wastewater treatment plants (WWTP) and the development and implementation of conservation plans in priority areas of the watershed. From 2011 through 2017, 126 Water Quality Management Plans (WQMP) have been written for 69,142 acres in the Mission River watershed, which could be the reason for the decreasing trends in alkalinity, nitrate, and TSS.

FY2018 Monitoring Locations in the San Antonio – Nueces Coastal Basin

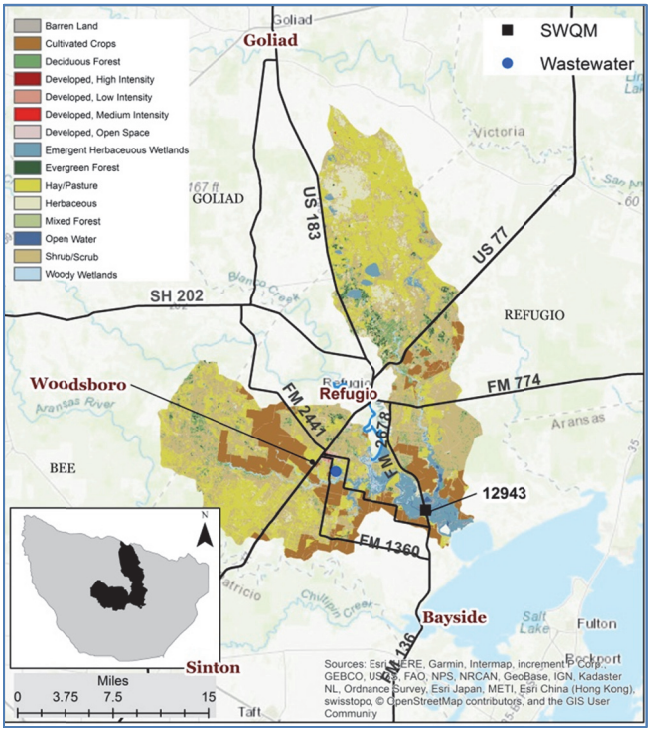
Segment	Station Id	Description	Monitoring Entity	Conventional, Bacteria, Field	Other
2001 Mission River Tidal	12943 (AU_01)	Near south bank immediately downstream of FM 2678 between Refugio and Bayside	NRA	Quarterly	
2002 Mission River Above Tidal	12944 (AU_01)	At US 77 upstream from bridge at Refugio	NRA	Quarterly	
2003 Aransas River Tidal	12947 (AU_01)	At boat ramp at FM 629 terminus south of Bonnie View	NRA	Quarterly	
2004 Aransas River Above Tidal	12952 (AU_01)	At county road east of Skidmore	NRA	Quarterly	
2004A Aransas Creek	12941 (AU_01)	At US 181 North of Skidmore	NRA		(4) 24-Hr DO
2004B Poesta Creek	12937 (AU_01)	77 m downstream of SH 202	NRA	Quarterly	

Permitted Wastewater Treatment Plants in the San Antonio – Nueces Coastal Basin

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2001 Mission River Tidal	WQ0010156-001	Town of Woodsboro	250,000
2002 Mission River Above Tidal	WQ0010255-001	Town of Refugio	576,000
	WQ0010748-001	Pettus Municipal Utility District (MUD	105,000
2003 Aransas River Tidal	WQ0010055-001	City of Sinton	800,000
	WQ0013412-001	Texas Department of Transportation (TxDOT)	3,800
	WQ0013641-001	City of Sinton Rob and Bessie Welder Park	15,000
	WQ0014119-001	St. Paul Water Supply Corporation (WSC)	50,000
2004 Aransas River Above Tidal	WQ0010124-004	City of Beeville, Chase Field	2,500,000
	WQ0014112-001	Skidmore WSC	131,000
	WQ0014123-001	Tynan WSC	45,000
2004A Poesta Creek	WQ0010124-002	City of Beeville	3,000,000

MISSION RIVER TIDAL – SEGMENT 2001

Segment 2001, Mission River Tidal, flows 19 miles from a point 4.6 miles downstream of US 77 in Refugio County to its confluence with Mission Bay in Refugio County. It is a single Assessment Unit (AU). Its watershed is 199,798 acres. The area is predominately ranch and farm land. The town of Woodsboro is the only community in the watershed.



Special Studies

A Copano Bay TMDL was initiated in 2004. The TMDL and Implementation Plan were completed in 2011, and accepted by the EPA in May 2016, to address the bacteria impairment in Copano Bay, the tidal portions of the Mission River and both segments of the Aransas River. BMPs to address the issue include improvements and upgrades to WWTPs and the development and implementation of conservation plans in priority areas of the watershed. From 2011 through 2017, 126 Water WQMPs have been written for 69,142 acres in the Mission River watershed, which could be the reason for the decreasing trends in alkalinity, nitrate, and TSS indicated below.

Water Quality Analysis

The analysis for this segment is based on data from **Station 12943** at FM 2678.

Aquatic Life Use Assessment

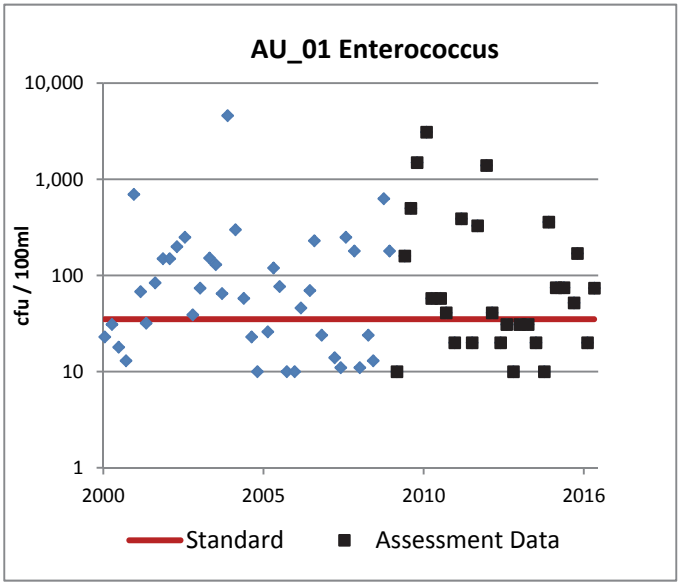
DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	29	1.9	15.9	6.5	1	2
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or dissolved oxygen demand (DOD) over time.

Sampling location for Station 12943 upstream at FM 2678

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	NS	28	<10	3100	76.1	3	17



The segment has been impaired for bacteria, Enterococcus, for contact recreation since the 2004 Assessment. The geometric mean has increased from the 71.1 cfu/100ml calculated for the 2014 Integrated Report. Trend analysis did not indicate any trends in Enterococci concentrations over time.

Non-point source pollution, wildlife, and feral hogs are the most likely contributors to bacteria loading.

General Use

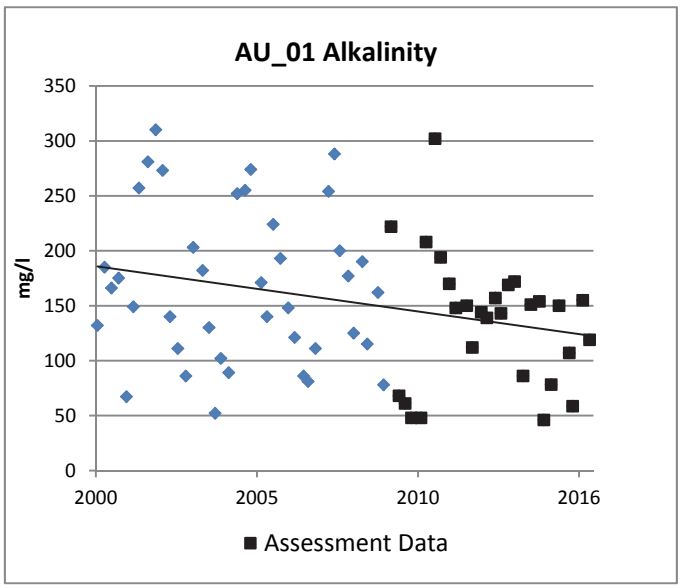
Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	29	8.0	31.1	25.0	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	29	7.1	8.9	8.1	0	0

Trend analysis did not indicate any trends in pH levels over time.

Alkalinty		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	46	302	146



Trend analysis indicates a decreasing trend in alkalinity over time ($t = -2.33$, $p = 0.023$).

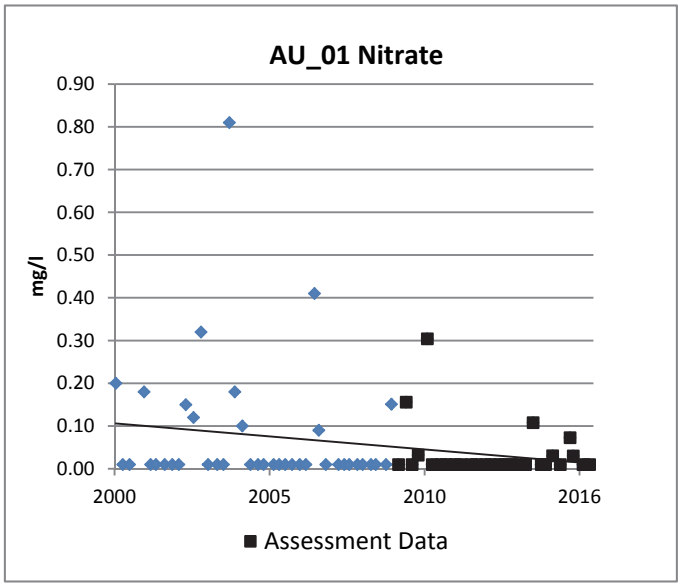
Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	28	<0.02	0.06	0.02	17	0

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21µg/l	NC	28	<2	74.2	16.2	4	5

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.10
AU_01	1.10 mg/l	NC	28	<0.01	0.30	0.01	21	0



Trend analysis indicates a decreasing trend in nitrate concentrations over time (t = -2.37, p = 0.021). All values are below the screeing level.

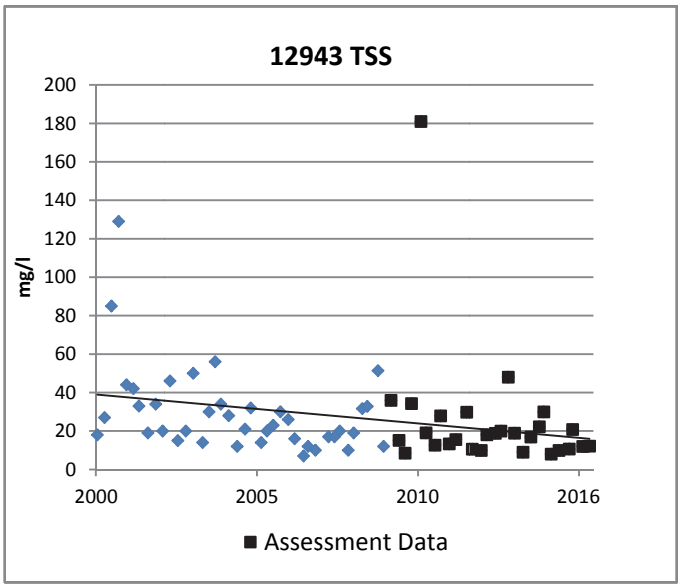
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	0.088	3.59	1.58

There was insufficient data for trend analysis on TKN concentrations.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	28	<0.06	0.27	0.11	4	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	7.99	181	17.5



Trend analysis indicates a decreasing trend in TSS over time (t = -2.13, p = 0.037).

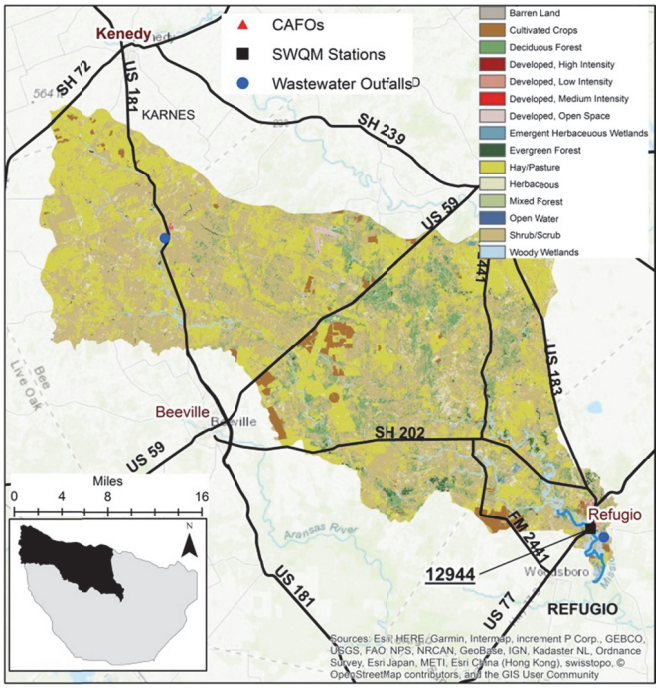
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	1.98	15.9	4.03

Trend analysis did not indicate any trends in TOC concentrations over time.

Google Earth view of Station 12943 location

MISSION RIVER ABOVE TIDAL – SEGMENT 2002

Segment 2002, Mission River above Tidal, flows 9 miles from the confluence of Blanco Creek and Medio Creek to a point 4.6 miles downstream of US 77 in Refugio County. It is a single AU. Its watershed is 452,172 acres. The area is predominately ranch and farm land. The Town of Refugio is the only community in the watershed.

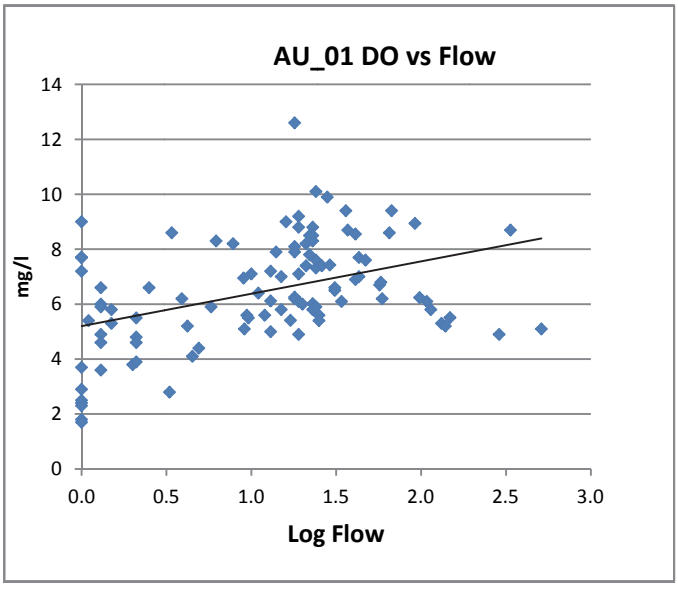


Water Quality Analysis

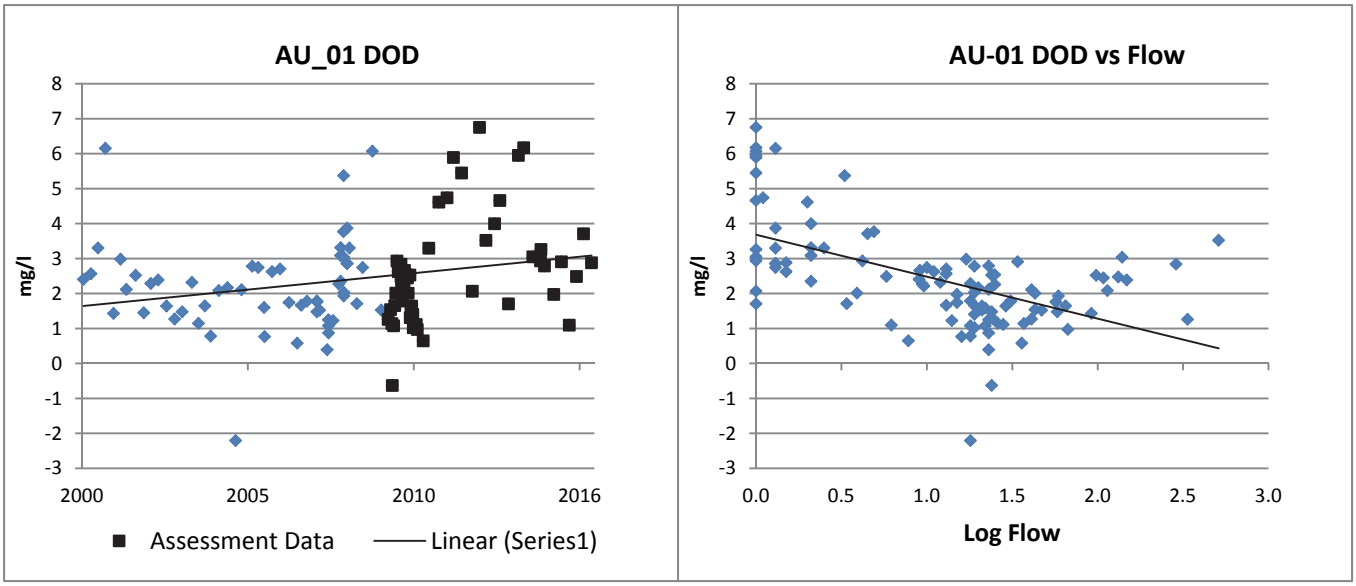
The analysis for this segment is based on data from **Station 12944** at US 77.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	50	1.7	10.1	6.0	5	11
	Screening Level 5.0 mg/l	NC						

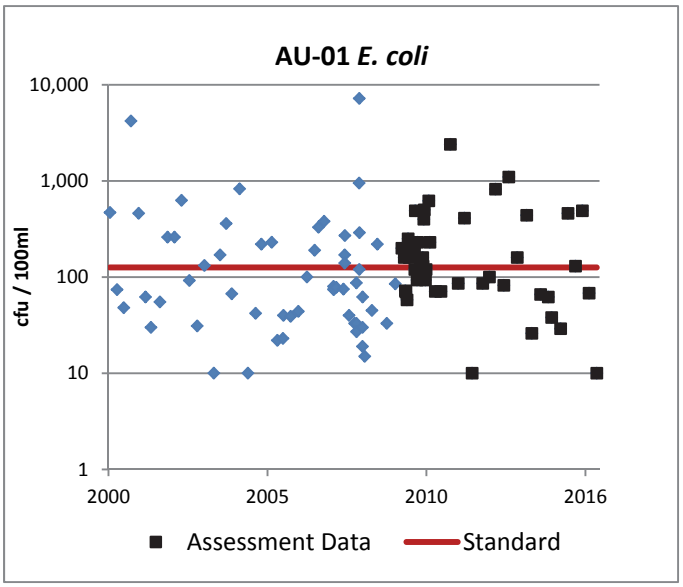


Trend analysis indicates an increasing trend in DO concentrations (t = 2.06, p = 0.042) and a decreasing trend in DOD (t = -6.47, p = 0.000) with respect to flow. DOD also has an increasing trend (t = 2.64, p = 0.010) over time.



Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	49	10	>2400	143.06	0	27



The most recent data indicate that the bacteria geomean is higher than the standard. The Draft 2016 Integrated Report assessment indicates that the segment meets the standard. From October 2007 through January 2011, NRA conducted a special study collecting water quality samples below WWTPs in the watershed. These extra samples were included in the analysis for this report, but only the 28 samples collected during routine sampling were used for the Integrated Report assessment.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	50	10.4	29.8	22.8	0

Trend analysis did not indicate any trends in water temperature over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	50	7.3	8.0	7.7	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	62	340	220

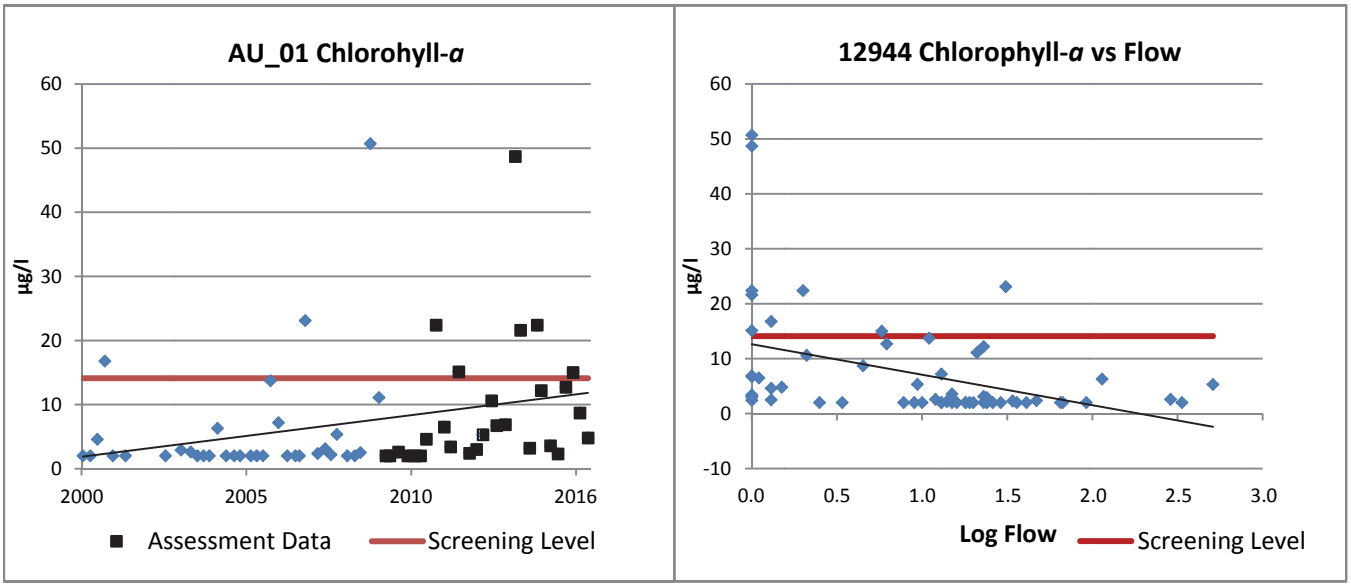
Trend analysis did not indicate any trends in alkalinity over time or with respect to flow.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	28	<0.02	0.09	0.02	15	0

Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	28	<2	48.7	5.06	4	6

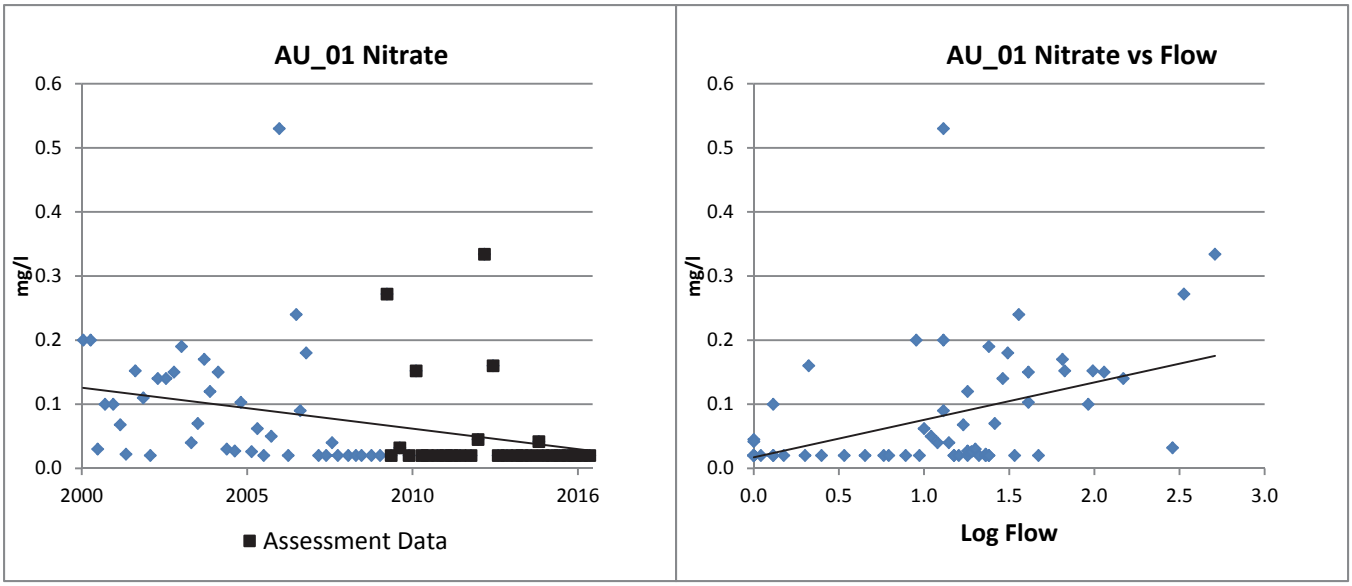
Trend analysis indicates a decreasing trend in chlorophyll-*a* concentrations (t = -4.11, p = 0.000) with respect to flow and an increasing trend (t = 2.33, p = 0.023) over time.



Sampling location for Station 12944 upstream at US 77

Nitrates		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	28	<0.02	0.33	0.02	21	0

Trend analysis indicates a decreasing trend in nitrate concentrations (t = -3.37, p = 0.001) over time and an increasing trend (t = 3.05, p = 0.003) with respect to flow. All values are below the screening level.

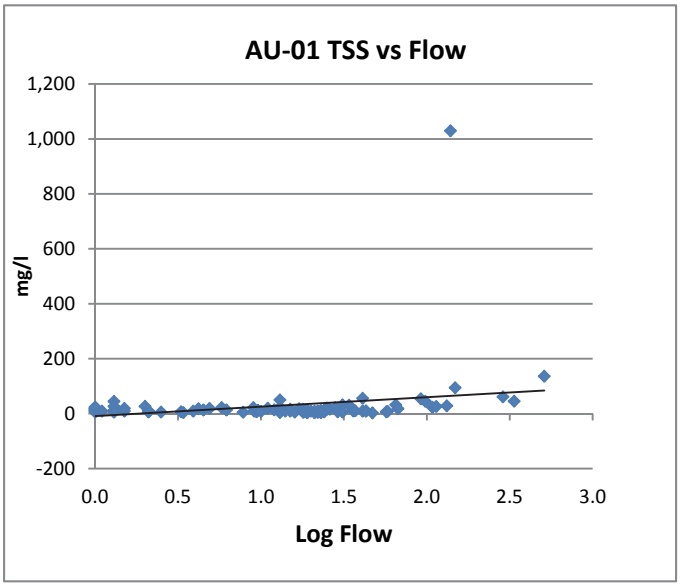


There is insufficient data for either trend or statistical analysis on TKN concentrations.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	28	<0.02	0.74	0.06	7	1

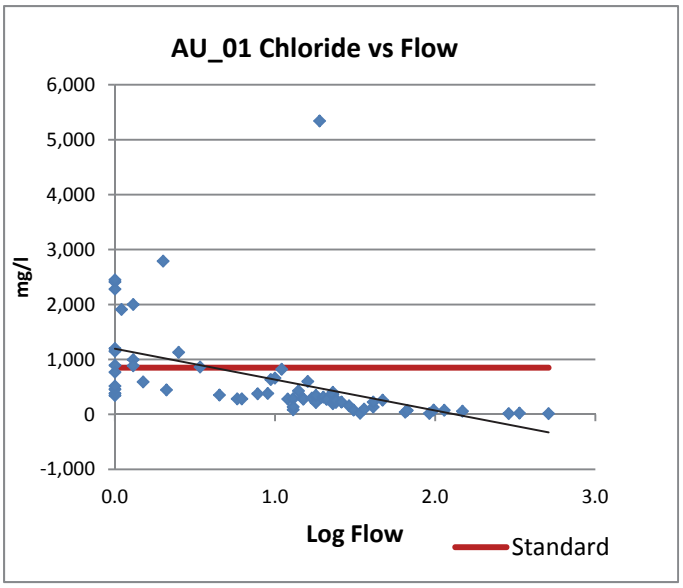
Trend analysis did not indicate any trends in total phosphorus concentrations over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	49	3.2	136	12.2



Trend analysis indicates an increasing trend in TSS concentrations (t = 2.28, p = 0.024) with respect to flow.

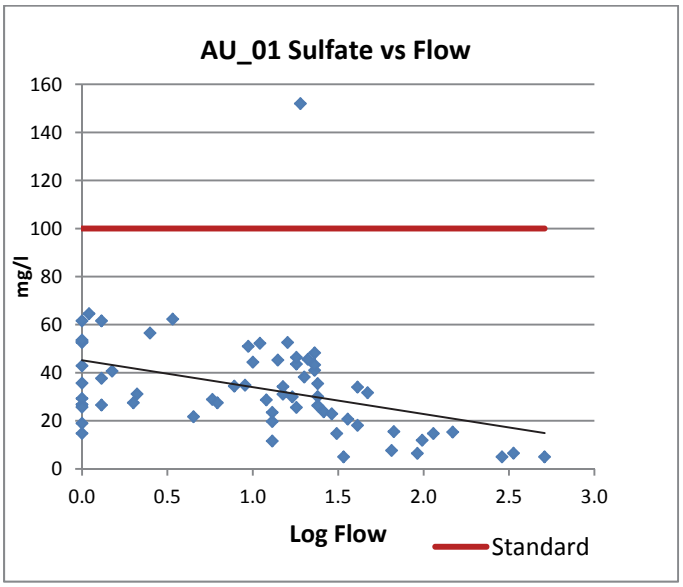
Chloride		Status	# samples	Min	Max	Average	ND	>850
AU_01	850 mg/l	FS	28	12.8	2790	694	0	8



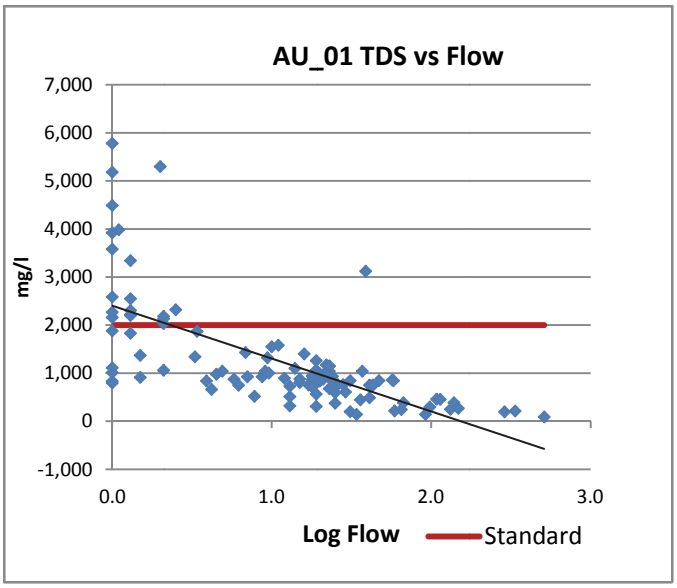
Trend analysis indicates a decreasing trend in chloride concentrations (t = -4.46, p = 0.000) with respect to flow.

Sulfate		Status	# samples	Min	Max	Average	ND	>100
AU_01	100 mg/l	FS	28	<5.0	64.6	30.0	3	0

Trend analysis indicates a decreasing trend in sulfate concentrations (t = -3.13, p = 0.002) with respect to flow.



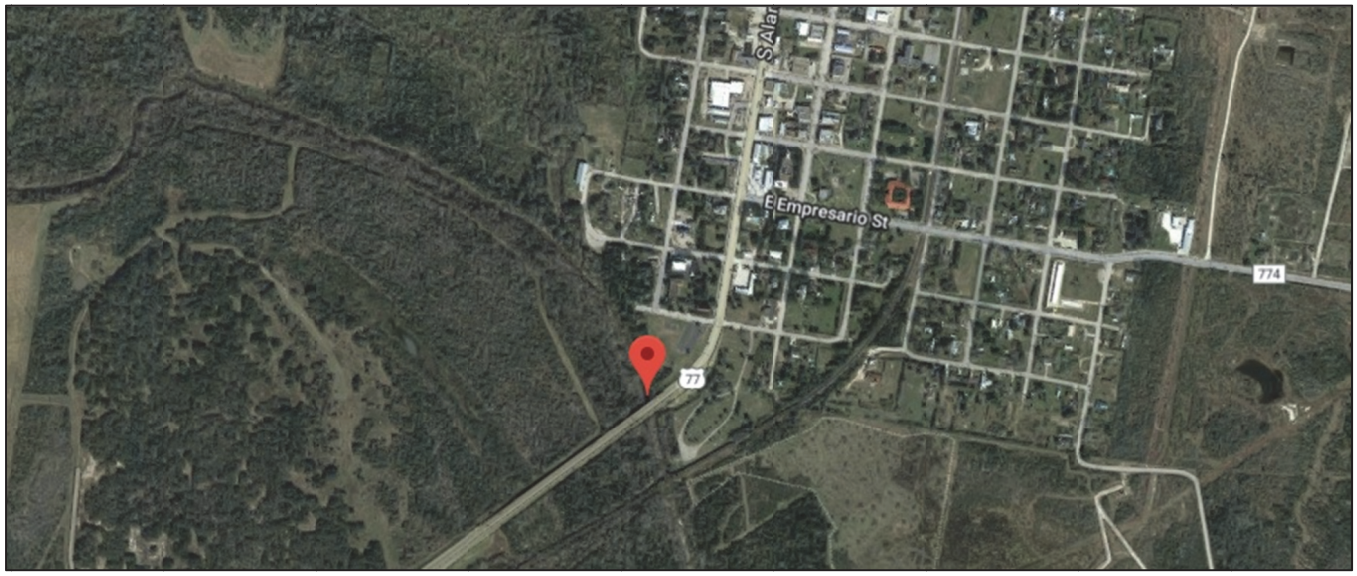
TDS		Status	# samples	Min	Max	Average	ND	>2000
AU_01	2000 mg/l	FS	50	87.8	5298	1274	3	8



Trend analysis indicates a decreasing trend in TDS concentrations (t = -9.93, p = 0.000) with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	1.99	12.5	5.96

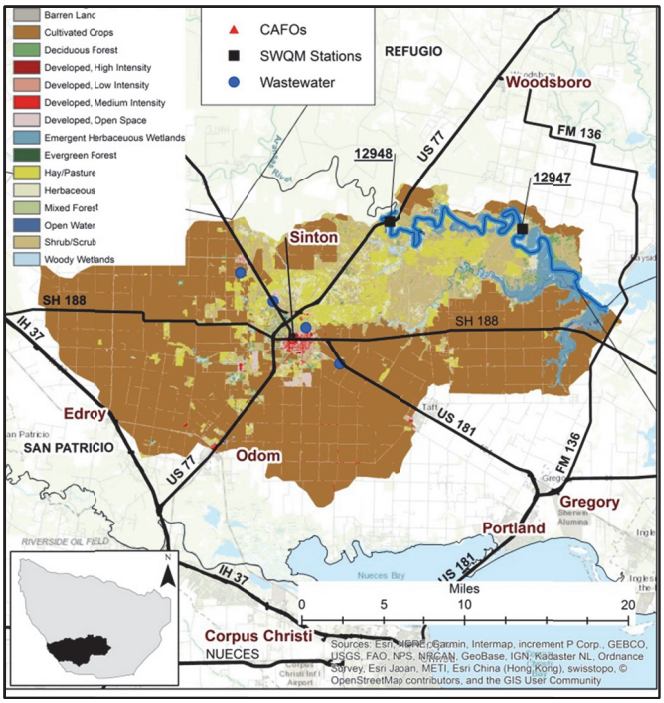
Trend analysis did not indicate any trends in TOC concentrations over time or with respect to flow.



Google Earth view of Station 12944 location

ARANSAS RIVER TIDAL – SEGMENT 2003

Segment 2003, Aransas River Tidal, forms part of the county line between Refugio and San Patricio Counties. It flows 6 miles from a point 1.0 mile upstream of US 77 in to its confluence with Copano Bay. It is a single AU. Its watershed is 208,031 acres.



Special Studies

As described in the discussion of Segment 2001, this segment is included in the Copano Bay TMDL and Implementation Plan. From 2011 through 2017, 141 WQMPs have been written for 54,601 acres in the Aransas River watershed, which could be the reason for the decreasing trends in alkalinity, and total phosphorus indicated below.

Water Quality Analysis

The analysis for this segment is based on data from **Station 12947** at FM 629.

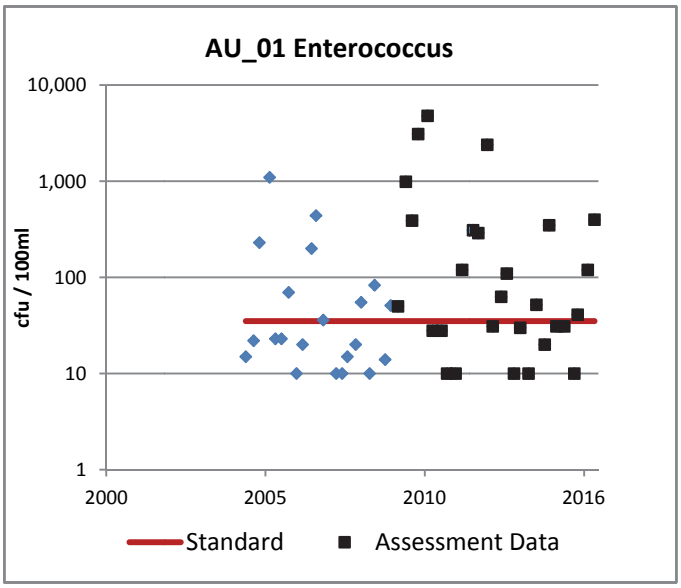
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	28	3.5	11.0	6.9	0	0
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	NS	28	<10	4800	87.8	2	16



The segment has been impaired for bacteria for contact recreation since the 2004 Assessment. The geometric mean has increased from the 64.3 cfu/100ml calculated for the 2014 Integrated Report. Trend analysis did not indicate any trends in Enterococcus concentrations over time.

Wildlife, feral hogs, pets, and failing septic systems are assumed to be the primary contributors to the bacteria loading.

General Use

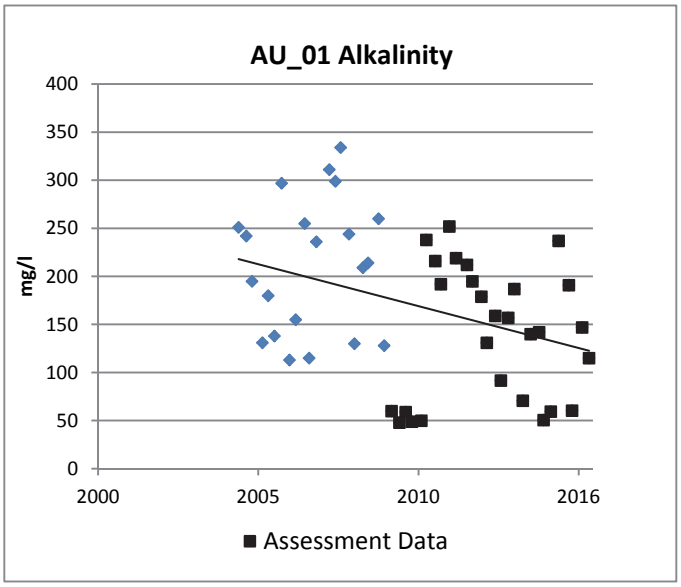
Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	29	8.0	31.1	25.0	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	28	7.3	8.8	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time.

Alkalinty		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	48	252	144



Trend analysis indicates a decreasing trend in alkalinity over time (t = -2.70, p = 0.009).

Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	28	<0.02	0.20	0.02	17	0

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21µg/l	NC	28	<2	52.6	11.4	4	4

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time.

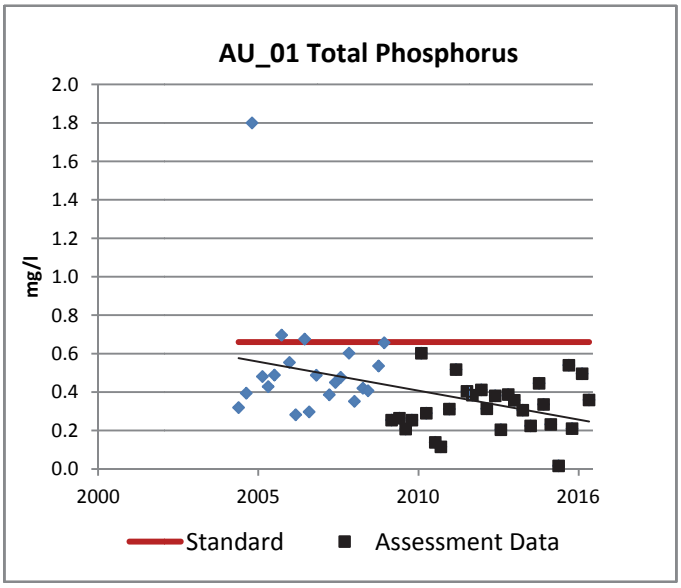
Nitrate		Status	# samples	Min	Max	Median	ND	>1.10
AU_01	1.10 mg/l	NC	28	<0.02	1.29	0.02	18	1

Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	0.1	2.43	1.53

There was insufficient data for trend analysis on TKN concentrations.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	28	0.02	0.60	0.31	0	0



Trend analysis indicates a decreasing trend in total phosphorus over time (t = -3.11, p = 0.003).

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	9.7	375	25.4

Trend analysis did not indicate any trends in TSS concentrations over time.

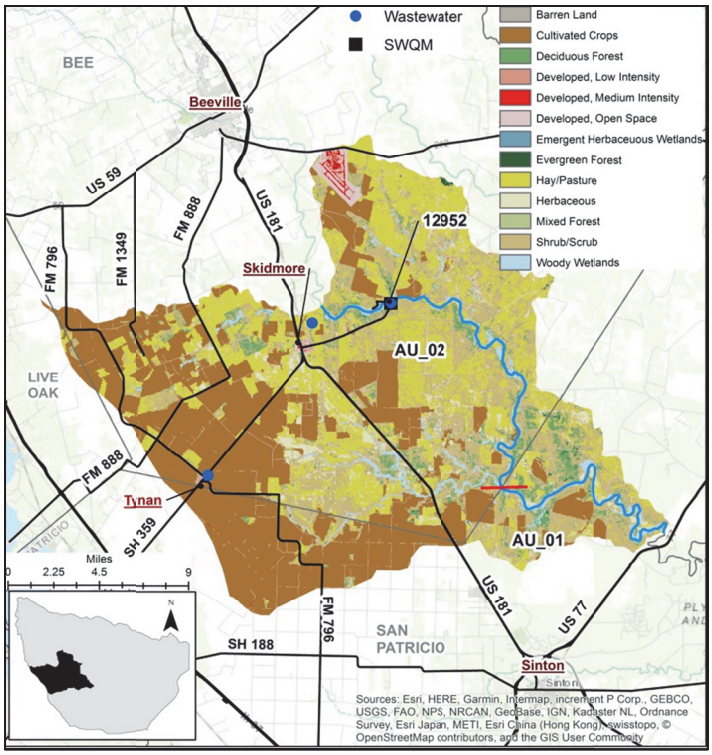
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	1.9	13	4.92

Trend analysis did not indicate any trends in TOC concentrations over time.

Sampling location for Station 12947

ARANSAS RIVER ABOVE TIDAL – SEGMENT 2004

The above tidal segment flows 35 miles from the confluence of Poesta Creek and Aransas Creek to a point 1.0 mile upstream of US 77. Its watershed is 178,807 acres. The segment is divided into two AUs. **AU_01** is from the downstream end to the confluence with Papalote Creek. AU_02 is from the confluence with Papalote Creek to the confluence with Aransas Creek and Poesta Creek. The area is predominately ranchland. Skidmore and Tynan are the only communities in the watershed.



Special Studies

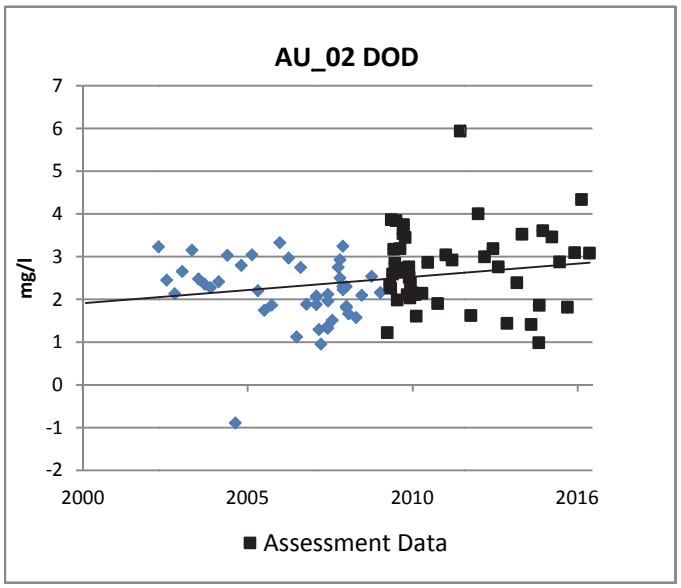
As described in the discussion of Segment 2001, this segment is included in the Copano Bay TMDL and Implementation Plan. From 2011 through 2017, 141 WQMPs have been written for 54,601 acres in the Aransas River watershed, which could be the reason for the decreasing trends in alkalinity, and total phosphorus indicated below.

Water Quality Analysis

The analysis for this segment is based on data from **Station 12952** at County Road (Corrigan Road) east of Skidmore. There are no sampling sites on AU_01.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_02	Minimum 3.0 mg/l	FS	49	2.1	10.1	5.9	1	10
	Screening Level 5.0 mg/l	NC						

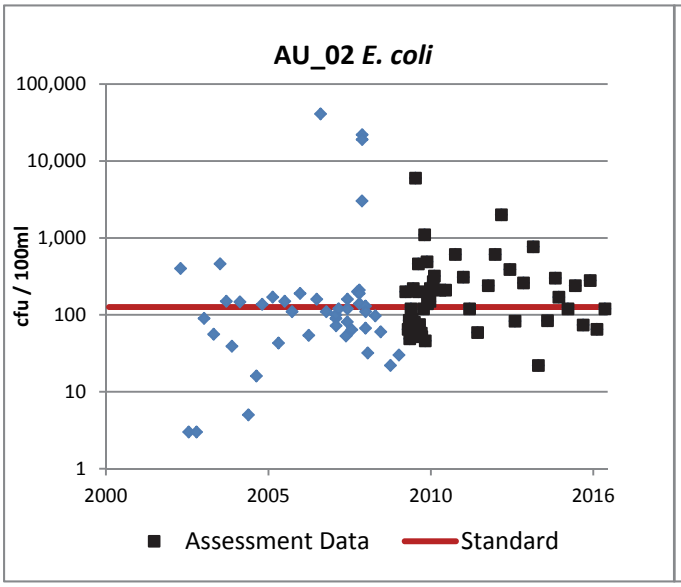


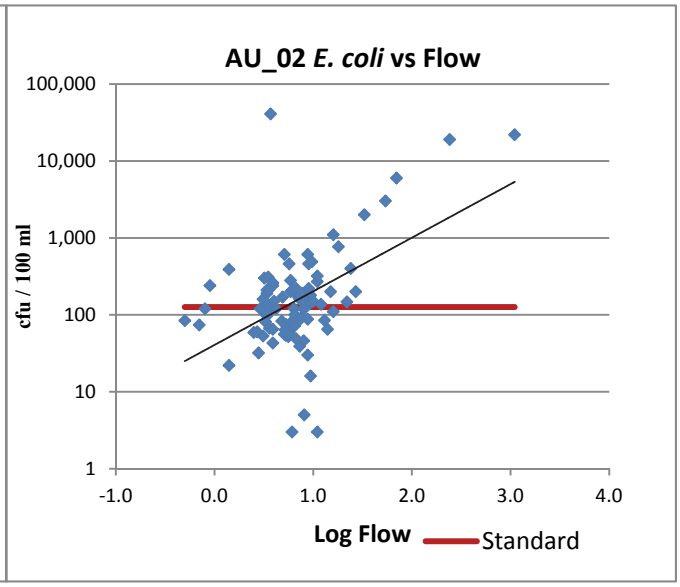
Trend analysis indicates an increasing trend in DOD ($t = 2.25$, $p = 0.027$) over time.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_02	Geomean 126 cfu/100 ml	NS	49	22	>6000	177.16	0	28

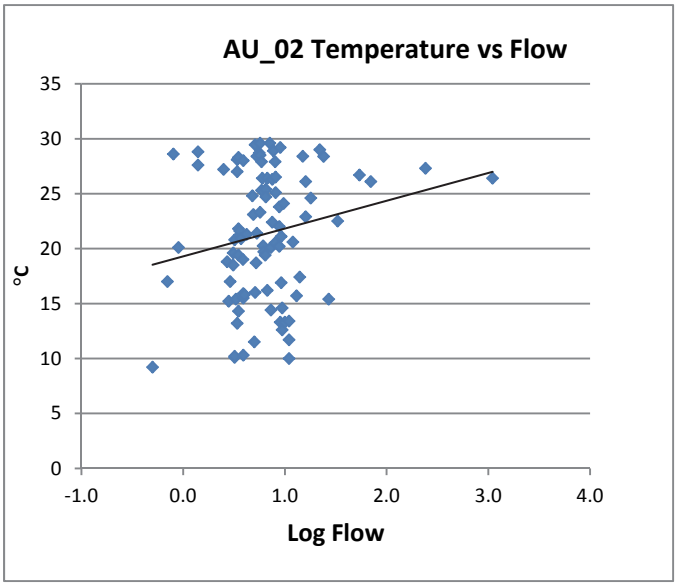
AU-02 is listed as being impaired for bacteria for contact recreation. The measured concentrations continue to exceed the standard. Trend analysis indicates an increasing trend in *E. coli* concentrations (t = 5.34, p = 0.000) with respect to flow.





General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_02	35.0 °C	FS	49	9.2	29.6	22.5	0

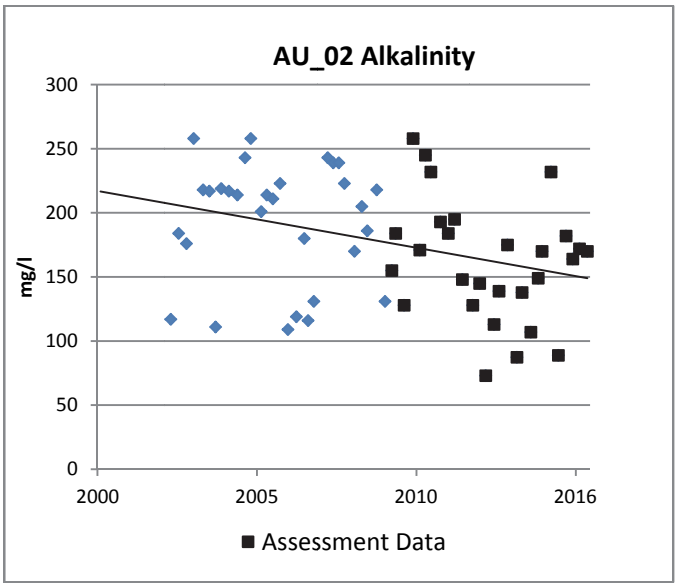


Trend analysis indicates an increasing trend in water temperature (t = 2.82, p = 0.006) with respect to flow. All values are below the standard.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_02	6.5 – 9.0 su	FS	49	7.2	8.1	7.7	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	28	73	258	167



Trend analysis indicates a decreasing trend in alkalinity (t = -2.80, p = 0.007) over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_02	0.33 mg/l	NC	28	<0.02	0.327	0.044	4	0

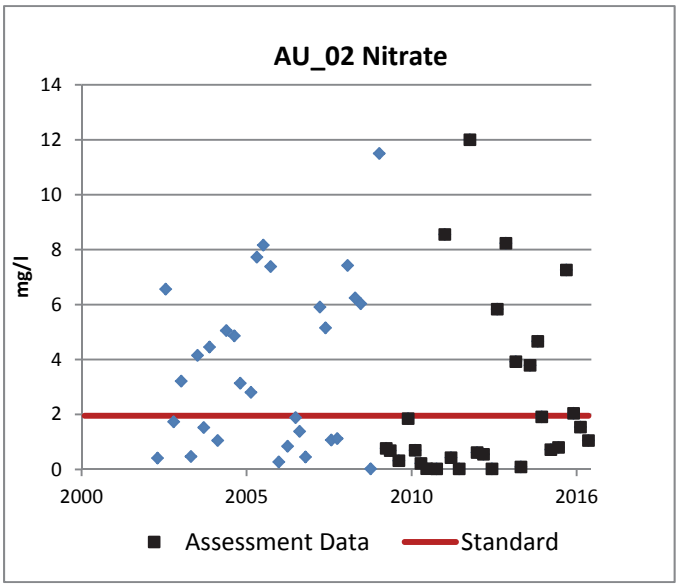
Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_02	14.1 µg/l	NC	28	<2	10.9	2	18	0

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time or with respect to flow.

Sampling location for Station 12952 at Corrigan Road

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_02	1.95 mg/l	CS	28	<0.02	12	0.78	3	9



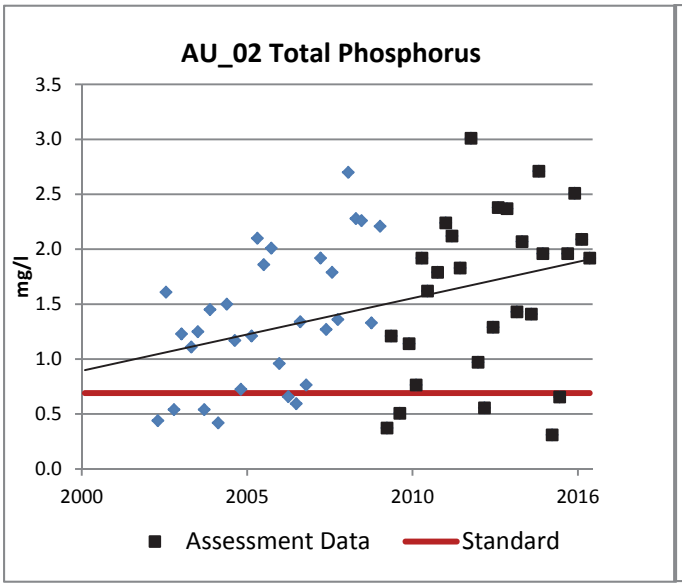
AU-02 has been assessed as having a concern for nitrate. Trend analysis did not indicate any trends over time or with respect to flow.

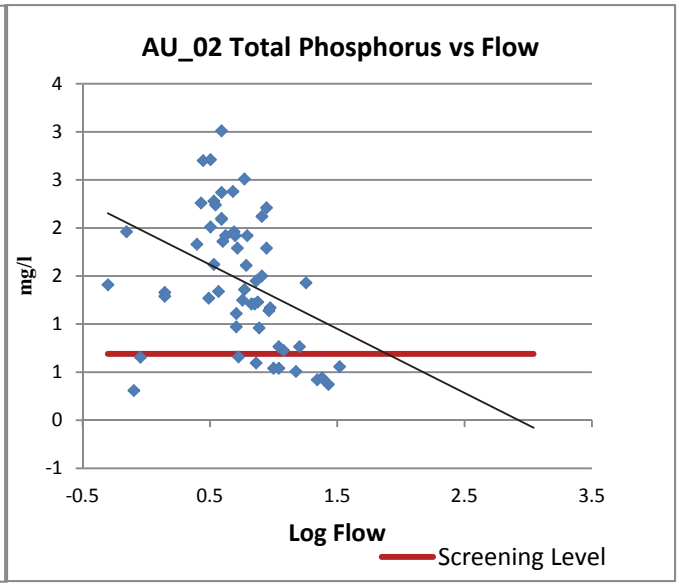
TKN		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	21	0.21	1.74	1.17

There was insufficient data for trend analysis on TKN concentrations.

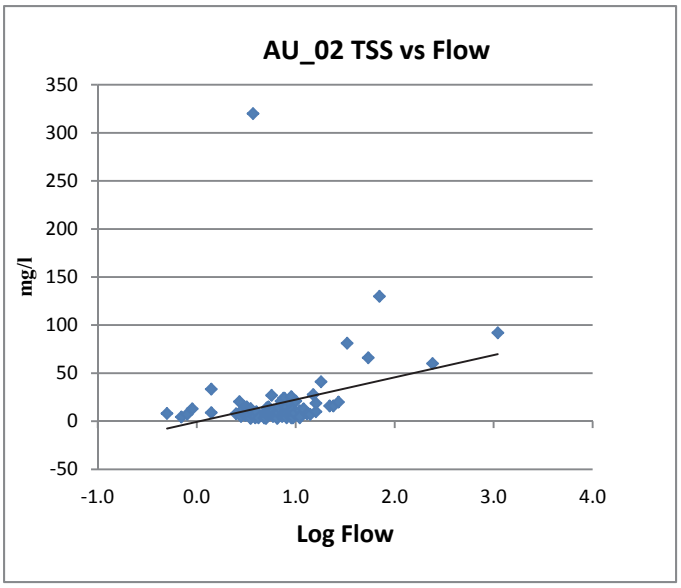
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_02	0.69 mg/l	CS	28	0.31	3.01	1.81	0	23

AU-02 has been assessed as having a concern for total phosphorus. Trend analysis indicates an increasing trend (t = 3.07, p = 0.003) over time and a decreasing trend (t = -2.49, p = 0.014) with respect to flow.



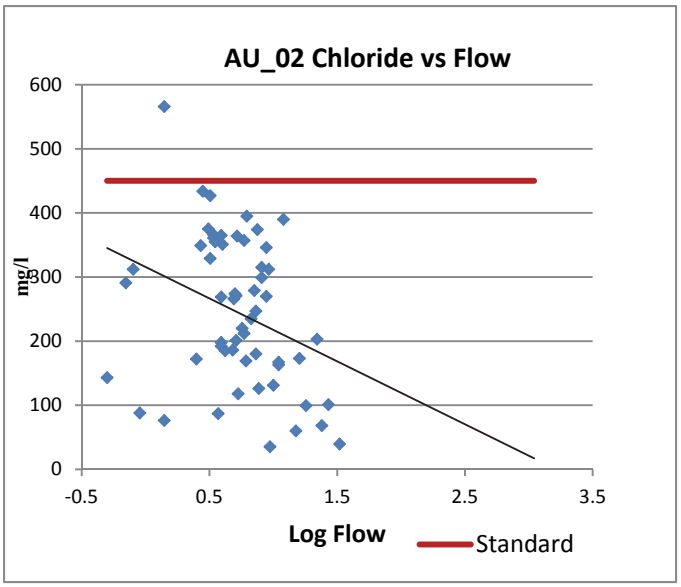


TSS		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	49	3.0	130	7.8



Trend analysis indicates an increasing trend in TSS concentrations (t = 3.32, p = 0.001) with respect to flow.

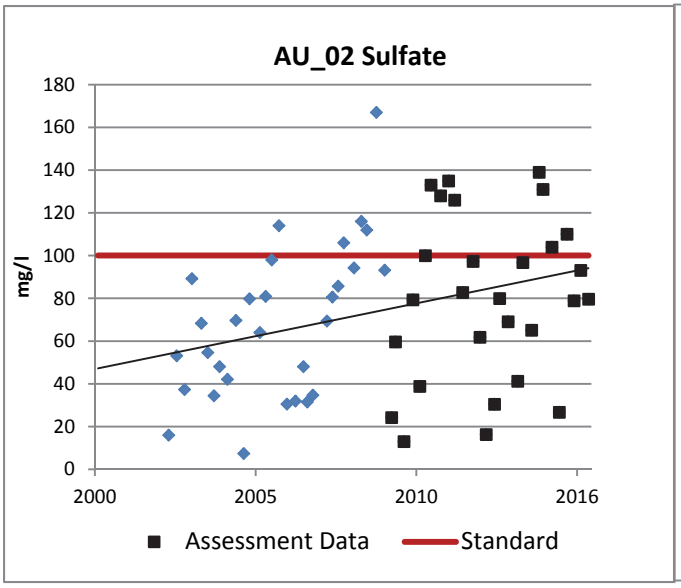
Chloride		Status	# samples	Min	Max	Average	ND	>450
AU_02	450 mg/l	FS	28	39.6	395	218	0	0

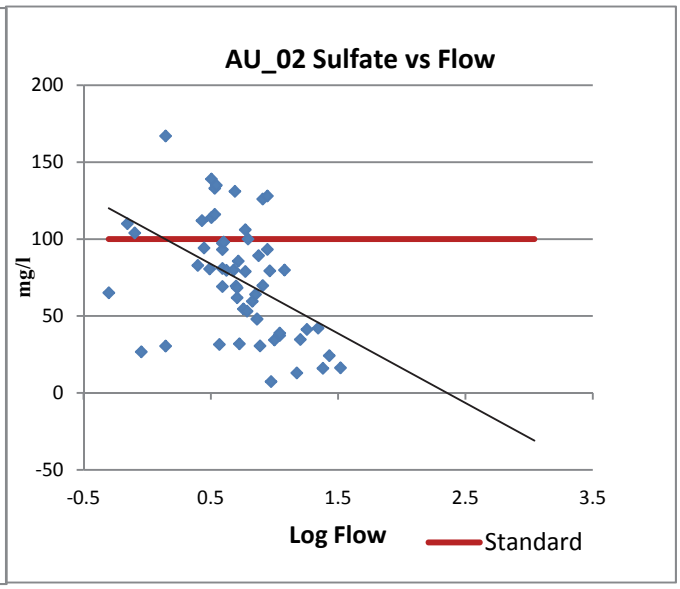


Trend analysis indicates a decreasing trend in chloride concentrations (t = -2.31, p = 0.023) with respect to flow.

Sulfate		Status	# samples	Min	Max	Average	ND	>100
AU_02	100 mg/l	FS	28	13	139	80.0	0	8

Trend analysis indicates an increasing trend in sulfate concentrations (t = 2.53, p = 0.014) over time and a decreasing trend (t = -291, p = 0.004) with respect to flow.

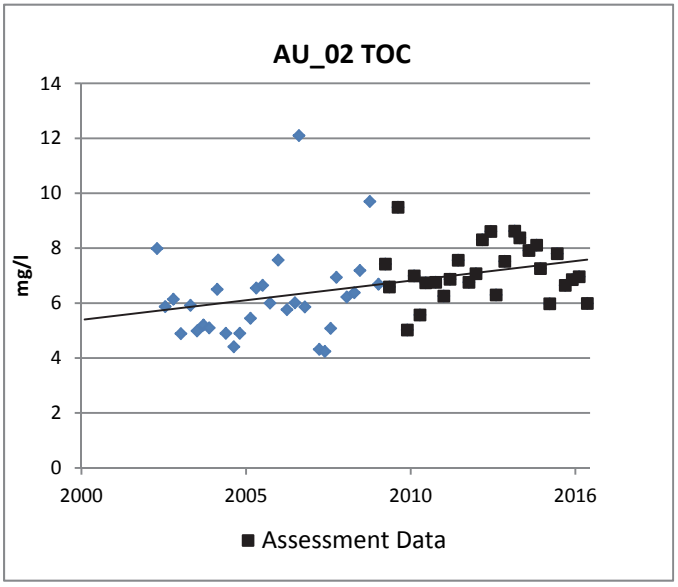




TDS		Status	# samples	Min	Max	Average	ND	>1700
AU_02	1700 mg/l	FS	49	164	1404	778	0	0

Trend analysis did not indicate any trends in TDS concentrations over time or with respect to flow.

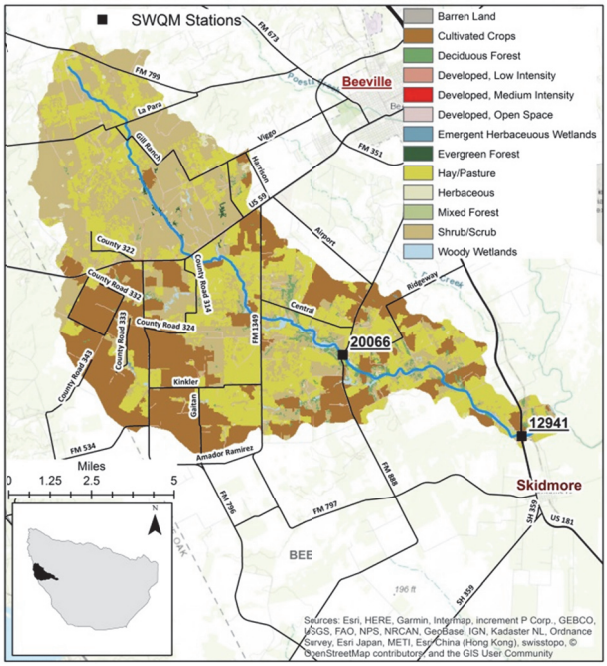
TOC		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	28	5.02	9.49	6.98



Trend analysis indicates an increasing trend in sulfate concentrations (t = 3.14, p = 0.003) over time.

ARANSAS CREEK – SEGMENT 2004A

Segment 2004A, Aransas Creek, is 20 miles long, beginning west of Beeville to its confluence with the Aransas River. It is a single AU. Its watershed is 45,196 acres. The area is predominately ranchland. There are no major communities in the watershed.



Water Quality Analysis

The analysis for this segment is based on data from **Station 12941** at US 181 north of Skidmore (January 2000 – October 2010) and **Station 20066** at FM 888 (October 2007 – January 2011)**.** There is insufficient data for trend analysis on any parameter as there is data gap from March 2003 through August 2007. The parameters with sufficient data for the statistical analysis are shown below. Only DO and bacteria were assessed in the Draft 2016 Integrated Report. The standards for the other parameters were assumed to be the same as for Segment 2004.

Special Studies

NRA, under contract with the Texas State Soil and Water Conservation Board (TSSWCB), conducted an RUAA on Aransas Creek. The final report was submitted to TSSWCB in May 2013.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<2	<3
AU-01	Minimum 2.0 mg/l	NC	18	3.1	8.5	5.4	0	8
	Screening Level 3.0 mg/l	FS						

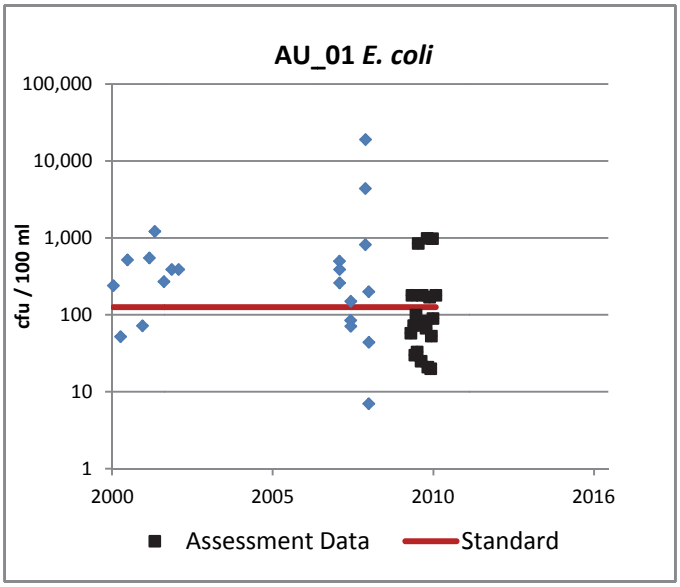
A concern for low DO that was carried forward in the 2014 Integrated Report has been removed in the Draft 2016 Integrated Report based on the data collected during a special study conducted by NRA from October 2007 through January 2011.

Sampling location for Station 12941 at US 181

Aransas Creek – 2004A

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU-01	Geomean 126 cfu/100 ml	NS	20	20	990	95.8	0	7



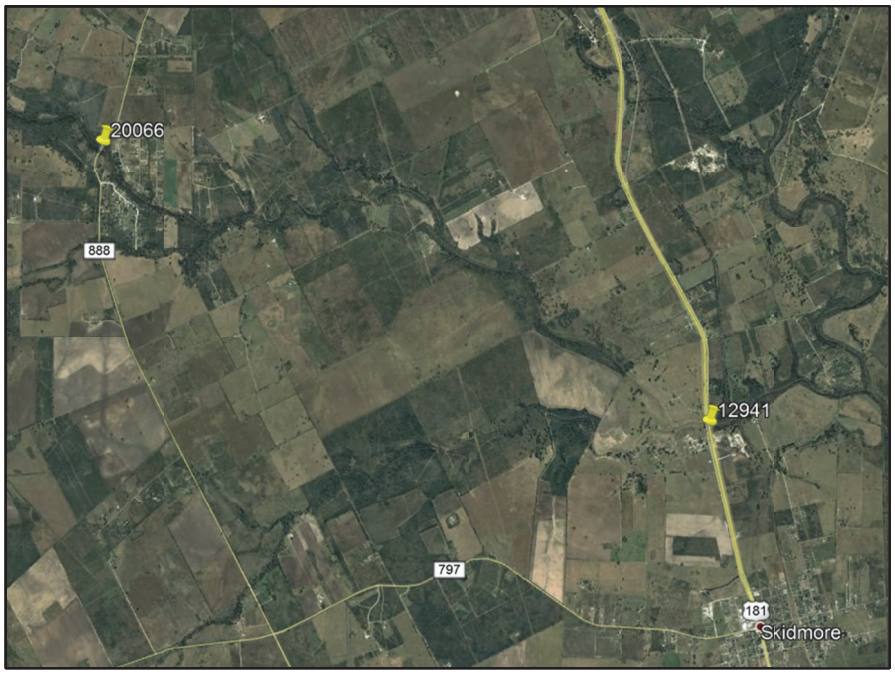
The segment has been listed as being impaired for bacteria since 2006 based on Fecal coliform analysis. For several years, Aransas Creek at Station 12941, at US 181, was accidently monitored instead of the Aransas River at Station 12952, resulting in the impairment on Aransas Creek. Data collected at Station 20066 during the Copano TMDL confirmed the impairment. If the recreational use is designated as secondary contact based on the RUAA study, the creek may meet the new standard. No additional sampling for bacteria has taken place since 2011. Routine sampling may be implemented in the future to reassess this impairment, regardless of a standards change.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU-01	35.0 °C	N/A	18	7.9	29.5	21.7	0

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU-01	6.5 – 9.0 su	N/A	18	7.3	7.8	7.7	0	0

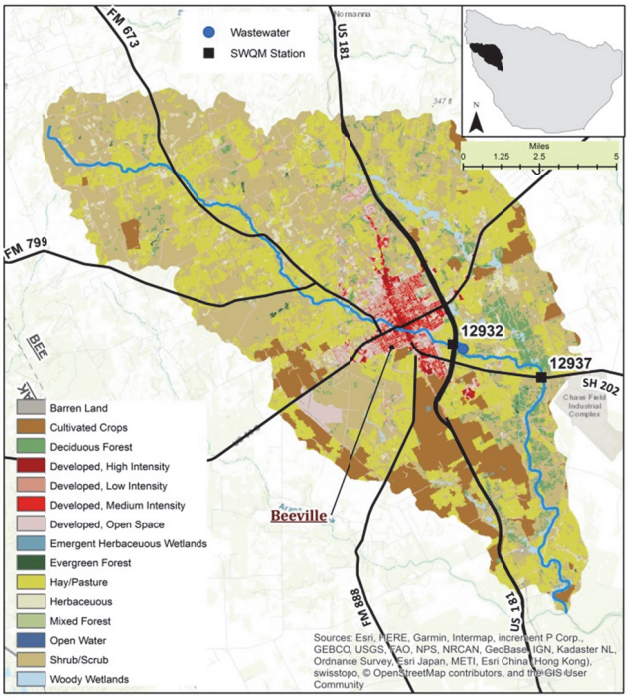
TDS		Status	# samples	Min	Max	Average	ND	>1700
AU-01	1700 mg/l	N/A	19	247	2925	1630	0	10



Google Earth view of Station 12941 and Station 20066 locations

POESTA CREEK – SEGMENT 2004B

Segment 2004B, Poesta Creek, is approximately 24 miles long, beginning northwest of Beeville, 7.5 km upstream of FM 673, to its confluence with the Aransas River. It is a single AU. Its watershed is 78,921 acres. The area is predominately ranchland. Beeville is the only community in the watershed.

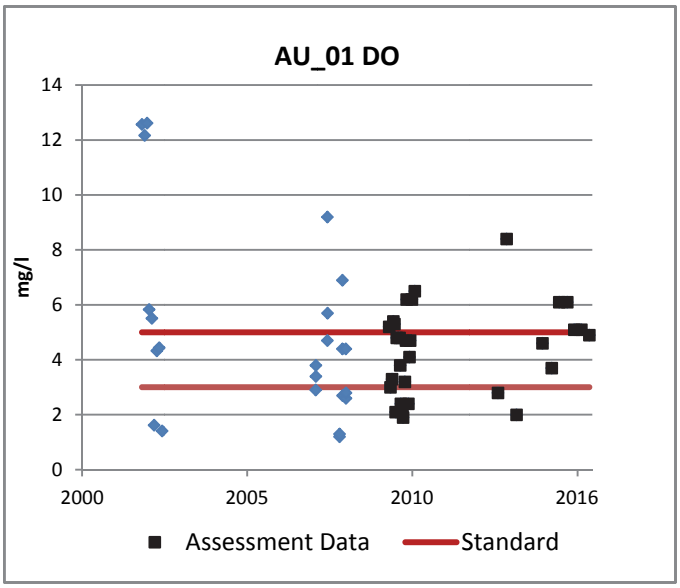


Water Quality Analysis

The analysis for this segment is based on data from **Station 12932** at US 181 Bypass (September 2001 – July 2015) and **Station 12937** at SH 202 (October 2015 – October 2016)**.** There is insufficient flow data for correlation trend analysis. The parameters with sufficient data for the statistical analysis are shown below. Only DO and bacteria were assessed in the Draft 2016 Integrated Report. The standards for the other parameters were assumed to be the same as for Segment 2004. There is a data gap from September 2002 through September 2007, so the trend analysis is for the data from October 2007 through November 2016.

Aquatic Life Use Assessment

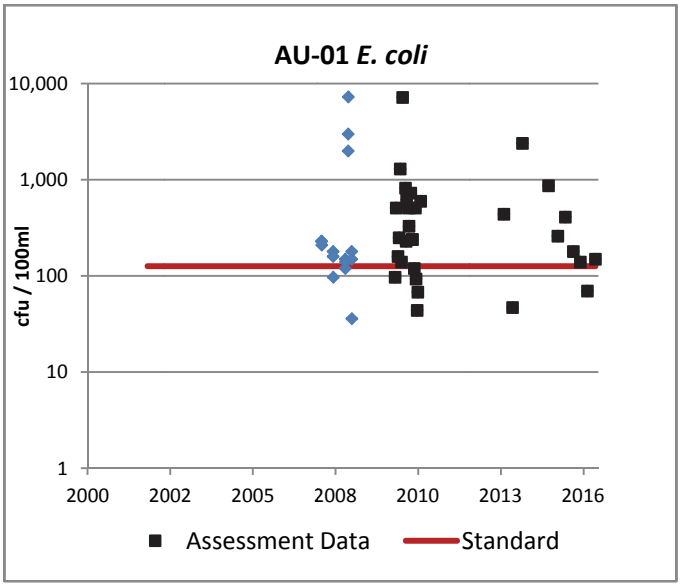
DO		Status	# samples	Min	Max	Median	<2	<3
AU-01	Minimum 2.0 mg/l	FS	30	1.9	8.4	4.7	1	7
	Screening Level 3.0 mg/l	CS						



The segment has been assessed as having a concern for low DO at the grab screening level. The low DO levels may be related to low flow conditions. Trend analysis did not any indicate trends for either DO or DOD over time.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU-01	Geomean 126 cfu/100 ml	NS	31	44	7200	292	0	24



The segment is listed as being impaired for bacteria for contact recreation. An RUAA is recommended to determine if primary contact recreation is the proper standard for this water body. Trend analysis did not indicate any trends in *E. coli* concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU-01	35.0 °C	N/A	30	5.5	28.8	23.1	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU-01	6.5 – 9.0 su	N/A	30	7.2	7.8	7.5	0	0

Trend analysis did not indicate any trends in pH over time.

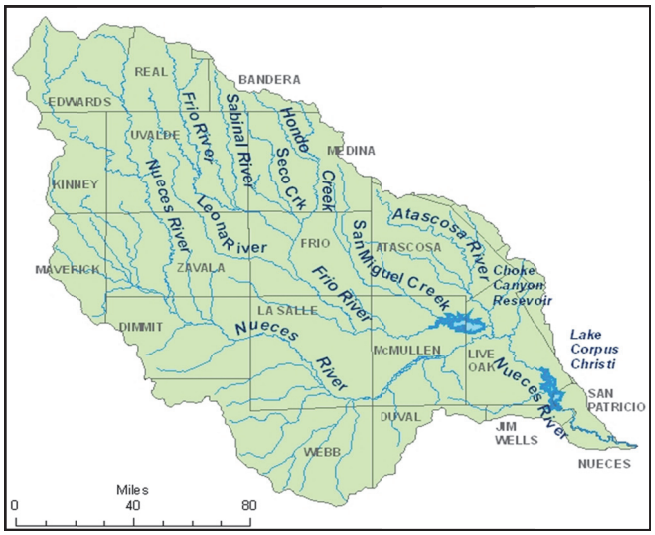
TDS		Status	# samples	Min	Max	Average	ND	>1700
AU-01	1700 mg/l	N/A	30	132	1716	1120	0	1

Trend analysis did not indicate any trends in TDS concentrations over time.

Sampling location for Station 12937 at SH 202

WATERSHED SUMMARIES OF THE SAN ANTONIO – NUECES COASTAL BASIN

The Nueces River Basin originates in Edwards County and extends approximately 315 miles to Nueces Bay near Corpus Christi. The basin is bordered by: the Colorado, Guadalupe, and San Antonio River Basins to the north; the San Antonio – Nueces Coastal Basin to the southeast; the Nueces – Rio Grande Coastal Basin to the south, and the Rio Grande River basin to the south and southwest. The total basin drainage area covers approximately 17,000 square miles, encompassing all or part of 23 counties in South-Central Texas. Rivers within the basin include the Atascosa River, the Frio River and its tributaries (San Miguel Creek, Hondo Creek, Sabinal River, and Leona River), and the Nueces River and its tributaries.



Throughout the basin, the rivers are used for water supply and recreational purposes. The basin is home to numerous state-operated recreational areas including: Choke Canyon State Park on the south side of Choke Canyon Reservoir near Three Rivers, Lake Corpus Christi State Park on the southeast bank of Lake Corpus Christi near Mathis, Garner State Park north of Concan, Tips State Recreational Area on the Frio River in Three Rivers, Lipantitlan State Historic Park State Historic Park near Sandia, Lost Maples State Natural Area north of Vanderpool, and Hill Country State Natural Area north of Hondo.

Water Quality Overview

The headwaters of the Nueces River Basin begin in Edwards, Real, and Bandera counties in the Edwards Plateau and include several spring fed creeks and rivers including the Nueces, Frio, and Sabinal rivers. Very few water quality concerns or impairments exist in this area. As the Nueces and its tributaries flow through the Southern Texas Plains flows become increasingly dependent on precipitation events to sustain river flows. Soils become finer and sediment loads build increasing turbidity. Salts and other minerals increase in concentration under low stream flow conditions. In times of moderate or extreme drought conditions, flows in the Nueces and Frio rivers may stop completely. Biological communities survive in isolated pools until flows resume. DO concentrations can be very low, especially in the summer months where high temperatures decrease available oxygen to fish and other aquatic species. Continued low flows allow for the increase in concentrations of other parameters, such as chlorophyll-a, nitrate, and total phosphorus. This results in concerns for these parameters until flow conditions improve. Impairments for bacteria also exist throughout the basin – the common causes being failing on-site sewage facilities (OSSF), wildlife, and feral hogs.

During flood events, water that originates near the headwaters can take several weeks to travel to the two main reservoirs in the lower half of the river basin. Choke Canyon Reservoir, located in McMullen and Live Oak Counties, is capable of impounding 662,821 AF of water from the Frio River and San Miguel creek. Lake Corpus Christi, located in Live Oak, San Patricio, and Jim Wells counties, is capable of impounding 256,339 AF of water from the Nueces, Frio, and Atascosa rivers. Water from Choke Canyon can be used to supplement Lake Corpus Christi in times of extreme drought. Together, both Lake Corpus Christi and Choke Canyon are known as the Reservoir System and supply water to many of the communities, cities, and industries in the region. Water in the Reservoir System is subject to the effects of evaporation in between rain events. Dissolved minerals concentrations tend to increase as water levels decrease.

In the lower basin, a WPP has been developed for the Lower Nueces River below Lake Corpus Christi. Management measures to address a TDS impairment, a chlorophyll-*a* concern, and increasing trends in bacteria, chloride, alkalinity, and TOC include repair and replacement of failing OSSFs, pet waste stations, large debris removal, and annual river cleanups. The installation of the pet waste stations and the large debris removal have been completed. An OSSF repair and replacement program is underway. The WPP and additional information is available at www.nuecesriverpartnership.org.

Several RUAAs have been conducted in the basin to evaluate the appropriate contact recreation for the segments. For the Atascosa River and San Miguel Creek, the RUAAs determined that no primary contact recreation is occurring on the river, but there were instances of secondary contact recreation occurring. Stakeholders for each segment expressed an interest in wanting to see the river and creek reclassified as secondary contact recreation. For the Leona River, although no contact recreation was confirmed, in large part due to the drought, the stakeholders have expressed interest in being able to use the river for recreational purposes when there is sufficient flow. Therefore, they are not in favor of changing the standard from primary contact recreation to secondary contact recreation.

A TMDL to address the nitrate concern in the Lower Sabinal River resulted in a new WWTP for the City of Sabinal. The old plant was periodically inundated during flood events. The nitrate levels since 2011 when the new plant went online, have decreased slightly.

The upper basin experienced a rapid increase in the invasive giant cane (*Arundo donax*). *Arundo* is very similar in appearance to common reed (*Phragmites*) or bamboo. *Arundo* is a vigorous plant that, once established, can create dense patches that out compete native vegetation in both wet and dry areas. In response to the rapid colonization of Arundo, NRA staff and landowners banded together and formed an alliance know as Pull.Kill.Plant. The project's aim is to stop the spread of the plant while restoring native riparian plant communities. The process includes the physical removal the plants and aerial application of a herbicide. The project has aligned landowners with state and federal agencies under a common cause.

FY2018 Monitoring Locations in the Nueces River Basin

Segment Name	Station Id	Description	Monitoring Entity	Conventional, Bacteria, Field	Other
2101 Nueces River Tidal	12960 (AU_01)	North of Viola Turning Basin	TCEQ Region 14	Bi-annually	
2102 Nueces River Below Lake Corpus Christi	21815 (AU_01)	Immediately upstream of the saltwater barrier dam at Labonte Park	NRA	Quarterly	
	20936 (AU_01)	At Hazel Bazemore Park Boat Ramp	NRA	Quarterly	
	12964 (AU_01)	Bluntzer Bridge at FM 666	NRA	Quarterly	
	12965 (AU_02)	At La Fruta Bridge on SH 359	NRA	Quarterly	
2103 Lake Corpus Christi	12967 (AU_01)	380 m north-northwest of northern tip of dam	NRA	Quarterly	
	17384 (AU_04)	0.2 miles off western shore directly west of Hideaway Hill	NRA	Quarterly	
	17648 (AU_06)	At Live Oak CR 151 near River Creek Acres	NRA	Quarterly	
2104 Nueces River Above Frio River	12972 (AU_01)	At FM 1042 bridge 1.2 miles north of Simmons	NRA	Quarterly	
	12973 (AU_02)	At SH 16 south of Tilden	NRA	Quarterly	
	12974 (AU_03)	At FM 624	NRA		(4) 24-Hr DO
2105 Nueces River Above Holland Dam	12975 (AU_01)	At Business IH 35 south of Cotulla	TCEQ Region 16	Quarterly	
	12976 (AU_02)	At FM 190-north of Asherton	TCEQ Region 16	Quarterly	
	20156 (AU_02)	Immediately upstream of SH 85 approximately 12 miles east of Carrizo Springs	TCEQ Region 16	Quarterly	

Segment Name	Station Id	Description	Monitoring Entity	Conventional, Bacteria, Field	Other
2106 Nueces / Lower Frio River	12979 (AU_01)	At US 281 south of Three Rivers	NRA	Quarterly	
	20701 (AU_01)	Northeast of the intersection of Airport Rd and CR 379 / Paisano Dr.	NRA	Quarterly	
	12977 (AU_02)	At US 72 in Three Rivers	NRA	Quarterly	
2107 Atascosa River	12980 (AU_01)	At FM 99 west of Whitsett	NRA	Quarterly	
	20764 (AU_02)	At FM 541	NRA	Quarterly	(4) 24-Hr DO
	12981 (AU-03)	On dirt road directly east of Pleasanton at railroad bridge	NRA		(4) 24-Hr DO
2108 San Miguel Creek	12983 (AU_01)	At SH 16 north of Tilden	NRA	Quarterly	
2109 Leona River	12987 (AU_02)	At US 57 near Batesville	TCEQ Region 16	Bi-annually	
	18418 (AU_03)	370 m upstream of FM 140	NRA	Quarterly	
2110 Lower Sabinal River	12993 (AU_01)	At US 90 west of Sabinal	TCEQ Region 13	Quarterly	
2111 Upper Sabinal River	21948 (AU_01)	At RR 187 approx. 10 km south of Utopia and 400 m upstream of confluence with Onion Creek	BCRAGD	Quarterly	
	14939 (AU_02)	At FM 187 south of Vanderpool	BCRAGD	Quarterly	
2112 Upper Nueces River	12996 (AU_01)	20 m upstream of US 57 south of Uvalde	TCEQ Region 16	Bi-annually	
	17143 (AU_01)	At Lake Averhoff / Upper Nueces Lake 1.62 km upstream of Texas Parks and Wildlife Department (TPWD) boat ramp	TCEQ Region 16	Quarterly	
	16704 (AU_03)	Immediately downstream of SH 55 southbound bridge approx 2.5 km south of Laguna	NRA	Quarterly	
2113 Upper Frio River	13006 (AU_01)	At SH 127 east of Concan	TCEQ Region 13	Bi-annually	
2114 Hondo Creek	18408 (AU_01)	At FM 173 southeast of Hondo	NRA	Quarterly	
2115 Seco Creek	13017 (AU_02)	At SH 470 approximately 10 miles west of Tarpley	BCRAGD	Quarterly	
2116 Choke Canyon Reservoir	13020 (AU_03)	Mid lake 15 m east of Live Oak/McMullen County line near old HWY 99 1.25 km north of Choke Canyon State Park Point	NRA	Quarterly	
	17389 (AU_06)	0.45 km southeast of FM 99 southern most bridge crossing the Frio River Arm	NRA	Quarterly	
2117 Frio River Above Choke Canyon Reservoir	13023 (AU_01)	At SH 16 in Tilden	NRA	Quarterly	
	18373 (AU_02)	Immediately upstream of SH 97 north of Fowlerton	NRA	Quarterly	

Permitted Discharges in the Nueces River Basin

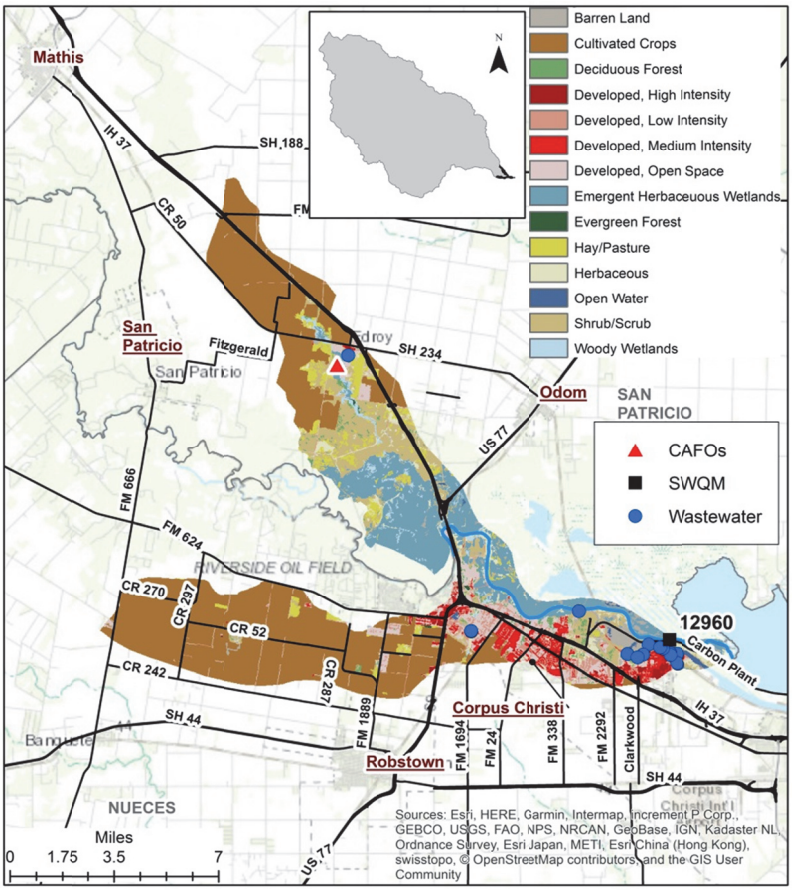
Segment	Permit Number	Entity	Permitted Discharge (gpd)
2101 Nueces River Tidal	WQ0000531-000	Flint Hill Resources Limited Partnership (LP)	Stormwater
	WQ0001255-000	Lon C Hill Power Plant	1,098,000
	WQ0004934-000	City of Corpus Christi	Sludge
	WQ0010401-006	City of Corpus Christi (Allison Plant)	5,000,000
	WQ0013644-001	San Patricio County MUD No. 1	75,000
2102 Nueces River Below Lake Corpus Christi	WQ0002027-001	Wright Gravel Pits	No discharge
2103 Lake Corpus Christi	WQ0004859-000	101 Bar Ranch	Sludge & Domestic Septic
	WQ0010015-001	City of Mathis	947,000
	WQ0010455-002	City of George West	539,000
	WQ0011165-001	Texas Parks and Wildlife Department (TPWD) – Lake Corpus Christi State Par	67,000 Irrigation and Evaporation
2104 Nueces River Above Frio River	WQ0004184-000	Webb County – Colorado Acres Water Plant	28,800 Evaporation
	WQ0005091-000	MultiChem Group Three Rives Facility	11,500 Reject Water
	WQ0010088-001	Freer Water Control and Improvement District (WCID)	280,000 Irrigation
	WQ0013461-001	US Department of Justice (DOJ)	300,000
	WQ0013943-001	Encinal WSC	95,000 Irrigation
2105 Nueces River Above Holland Dam	WQ0000546-000	Del Monte Foods (Crystal City Plant)	1,800,000 Irrigation
	WQ0010098-001	City of Crystal City	1,200,000
	WQ0010145-001	City of Carrizo Springs	950,000
	WQ0010153-001	City of Cotulla	990,000
	WQ0013746-001	City of Asherton	200,000
	WQ0013782-001	City of Big Wells	150,000
	WQ0014006-001	Zavala County (Crystal City Land Fill)	50,000
	WQ0015047-001	MacBain Properties Inc.	14,000 Irrigation
	WQ0015049-001 (pending)	Quail Run Services Limited Liability Corporation (LLC)	300,000
2106 Nueces / Lower Frio River	WQ0001353-000	Diamond Shamrock Refining Company	1,500,000
	WQ0010301-003	City of Three Rivers	400,000
2107 Atascosa River	WQ0002043-000 (8 outfalls)	San Miguel Electric Cooperative	62,000 Evaporation
	WQ0002601-000	San Miguel Electric Cooperative	Stormwater
	WQ0010096-001	City of Lytle	450,000
	WQ0010418-001	City of Jourdanton	980,000
	WQ0010598-001	City of Pleasanton	1,420,000
	WQ0013630-001	City of Poteet	640,000
	WQ0014767-001	TxDOT (Northbound rest stop):	10,000
	WQ0014768-001	TxDOT (Southbound rest stop)	10,000
	WQ0015400-001	Benton City	15,000,000
2108 San Miguel Creek	WQ0002043-000 (1 outfall)	San Miguel Electric Cooperative	62,000 Evaporation
	WQ0010142-001	City of Charlotte	220,000
	WQ0010160-001	City of Devine	650,000
	WQ0011806-001	City of Natalia	190,000
	WQ0014239-001	Moore WSC	65,000
2109 Leona River	WQ0010306-001	City of Uvalde	970,000
	WQ0014394-001	Batesville WSC	184,000

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2110 Lower Sabinal River	WQ0014689-001	City of Sabinal	340,000
2111 Upper Sabinal River	WQ0011951-001	Lost Maples State Park	8,000 Irrigation
2112 Upper Nueces River	WQ0012334-001	City of Camp Wood	101,000 Irrigation
	WQ0014367-002	Zavala County WCID	330,000 Irrigation
2113 Upper Frio River	WQ0011683-001	Alto Frio Baptist Encampment	20,000
	WQ0015083-001	NRA	360,000 (May – Sep) 180,000 (Oct – Apr) Irrigation
2114 Hondo Creek	WQ0010189-001	City of Hondo	1,800,000
2115 Seco Creek	WQ0011144-001	Medina County WCID 002	80,000
2116 Choke Canyon Reservoir	WQ0013100-001	TPWD – Choke Canyon State Park, Calliham Unit	13,000
	WQ0013461-001	US DOJ – Federal Corrections Institution at Three Rivers	300,000 Irrigation and Discharge
2117 Frio River Above Choke Canyon Reservoir	WQ0010360-001	City of Pearsall	1,950,000
	WQ0010404-002	City of Dilley	300,000
	WQ0010404-003	City of Dilley	800,000
	WQ0010404-005	City of Dilley	30,000
	WQ0010404-006	City of Dilley	30,000
	WQ0010404-007	City of Dilley	800,000
	WQ0011962-00	Garner State Park	60,000 Irrigation
	WQ0014945-001	McMullen County WCID No. 1 and McMullen County	96,000
	WQ0015016-001	South Central Water Company	300,000
	WQ0015043-001	Seventy Seven Land Company LCC	24,000
	WQ0015084-001	La Salle Oil Field Services	120,000 Irrigation

NUECES RIVER TIDAL – SEGMENT 2101

Segment 2101, Nueces River Tidal, forms part of the county line between Nueces and San Patricio Counties. It flows 12 miles from Calallen Dam 1.7 km (1.1 miles) upstream of US 77 / IH 37 to its confluence with Nueces Bay. Its watershed is 175,301 acres. The City of Corpus Christi borders the south bank of the river. A large portion of the area north of the river is included in the Coastal Bend Bays and Estuaries Program's (CBBEP) Nueces Delta Preserve. The rest is owned by private ranches.

Fresh water inflow into this segment of the river is primarily controlled by the pass-through requirements related to the Choke Canyon / Lake Corpus Christi Reservoir System. In general, and since 2001, the amount of water released from Lake Corpus Christi for freshwater inflows into the Nueces Estuary is based on the amount of water that has flowed into the reservoir system. The Rincon Bayou Pipeline diverts some of the freshwater inflows to the upper delta instead of being passed down the river. Therefore, except during times of major flooding, the water more or less sloshes back and forth with tides.



Water Quality Analysis

The analysis for this segment is based on data from **Station 12960**, north of the Viola Turning Basin and 2.11 miles upstream of the confluence with Nueces Bay.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	37	4.7	15.7	8.2	0	0
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	20	<10	2400	24.4	9	5

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

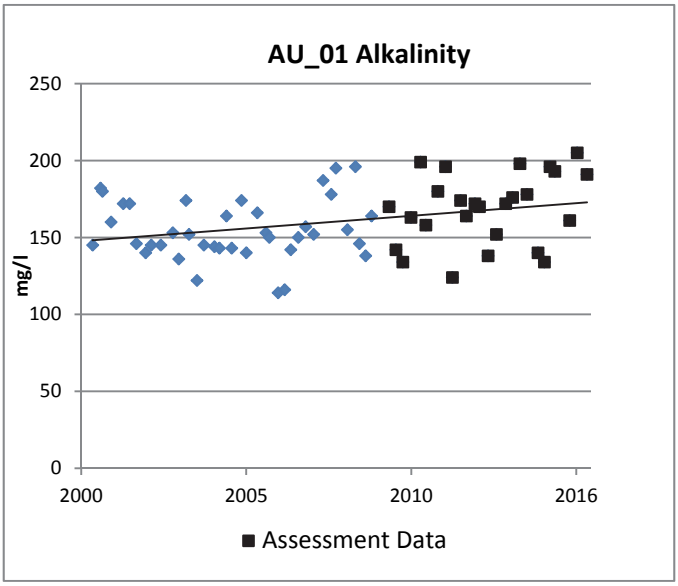
Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	37	11.9	32.2	24.5	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	37	8.0	9.1	8.5	0	1

Trend analysis did not indicate any trends in pH levels over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	124	205	171

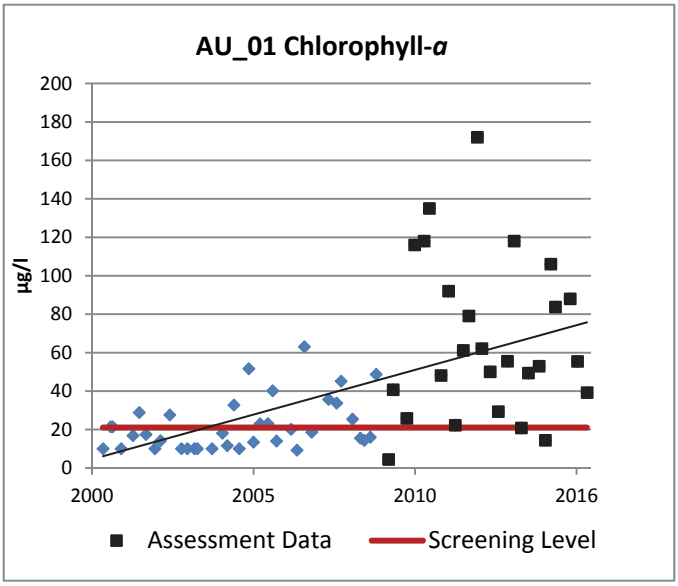


Trend analysis indicates an increasing trend in alkalinity over time (t = 2.78, p = 0.007), and may be result of the less frequent flushing of the river because of the Rincon Bayou Pipeline.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	26	<0.02	0.26	0.02	19	0

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21µg/l	CS	26	4.47	172	55.4	0	23

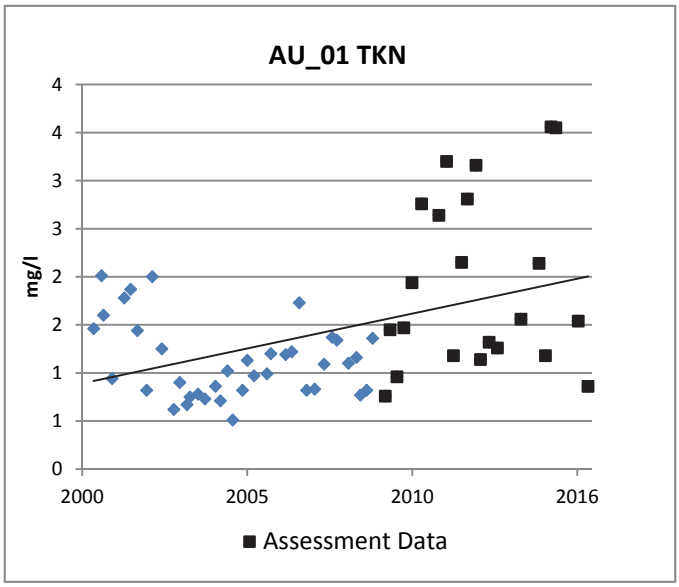


The segment is assessed as having a concern for chlorophyll-*a*, and may be the result of the less frequent flushing of the river. Trend analysis indicates an increasing trend in chlorophyll-*a* concentrations over time (t = 5.46, p = 0.000).

Nitrate		Status	# samples	Min	Max	Median	ND	>1.10
AU_01	1.10 mg/l	NC	26	<0.04	0.56	0.04	19	0

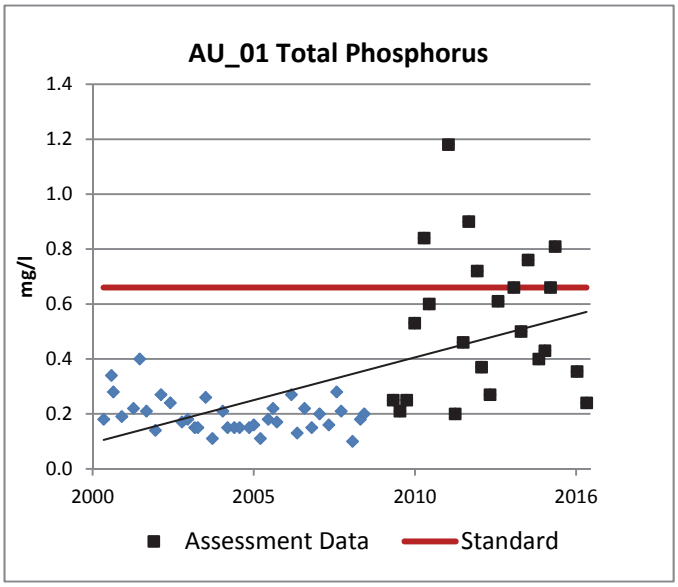
Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	0.76	3.56	1.55



Trend analysis indicates an increasing trend in TKN concentrations over time (t = 3.50, p = 0.001), and may be result of the less frequent flushing of the river.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	23	0.2	1.18	0.5	0	6

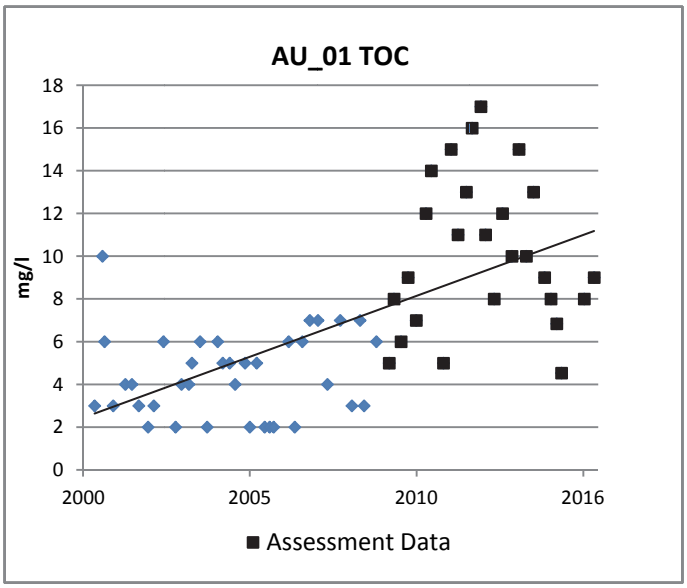


Trend analysis indicates an increasing trend in total phosphorus concentrations over time (t = 5.69, p = 0.000) and >20% of the samples exceed the standard. This may be result of the less frequent flushing of the river. The observed change in the concentration levels correlates to the termination of a demonstration project that began in the late 1990s. This project diverted some of the effluent from the City of Corpus Christi's Allison WWTP from the river to the Nueces Delta.

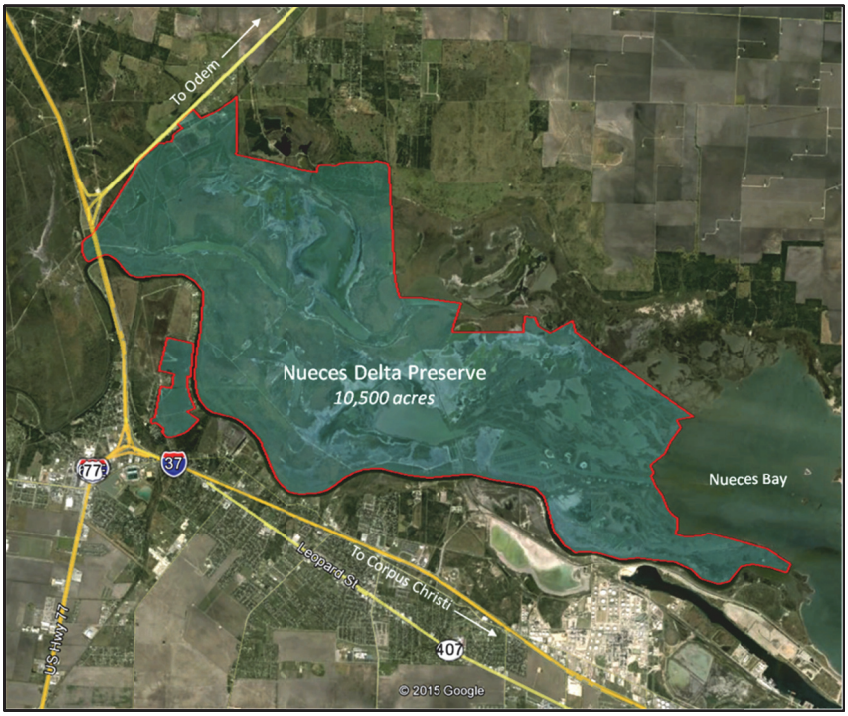
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	37	13	144	43

Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	4.53	17	9.5



Trend analysis indicates an increasing trend in TOC concentrations over time (t = 6.55, p = 0.000). The observed change in the concentration levels also correlates to the termination of the demonstration project.



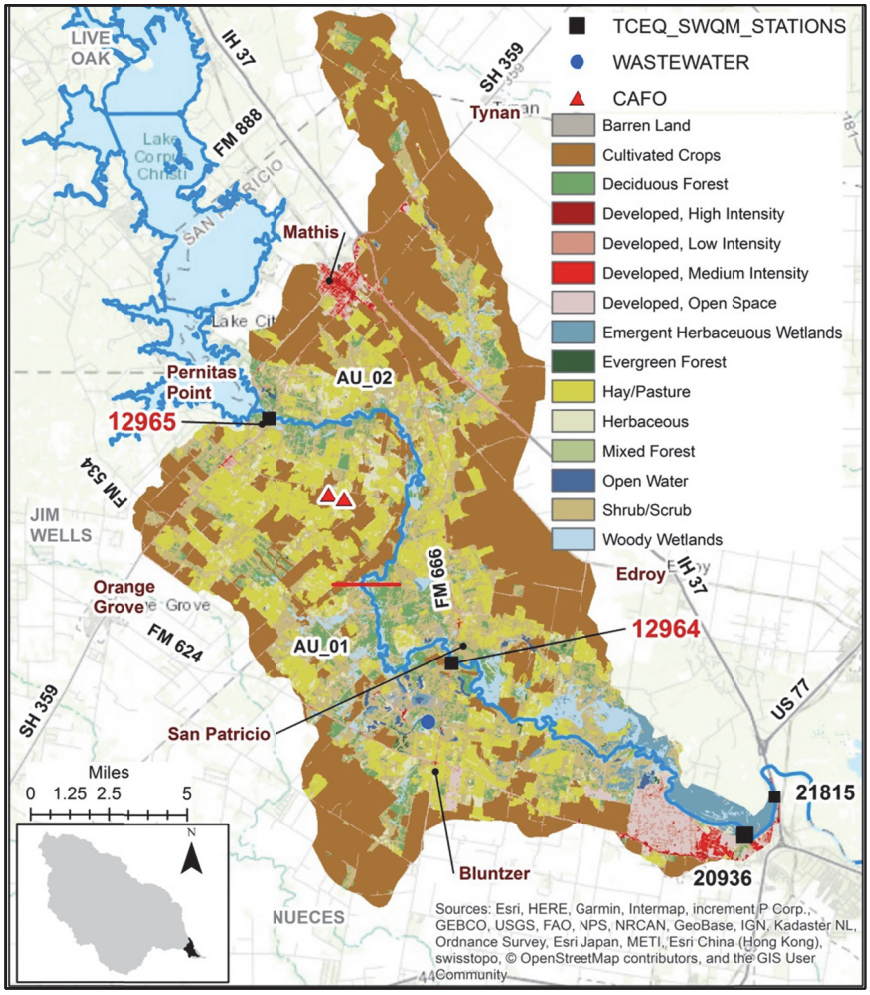
As mentioned in the segment description, a portion of the Nueces River Tidal watershed is within the CBBEP's Nueces Delta Preserve. It also includes a portion of the Nueces Bay, Segment 2482, watershed. The preserve consists of 10,500 acres located near Odem. It was acquired to protect a variety of habitats from future development. The CBBEP's education program is based at the preserve, and the property is used for various monitoring and freshwater inflow projects and for wildlife and habitat restoration projects.

The CBBEP is dedicated to protecting and restoring the health and productivity of the bays and estuaries in the Texas Coastal Bend, while supporting continued economic growth and public use of the bays. They work with local governments, conservation groups, teachers, students, and the public to raise awareness of our natural surroundings through research, restoration and recreation projects, and environmental education. The health, beauty, and bounty of our bays and estuaries are essential for continued enjoyment of both people and wildlife.

Visit the CBBEP's website, http://www.cbbep.org/, for more information about the Nueces Delta Preserve and the CBBEP.

NUECES RIVER BELOW LAKE CORPUS CHRISTI – SEGMENT 2102

Segment 2102, Nueces River Below Lake Corpus Christi, forms part of the county line between Jim Wells and San Patricio Counties and between Nueces and San Patricio Counties. It flows 39 miles from Wesley Seale Dam at Lake Corpus Christi to Calallen Dam 1.7 km (1.1 miles) upstream of US 77 / IH 37. Its watershed is 116,863 acres. **AU_01** is the reach from the downstream end of the segment at the Saltwater Barrier Dam to the confluence with Javelin Creek just downstream of the Jim Wells/Nueces county line. **AU_02** is the reach from the upstream end of AU_01 to the upstream end of the segment at Wesley E. Seale Dam at Lake Corpus Christi. The flow in this segment is controlled by the releases from the dam except during rare times when the lake is full and spills, and / or heavy rains occur below the dam.



The City of Corpus Christi borders the south bank of the river in the lower 10 miles of the segment. The City conducts its own water quality monitoring as this is the primary drinking water source for the area. There are several freshwater intakes in the Calallen Pool just above the Saltwater Barrier Dam. The upper half of the segment is primarily private ranches and farms. There are numerous, active and inactive, sand and gravel pits in the lower half.

Special Studies

A WPP has been developed for this segment of the Nueces River with funding from the City of Corpus and a Clean Water Act §319(h) grant to NRA, administered by the TSSWCB, from the EPA. The WPP was approved by the EPA in April 2016. The WPP and implementation progress can be found at www.nuecesriverpartnership.org.

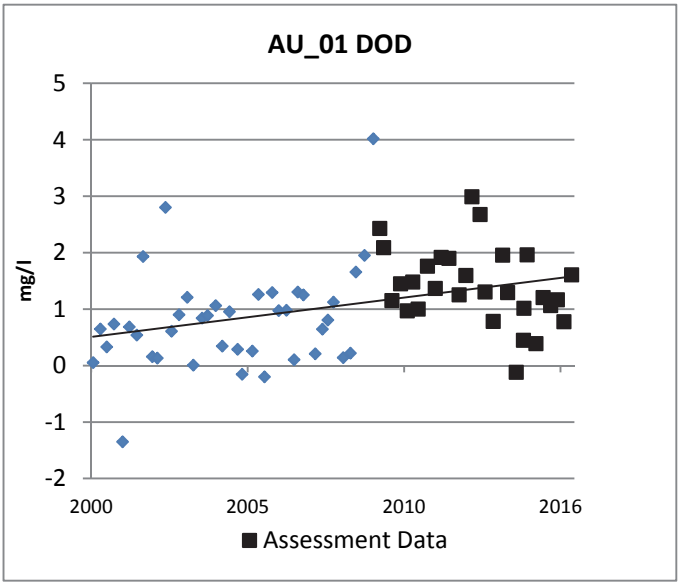
Water Quality Analysis

The analysis for AU_01 is based on data from **Station 12964** at FM 666. The analysis for AU_02 is based on data from **Station 12965** at SH 359.

Nueces River, looking downstream from FM 666 near Bluntzer, location of Station 12964.

Aquatic Life Use Assessment

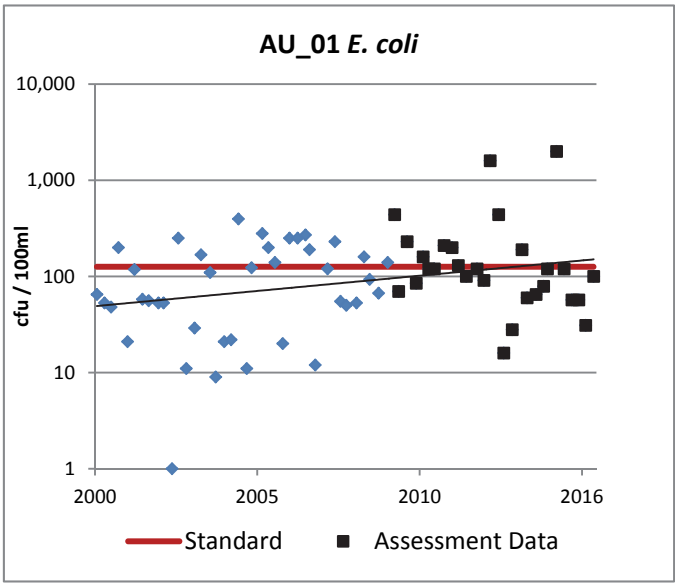
DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	29	5.1	10.6	7.2	0	0
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	FS	29	7.1	11.5	8.5	0	0
	Screening Level 5.0 mg/l	NC						



Trend analysis indicates an increasing trend in the DO Deficit over time at AU_01 (t = 3.18, p = 0.002). The measured DO concentrations, however, indicate that this parameter will continue to meet the water quality standards.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	28	16	2000	124.3	0	10
AU_02		FS	28	6	2400	32.3	0	1

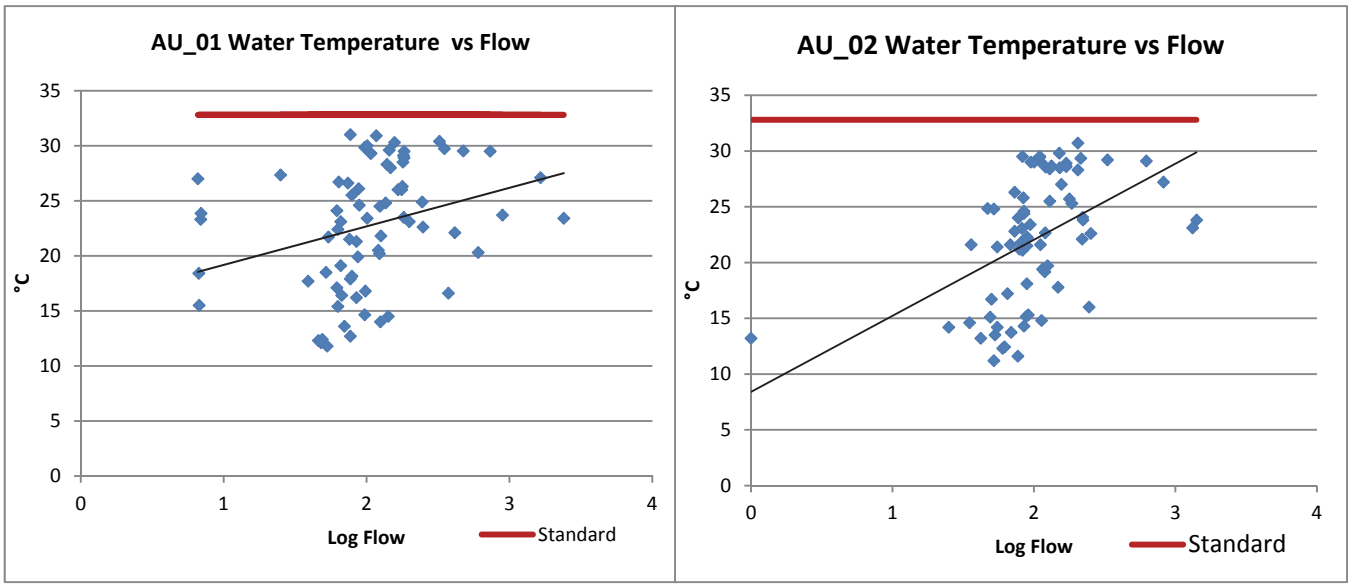


Trend analysis indicates an increasing trend in *E. coli* over time at AU_01 (t = 2.38, p = 0.020), and the geomean is approaching the standard. Wildlife, feral hogs, pets, and failing septic systems are assumed to be the primary contributors to the bacteria loading. Implementation of two of the WPP management strategies that address failing septic systems are underway. The OSSF inspection, repair, and replacement program began in October 2017. As of June 30, 2018, 43 inspections, five repairs, and 14 replacements had been completed. Fourteen of the systems were found to be in good working order. One additional system need repairs and five systems need to be replaced. The OSSF conversion feasibility study to connect some homes in the Calallen area to the City of Corpus Christi's existing wastewater infrastructure began in December 2017. Results will be provided to the residents upon completion.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.8
AU_01	32.8 °C	FS	29	11.8	31.0	23.1	0
AU_02		FS	29	11.2	29.5	22.8	0

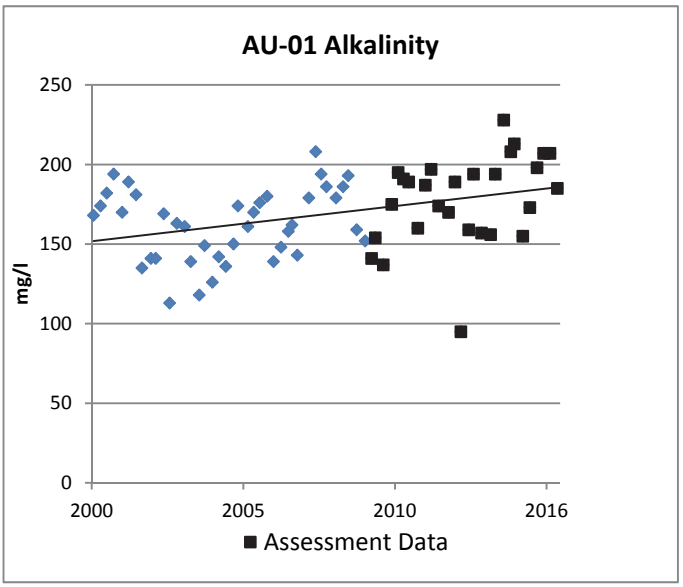
Trend analysis indicates an increasing trend in water temperature related to flow at AU_01 (t = 2.67, p = 0.009) and at AU_02 (t = 4.63, p = 0.000).



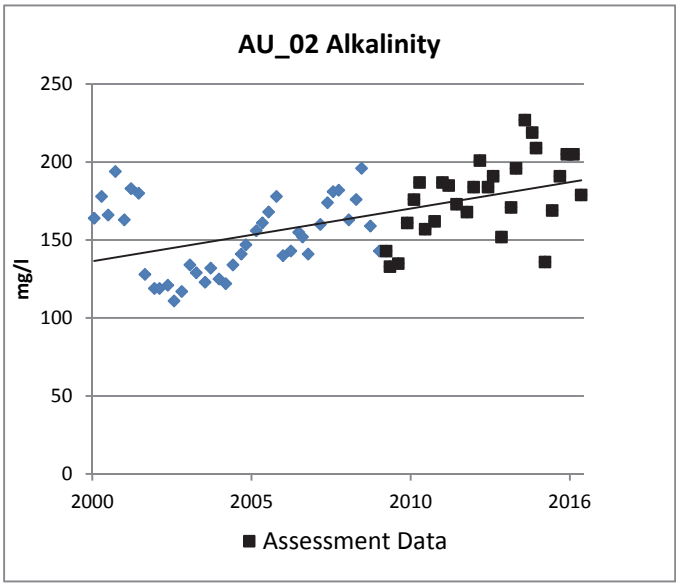
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	29	7.6	8.5	8.0	0	0
AU_02		FS	28	7.9	8.6	8.4	0	0

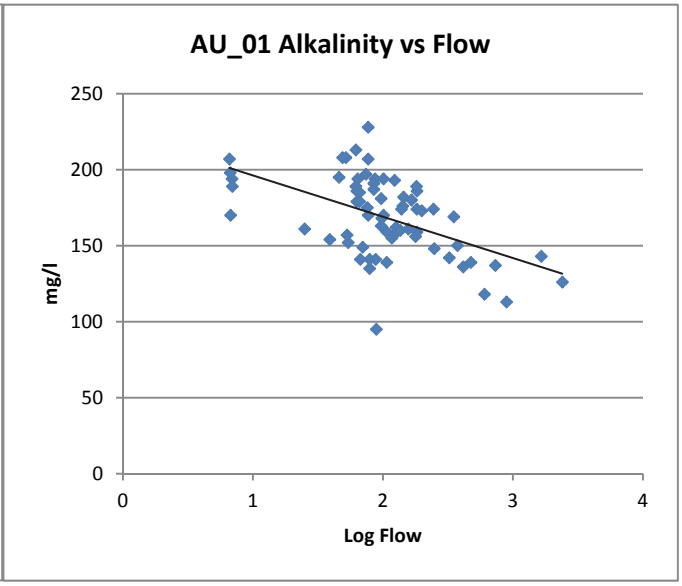
Trend analysis did not indicate any trends in pH in either AU over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	95	228	186
AU_02		N/A	28	133	227	182



Trend analysis indicates increasing trends in alkalinity over time in AU_01 (t = 3.38, p = 0.001) and in AU_02 (t = 5.45, p = 0.000), and a decreasing trend related to flow in AU_01 (t = -2.50, p = 0.015). These trends are consistent with those observed for chloride and TDS in this segment, and may be related to the runoff from agricultural lands, storm water runoff, failing septic systems, oil and gas production, and groundwater seepage sources attributed to the TDS impairment.

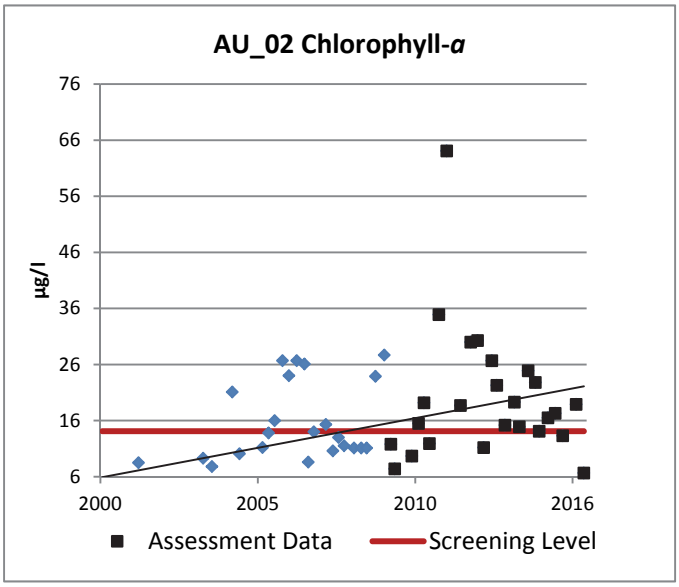




Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	28	<0.02	0.100	0.035	9	0
AU_02		NC	28	<0.02	0.149	0.02	15	0

Trend analysis did not indicate any trends in ammonia levels in either AU over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	28	<2	39	3.96	3	2
AU_02		CS	28	5	64	16.0	0	17



Both AUs were included in the 2014 Integrated Report as having concerns for chlorophyll-*a*. This concern has been removed in the Draft 2016 Integrated Report for AU_01. Trend analysis indicates an increasing trend in chlorophyll-*a* over time in AU_02 ($t = 3.95$, $p = 0.000$).

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	28	<0.02	0.451	0.140	1	0
AU_02		NC	28	<0.01	0.381	0.045	11	0

Trend analysis did not indicate any trends in nitrate concentrations in either AU over time or with respect to flow.

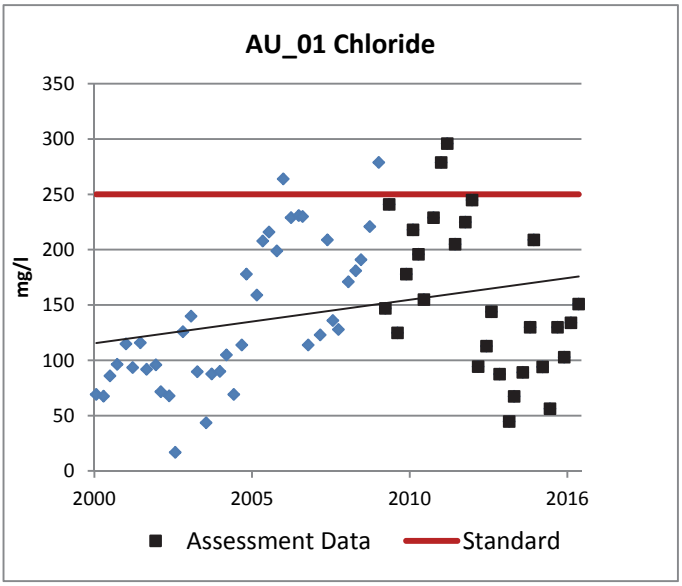
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	28	0.096	0.353	0.220	0	0
AU_02		NC	28	0.081	0.365	0.208	0	0

Trend analysis did not indicate any trends in total phosphorus concentrations in either AU over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	9.72	138	37.5
AU_02		N/A	28	6.3	65.9	17.6

Trend analysis did not indicate any trends in TSS concentrations in either AU over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	44.8	296	157	0	2
AU_02		FS	28	31.8	242	118	0	0



Trend analysis indicates an increasing trend in chloride concentrations over time in AU_01 ($t = 2.26$, $p = 0.027$), and may be related to groundwater seepage.

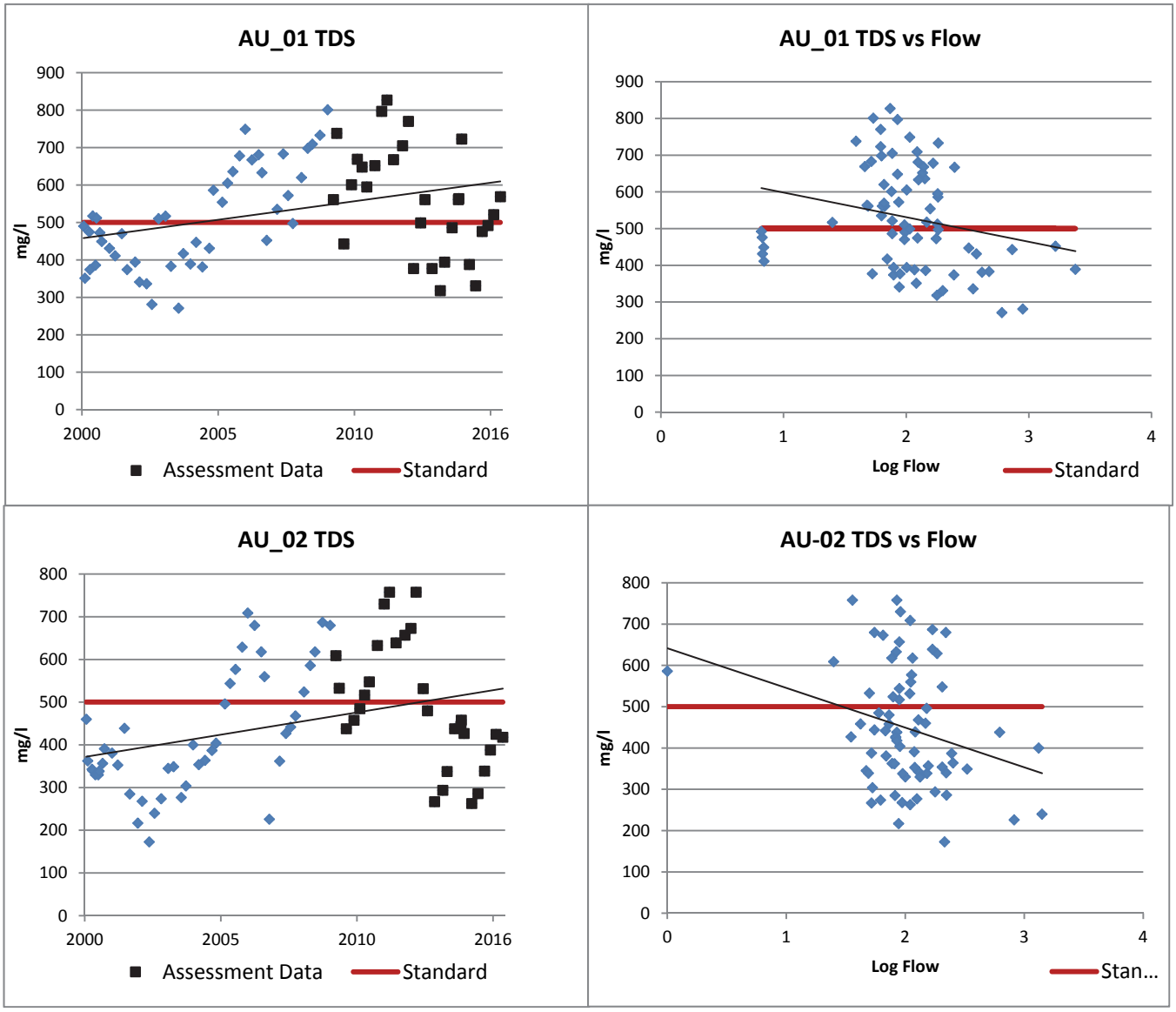
Sulfate		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	16.7	78.1	44.0	0	0
AU_02		FS	28	13.2	82.9	39.2	0	0

Trend analysis did not indicate any trends in sulfate concentrations in either AU over time or with respect to flow.

TDS		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	NS	29	318	827	562	0	18
AU_02		NS	29	263	758	491	0	12

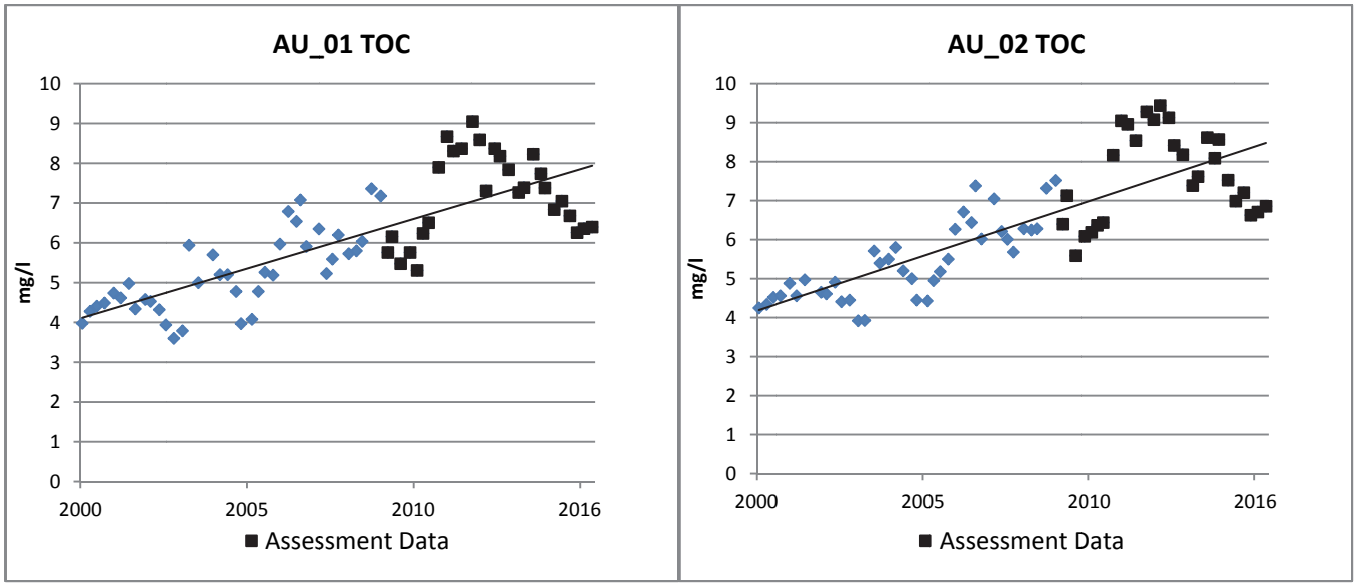
The segment was first listed as being impaired for TDS in the 2012 Assessment with an average concentration for the entire segment of 546 mg/l. The current combined average is 527 mg/l, with AU_02 just meeting the standard. Trend analysis indicates an increasing trend in TDS over time in AU_01 ($t = 3.05$, $p = 0.003$) and in AU_02 ($t = 3.09$, $p = 0.003$), and a decreasing trend related to flow in AU_01 ($t = -2.02$, $p = 0.047$) in AU_02 ($t = -2.32$, $p = 0.023$).

TDS levels can be attributed to many possible sources: runoff from agricultural lands, storm water runoff, failing septic systems, oil and gas production, and groundwater seepage. The decreasing trends related to flow are consistent with decreasing groundwater seepage during higher flows. A number of the management measures identified in the WPP address TDS loading from these sources.



TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	5.31	9.05	7.29
AU_02		N/A	28	5.59	9.44	7.58

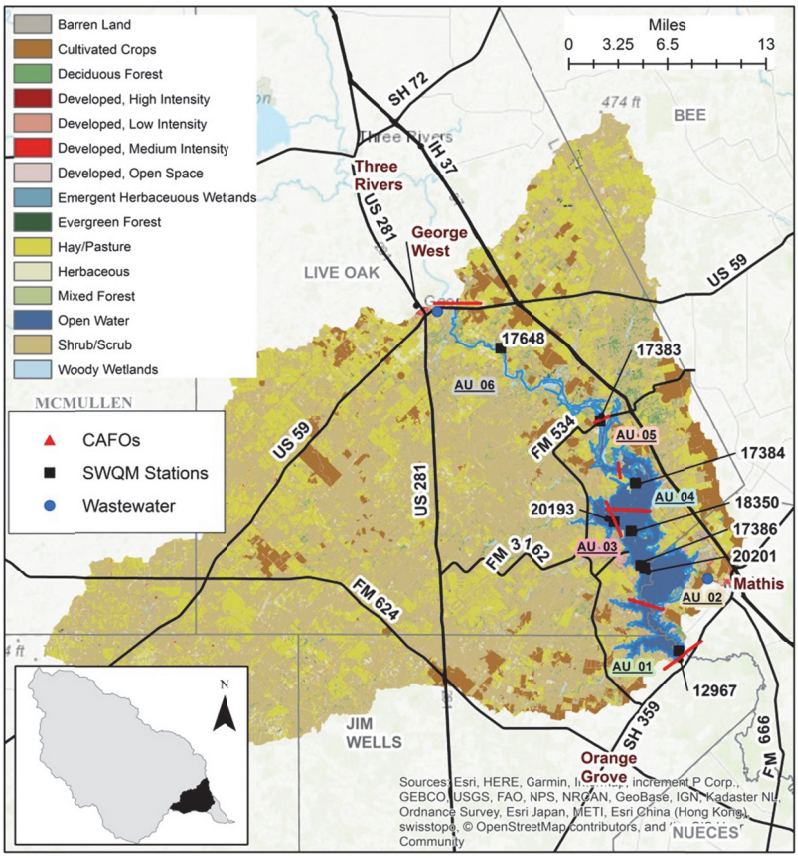
Trend analysis indicates increasing trends in TOC over time in AU_01 (t = 10.56, p = 0.000) and in AU-02 (t = 11.60, p = 0.000). These trends are likely associated with the increasing trends observed in the chloride and TDS concentrations.



The Nueces River, looking upstream from the saltwater barrier dam at Labonte Park in Calallen.

LAKE CORPUS CHRISTI – SEGMENT 2103

Segment 2103, Lake Corpus Christi, is formed by Wesley Seale Dam near Mathis and impounds the Nueces River. It is defined by the 94' above mean sea level (MSL) elevation. The lake covers portions of Live Oak, Jim Wells, and San Patricio Counties. The segment extends to a point 100 m (110 yards) upstream of US 59 in Live Oak County. Its watershed is 505,550 acres. When the lake is near capacity, the river levels are influenced by the lake level as far north as Airport Road north of George West.



The segment is divided into six AUs. **AU_01** is mid-lake near the dam. **AU_02** is the area approximately 4 miles SE of FM 3162 and FM 534 intersection near the western shore. **AU_03** is the western arm of the lake near the Lagarto Creek Inlet. **AU_04** is the upper portion of the lake on the opposite shore from Hideaway Hills. **AU_05** is the upper arm of the lake at FM 534 crossing. **AU_06** is the remaining riverine portion of the segment.

The City of George West is located near the upstream end of the segment. There are many smaller communities and individual homes surrounding the lake and along the river.

The last time the reservoir was full was in 2015. A graph of the water level from 2000 through 2016 is shown below.

Additional information about the reservoir is available at http://www.twdb.texas.gov/surfacewater/rivers/reservoirs/corpus_christi/index.asp.

Water Quality Analysis

The analysis for **AU_01** is based on data from **Station 12967** mid-lake at the dam. The analysis for **AU_02** is from 3 sites: **Station 18350** near the Lagarto Subdivision; **Station 20201** near the intersection of Live Oak Lane and Miller Drive; and **Station 17386** near the intersection of FM 3162 and FM 534. With no recent monitoring in these stations, there is insufficient data for the statistical analysis in AU_02. However, there was enough data from 2000 to 2010 for trend analysis for water temperature, DO, and pH. There is insufficient data for the statistical or trend analysis in **AU_03** due to very limited monitoring in this AU. However, TDS data from **Station 20193**, near the Lagarto Creek arm, is shown. The analysis for **AU_04** is based on data from **Station 17384** west of Hideaway Hill**.** There is insufficient data for the statistical or trend analysis in **AU_05** due to very limited monitoring in this AU. However, TDS data from **Station 20193**, at FM 534, is shown. The analysis for **AU_06** is based on data from **Station 17383** on the Nueces River at Live Oak CR 151. Trend analysis relative to lake level was evaluated for AU_01, AU_02, and AU_04. Trend analysis relative to flow was evaluated for AU_06.

New for the Draft 2016 Integrated Report are Reservoir Nutrient Assessment Data for chlorophyll-a, total nitrogen, and total phosphorus. These new criteria/threshold values will be discussed in the water quality discussions below.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	29	2.7	12.1	7.7	1	2
	Screening Level 5.0 mg/l	NC						
AU_04	Minimum 3.0 mg/l	FS	21	1.5	11.3	7.4	1	1
	Screening Level 5.0 mg/l	NC						
AU_06	Minimum 3.0 mg/l	FS	28	5.0	15.0	7.8	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends for either DO level or DOD in any of the AUs over time or with respect to the lake level or flow.

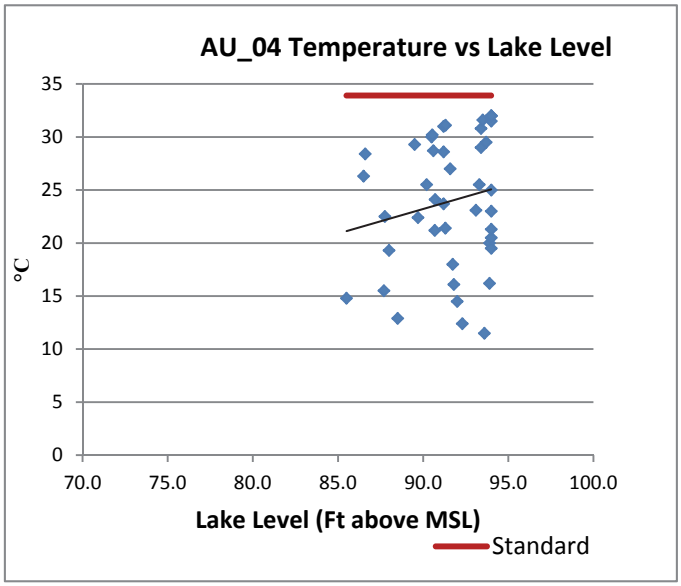
Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	28	<1	1400	2.94	4	1
AU_04		FS	20	<1	650	5.53	4	2
AU_06		FS	28	3	552	26.9	0	4

Trend analysis did not indicate any trends for *E. coli* in any of the AUs over time or with respect to the lake level or flow.

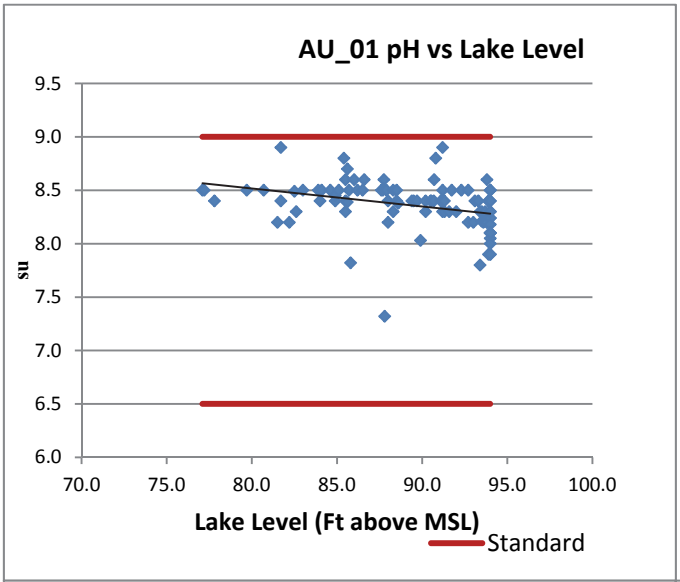
General Use

Water Temperature		Status	# samples	Min	Max	Median	>33.9
AU_01	33.9 °C	FS	31	12.6	30.7	24.0	0
AU_04		FS	21	12.4	31.6	23.7	0
AU_06		FS	28	12.5	32.8	25.0	0

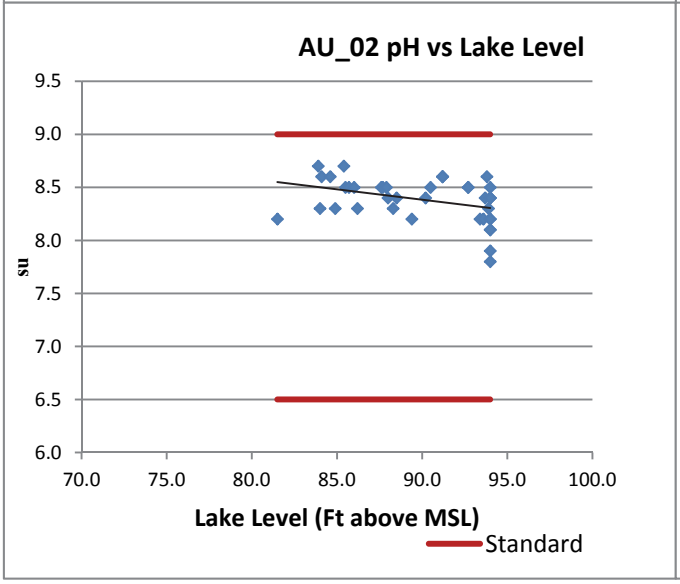


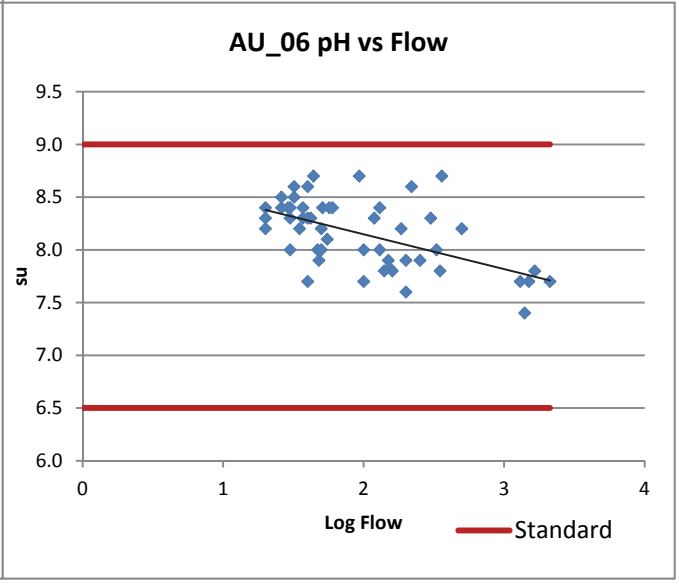
Trend analysis indicates an increasing trend in water temperature with respect to the lake level in AU_04 ($t = 2.24$, $p = 0.030$), but the temperatures themselves are below the standard.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	31	7.8	8.8	8.4	0	0
AU_04		FS	21	7.3	8.6	8.3	0	0
AU_06		FS	28	7.5	8.7	8.2	0	0



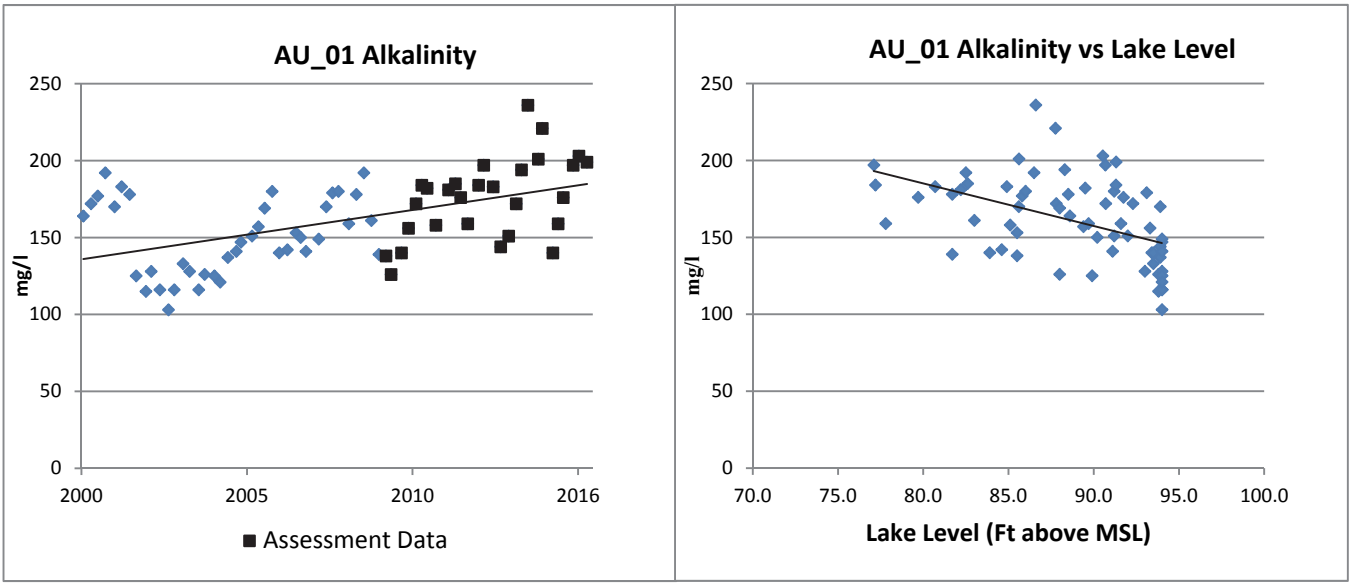
Trend analysis indicates a decreasing trend in pH levels in AU_01 (t = -3.50, p = 0.001) and in AU_02 (t = -2.53, p = 0.016) with respect to lake level. Trend analysis also indicates a decreasing trend in pH levels in AU_06 (t = -4.79, p = 0.000) with respect to flow. All of the pH readings in all of the AU's are within the standards range.



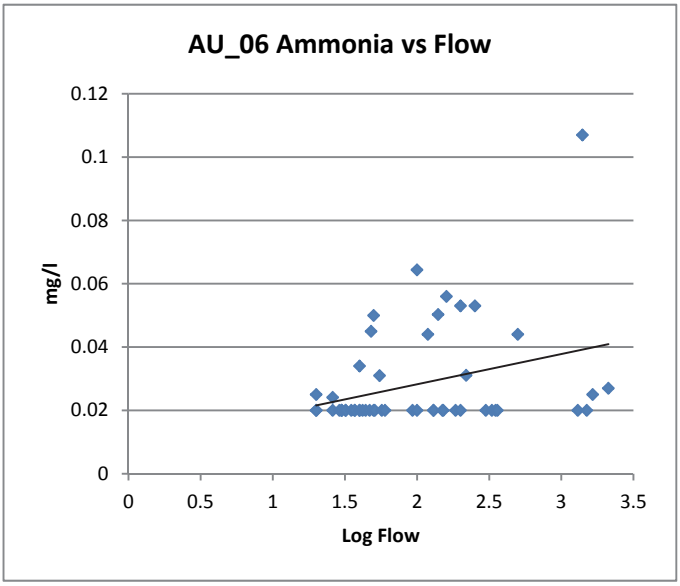


Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	126	236	178
AU_04		N/A	18	106	229	172
AU_06		N/A	28	85.6	219	159

Trend analysis indicates an increasing trend in alkalinity in AU_01 (t = 4.89, p = 0.000) over time and a decreasing trend (t = -2.48, p = 0.015) with respect to the lake level.



Ammonia		Status	# samples	Min	Max	Median	ND	>0.11
AU_01	0.11 mg/l	NC	28	<0.02	0.043	0.02	21	0
AU_04		NC	18	<0.02	0.061	0.02	16	0
AU_06		NC	28	<0.02	0.127	0.02	18	1

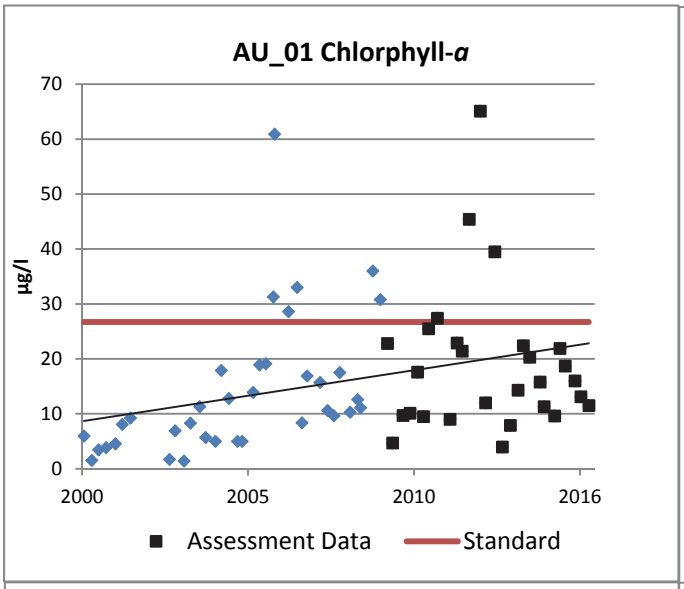


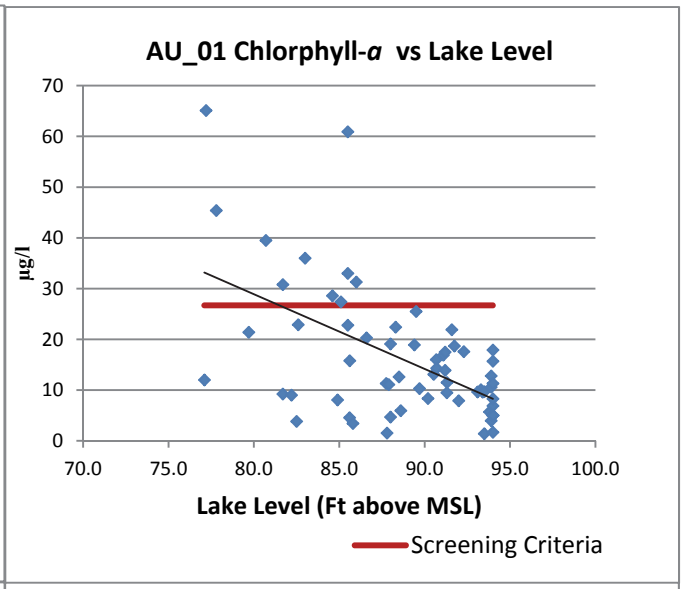
Trend analysis indicates an increasing trend in ammonia in AU_06 (t = 2.09, p = 0.042) with respect to flow. The majority of the values are below the detection limit, and only one exceeds the screening level.

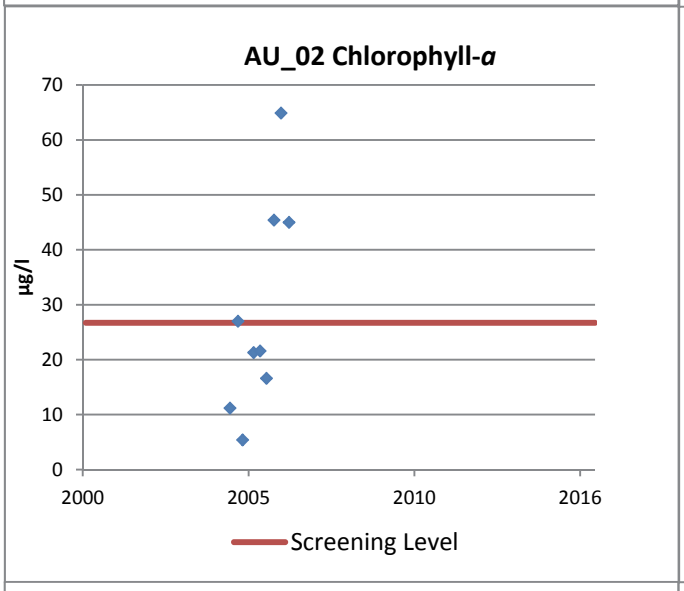
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>26.7
AU_01	26.7 µg/l	CS	28	3.97	65.1	15.9	0	4
AU_04		NC	18	6.91	29.6	19.2	0	3
AU_06		CS	28	2.79	83	23	0	8

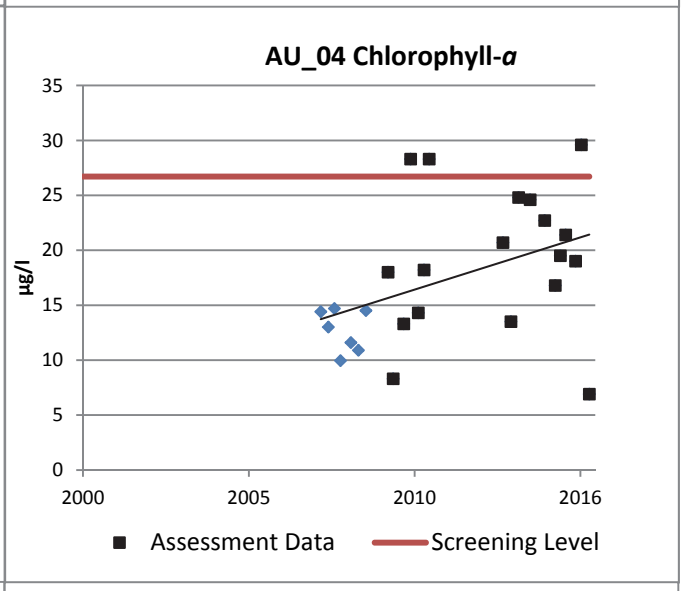
AU_01, AU_02, and AU_06 were all assessed as having concerns for chlorophyll-*a* in the 2014 Integrated Report. Trend analysis indicates increasing trends in AU_01 (t = 2.064, p = 0.010) and AU_04 (t = 2.44, p = 0.034) over time, decreasing trends in AU_01 (t = -5.36, p = 0.000) and AU_04 (t = -21.73, p = 0.090) with respect to the lake level, and a decreasing trend in AU_06 (t = -2.09, p = 0.041) with respect to flow.

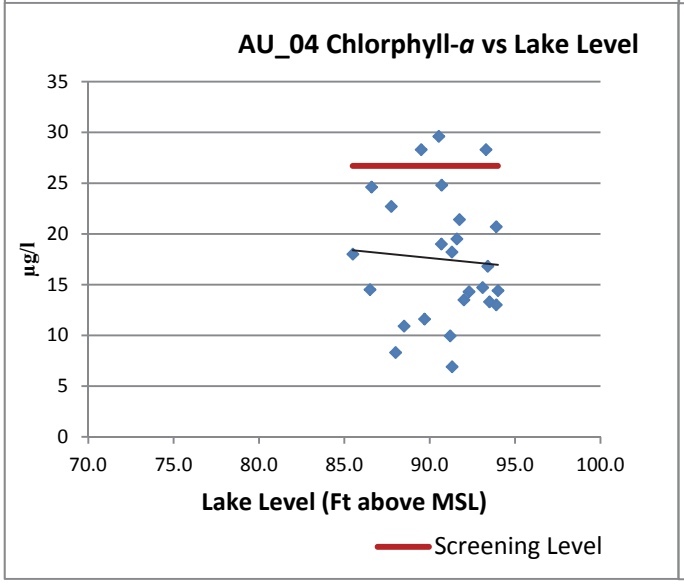
The criteria/threshold for chlorophyll-a in Lake Corpus Christi based on Reservoir Nutrient Assessment Data is 15.01 µg/l. Twenty-eight samples from AU_01 were assessed with a median of 15.90 µg/l.

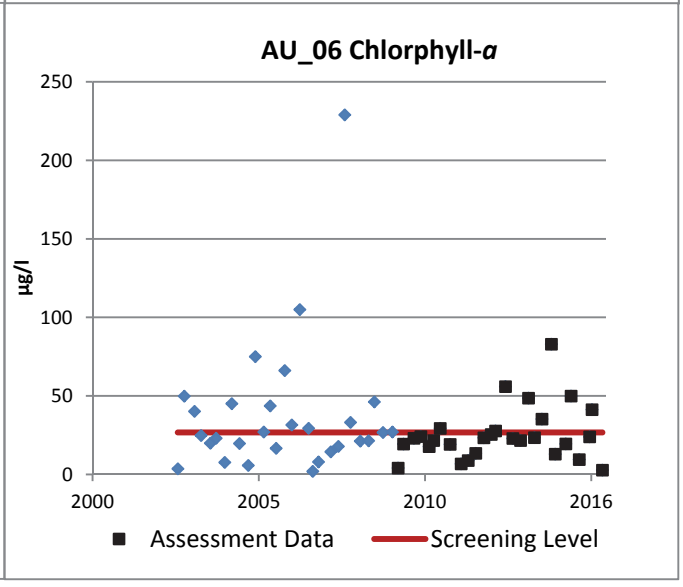

AU_01 Chlorphyll-a
µg/l
70
60
50
40
30
20
10
0
2000
2005
2010
2016
Assessment Data
Standard

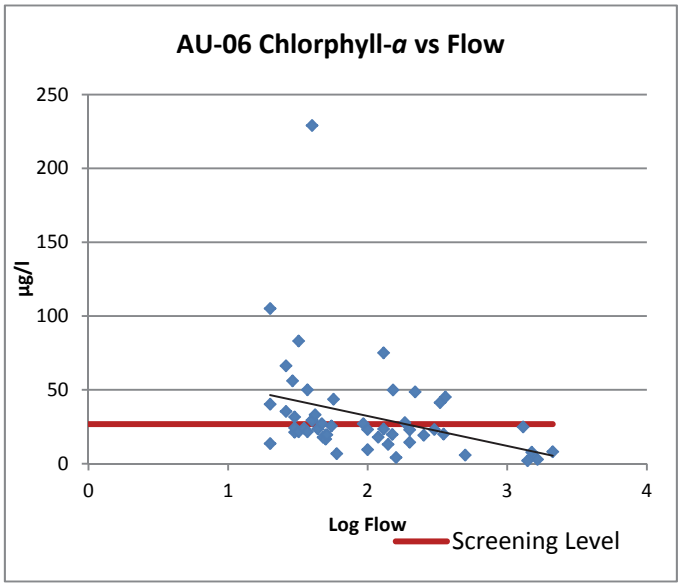

AU_01 Chlorphyll-a vs Lake Level
µg/l
70
60
50
40
30
20
10
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)
Screening Criteria


AU_02 Chlorophyll-a
µg/l
70
60
50
40
30
20
10
0
2000
2005
2010
2016
Screening Level

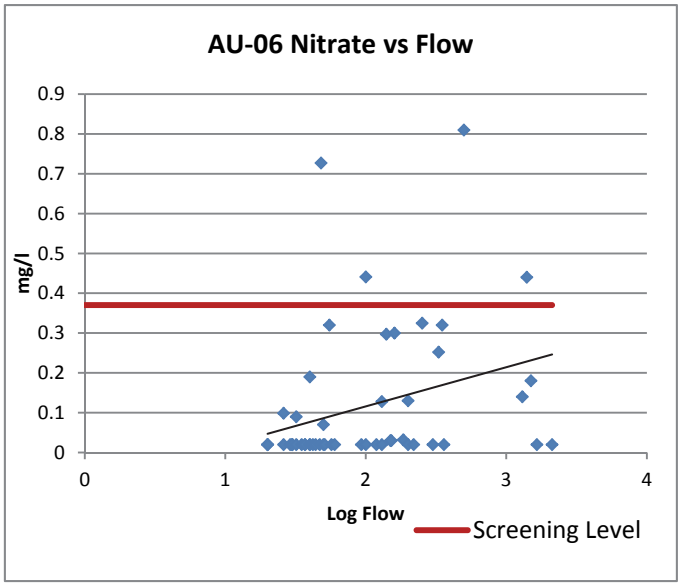

AU_04 Chlorophyll-a
µg/l
35
30
25
20
15
10
5
0
2000
2005
2010
2016
Assessment Data
Screening Level


AU_04 Chlorphyll-a vs Lake Level
µg/l
35
30
25
20
15
10
5
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)
Screening Level


AU_06 Chlorphyll-a
µg/l
250
200
150
100
50
0
2000
2005
2010
2016
Assessment Data
Screening Level



Nitrate		Status	# samples	Min	Max	Median	ND	>0.37
AU_01	0.37 mg/l	FS	28	<0.01	0.391	0.015	1	1
AU_04		FS	18	<0.02	0.054	0.02	16	0
AU_06		FS	28	<0.02	0.727	0.02	16	3



Trend analysis indicates an increasing trend in nitrate concentrations in AU_06 (t = 3.22, p = 0.002) with respect to flow.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	0.82	2.11	1.06
AU_04		N/A	11	0.84	1.56	1.11
AU_06		N/A	21	0.91	2.34	1.38

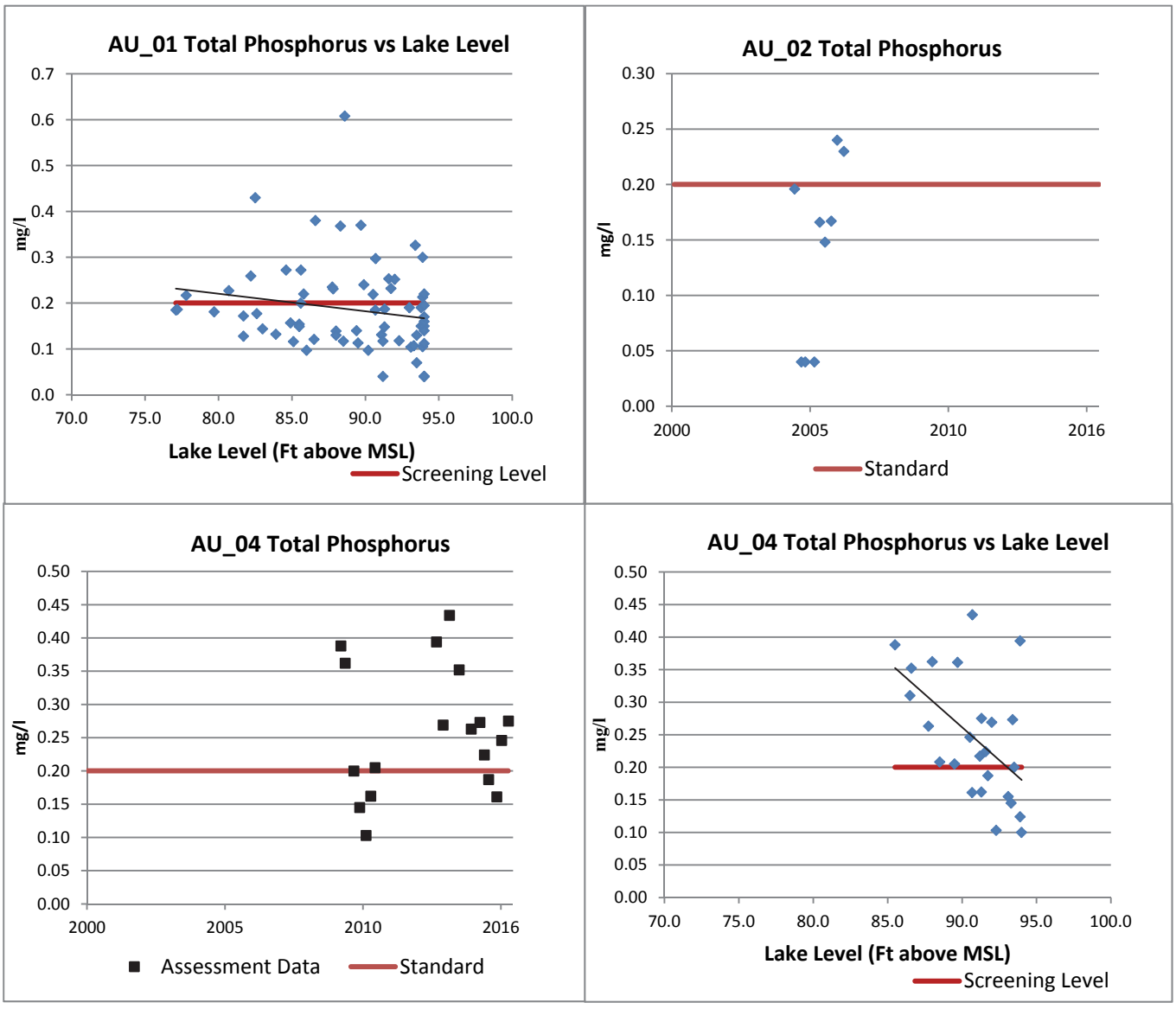
There is insufficient TKN data in any of the AUs for trend analysis.

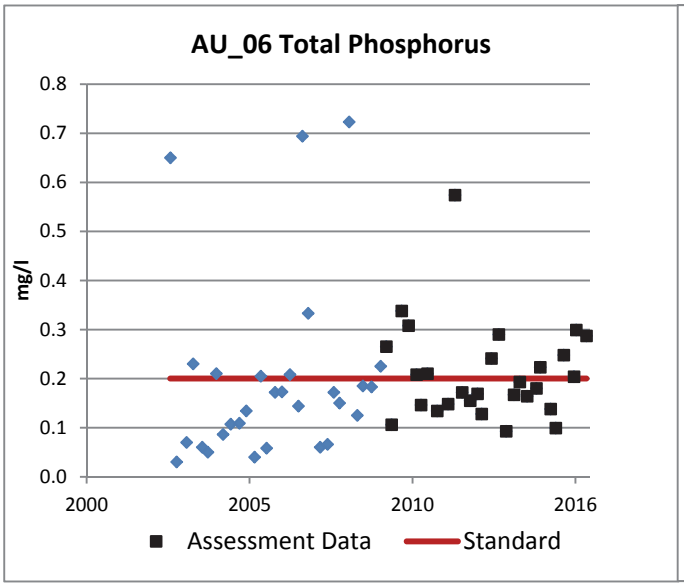
The criteria/threshold for total nitrogen in Lake Corpus Christi based on Reservoir Nutrient Assessment Data is 0.80 mg/l. Thirteen samples from AU_01 were assessed with a median of 1.53 µg/l, however, no concerns for nutrients are listed in the draft 2016 Integrated Report.

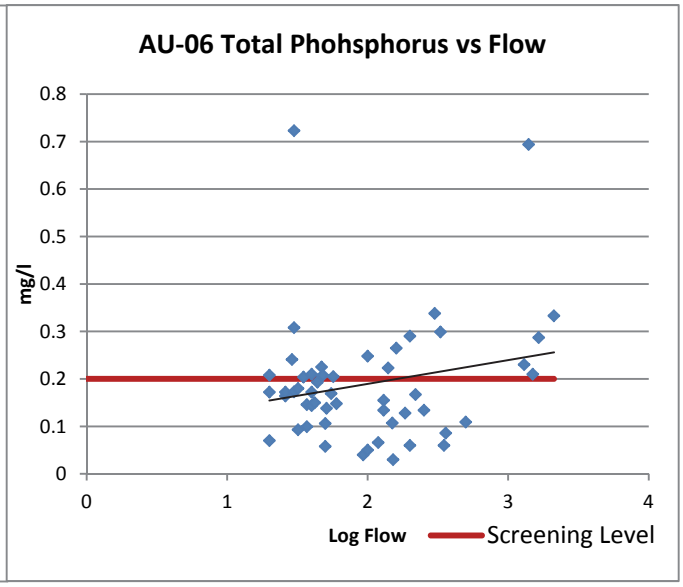
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.20
AU_01	0.20 mg/l	NC	28	0.107	0.38	0.2	0	14
AU_04		CS	18	0.103	0.434	.0254	0	12
AU-06		CS	28	0.093	0.574	0.186	0	13

AU_02, AU_04, and AU_06 were all assessed as having concerns for total phosphorus in the 2014 Integrated Report. Trend analysis indicates decreasing trends in AU_01 (t = -2.08, p = 0.041) and in AU_04 (t = -3.06, p = 0.004) with respect to the lake level and an increasing trend in AU_06 (t = 2.34, p = 0.023) with respect to flow.

The criteria/threshold for total phosphorus in Lake Corpus Christi based on Reservoir Nutrient Assessment Data is 0.18 mg/l. Twenty-eight samples from AU_01 were assessed with a median of 0.16 mg/l.

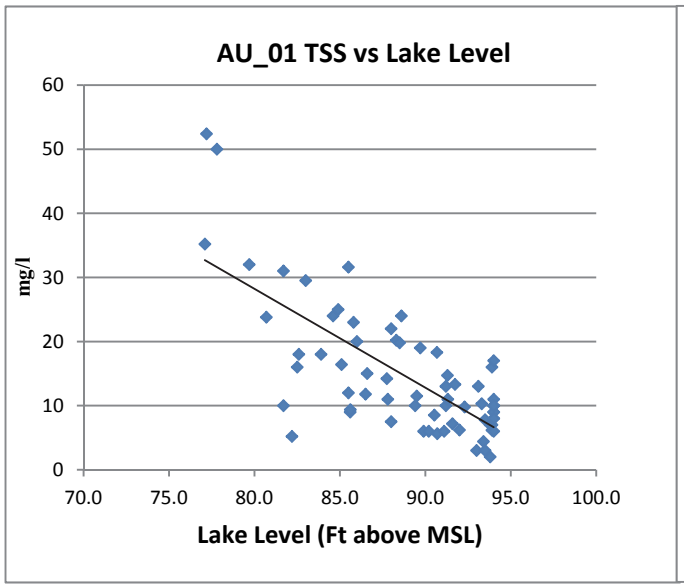


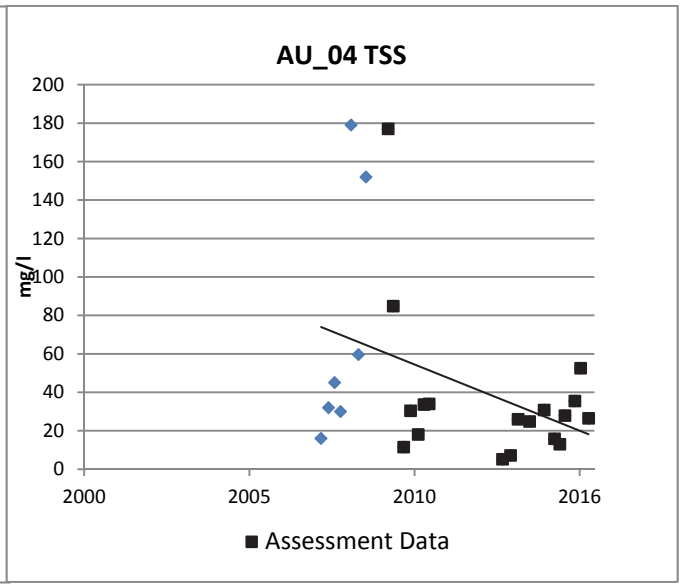


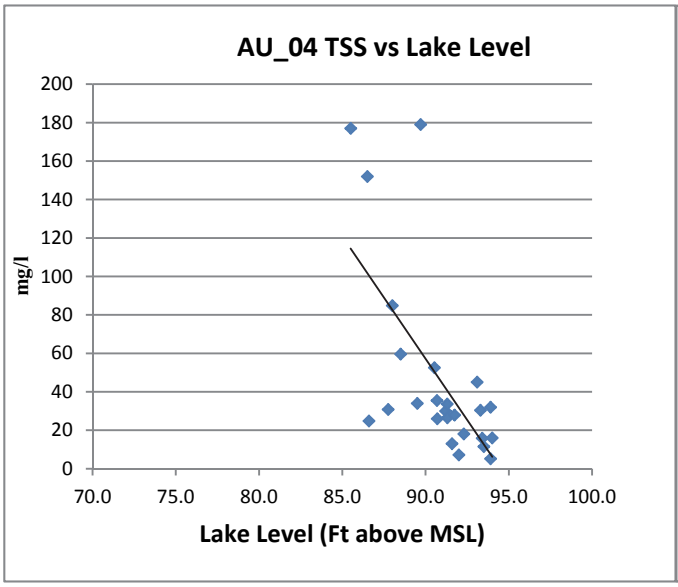


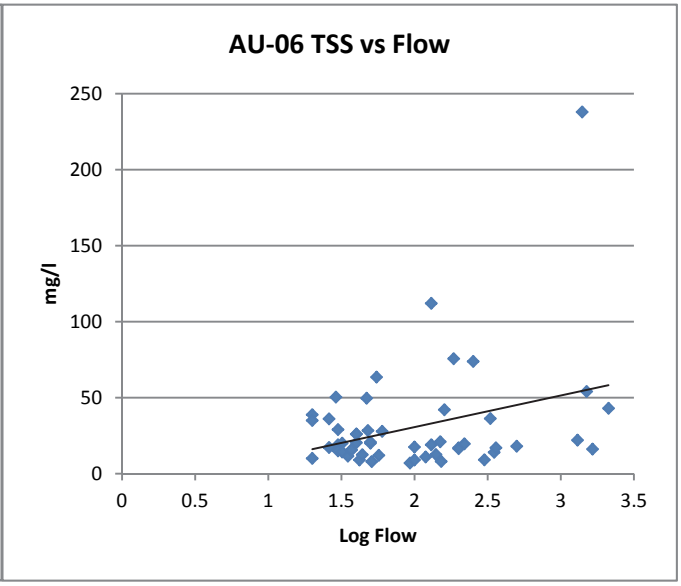
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	4.4	52.48	12.4
AU_04		N/A	18	5.2	177	27.2
AU_06		N/A	28	7.8	470	19.8

Trend analysis indicates decreasing trends for TSS in AU_01 (t = -6.99, p = 0.000) and in AU_04 (t = -4.19, p = 0.000) with respect to the lake level and an increasing trend in AU_06 (t = 3.15, p = 0.003) with respect to flow. There is also a decreasing trend in AU_04 (t = -2.05, p = 0.051) over time.



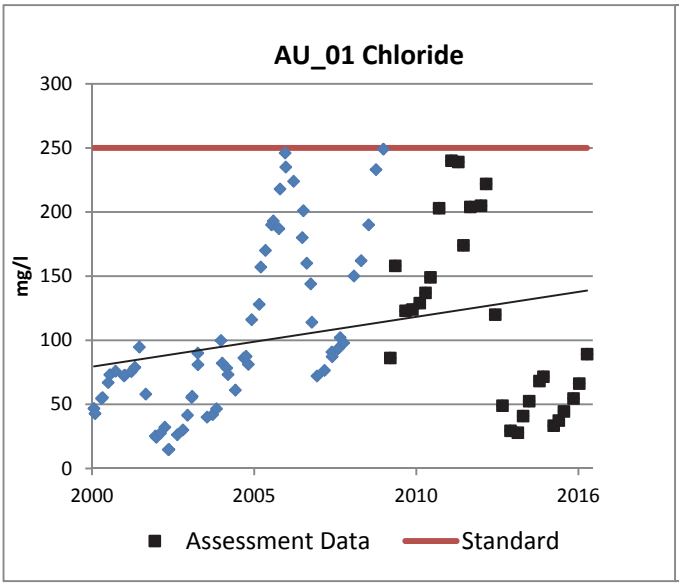


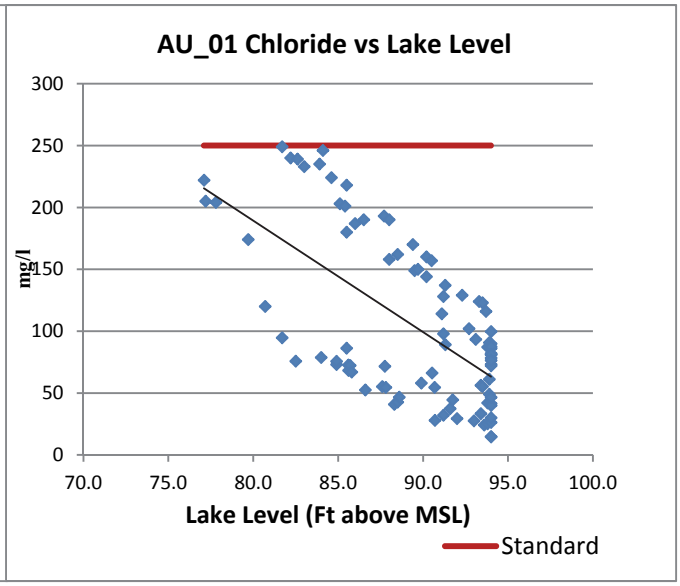


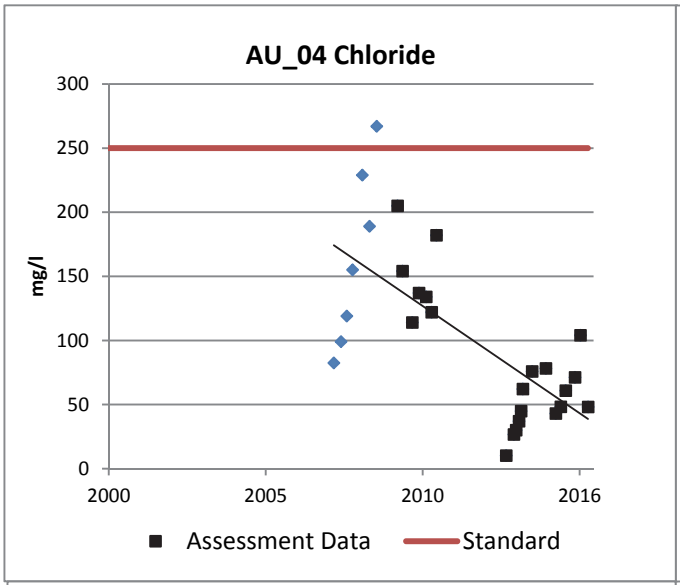


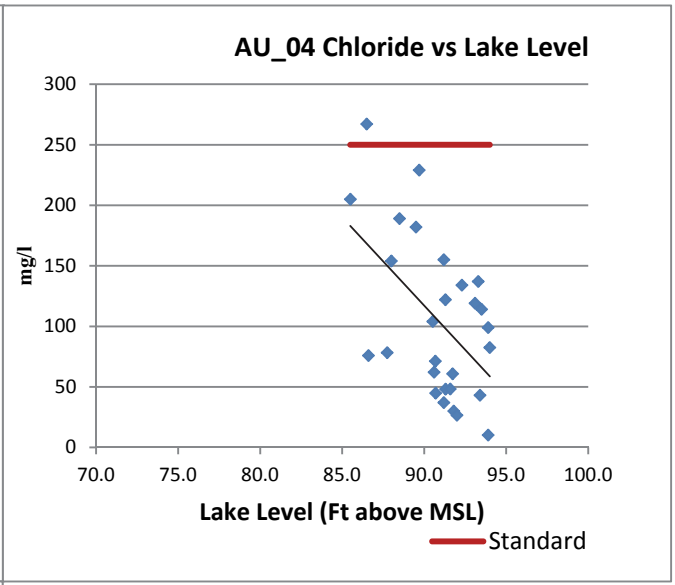
Chloride		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	27.9	240	113	0	0
AU_04		FS	21	10.2	205	85.1	0	0
AU_06		FS	28	23.3	314	183	0	5

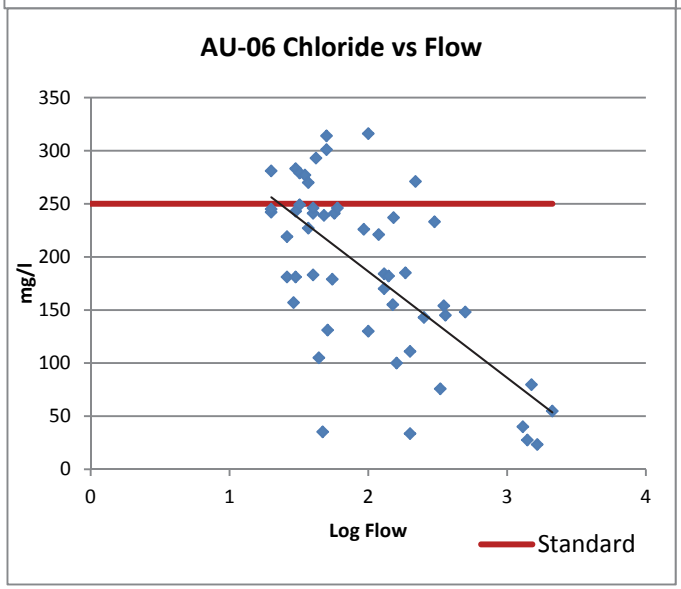
Trend analysis indicates an increasing trend in chloride concentrations in AU_01 (t = 2.54, p = 0.013) and a decreasing trend in AU_04 (t = -4.87, p = 0.000) over time. The trend direction difference is most likely due to difference in long-term verses short-term trends. The data for AU_01 ranged from 2000 through 2016 and the data for AU-04 ranged from 2007 through 2016. Trend analysis also indicates decreasing trends in AU_01 (t = -6.43, p = 0.000) and in AU_04 (t = -3.52, p = 0.001) with respect to the lake level and a decreasing trend in AU_06 (t = -6.05, p = 0.000) with respect to flow.





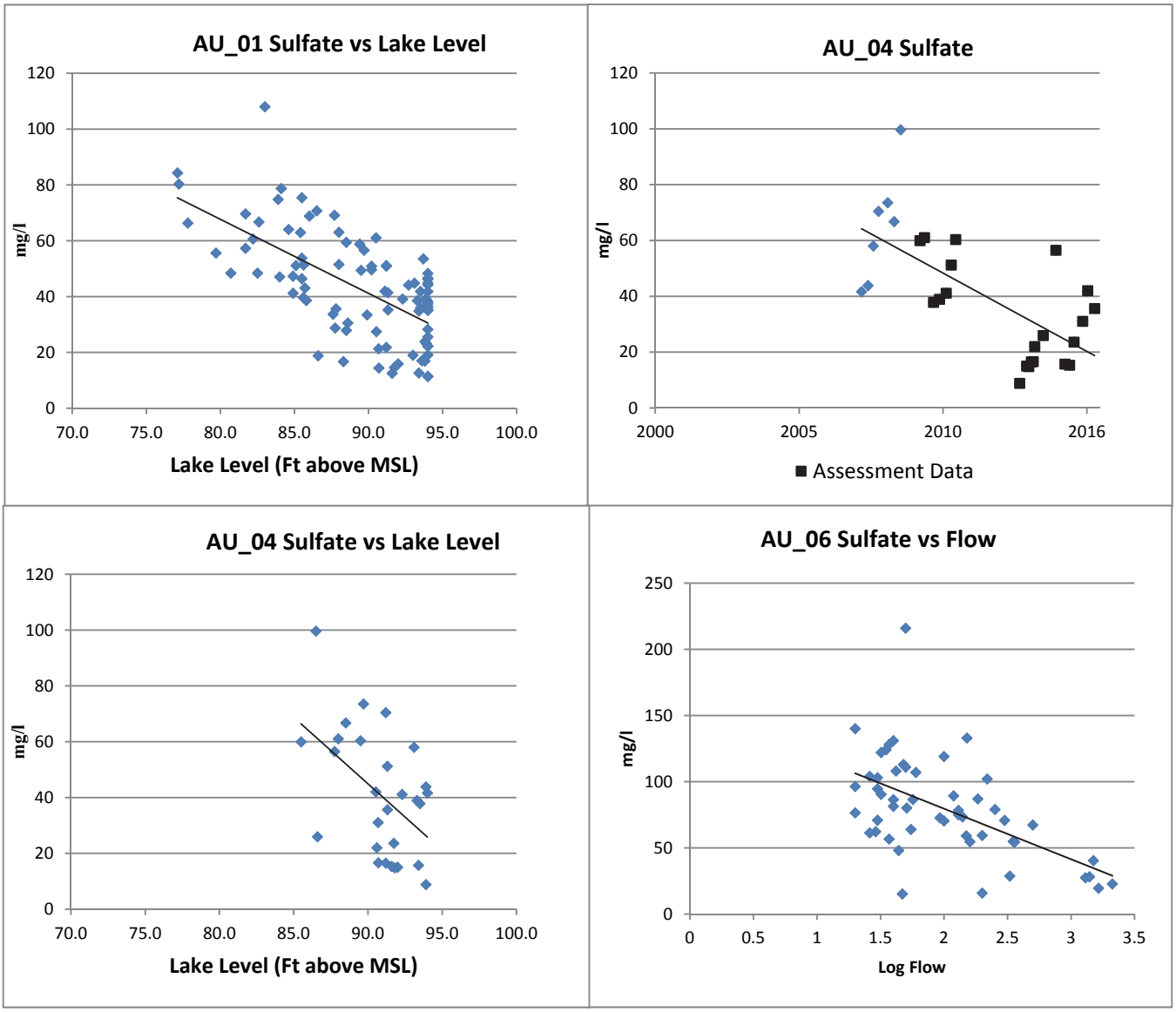






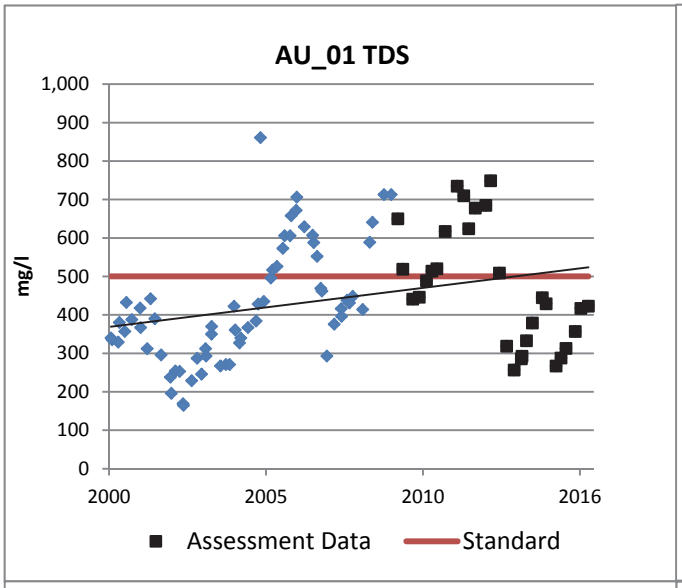
Sulfate		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	12.5	84.3	39.8	0	0
AU_04		FS	21	8.8	61.0	32.8	0	0
AU_06		FS	28	15.8	216	79.7	0	0

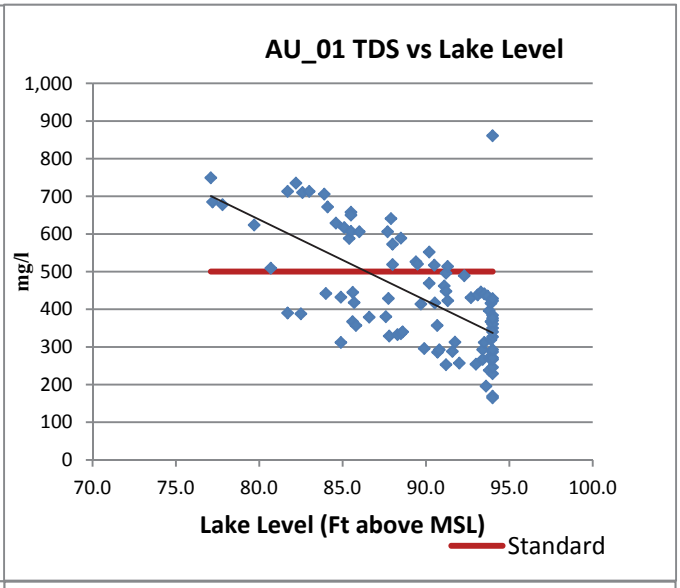
Trend analysis for sulfate concentrations is similar to the chloride trends. There is a decreasing trend in AU_04 ($t = -4.73$, $p = 0.000$) over time and decreasing trends in AU_01 ($t = -5.89$, $p = 0.000$) and in AU_04 ($t = -3.36$, $p = 0.002$) with respect to the lake level and a decreasing trend in AU_06 ($t = -4.44$, $p = 0.000$) with respect to flow. All values are below the standard.

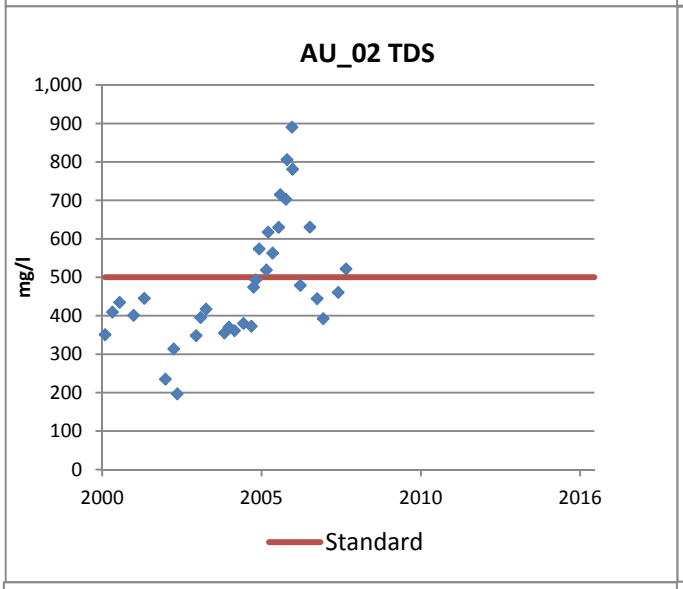


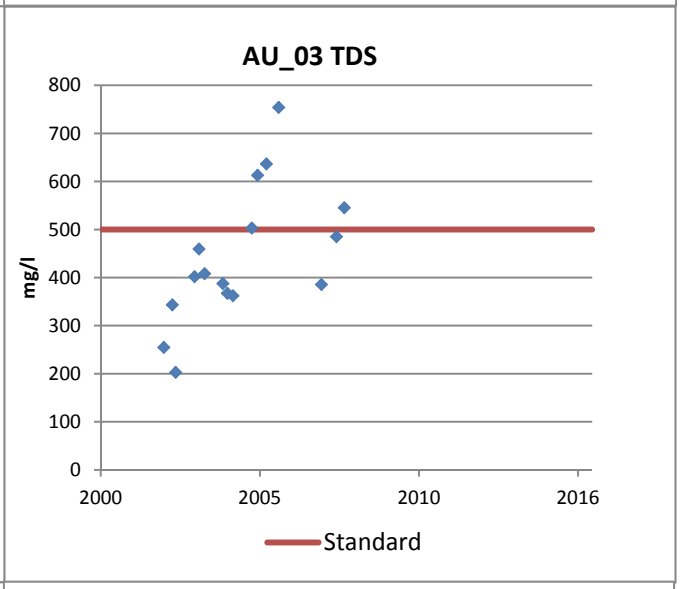
TDS		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	NS	29	257	749	472	0	0
AU_04		NS	21	195	587	401	0	5
AU_06		NS	28	197	1100	622	0	22

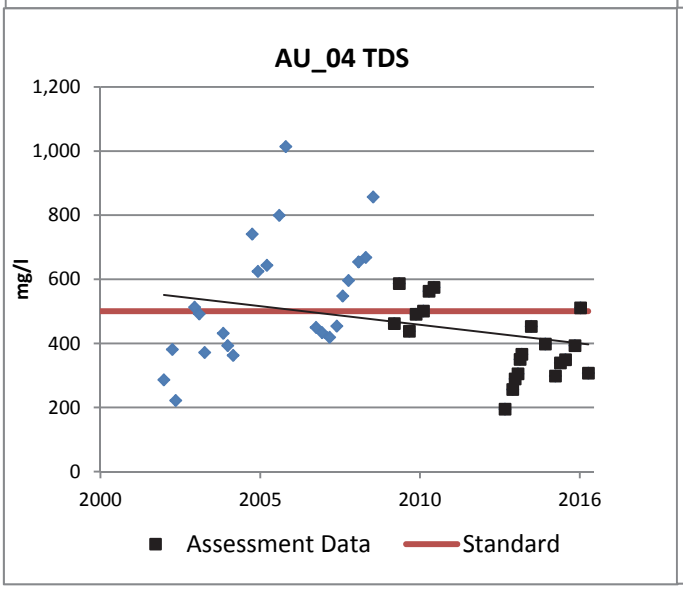
Lake Corpus Christi is listed as being impaired for TDS in all six AUs, based on the average of all data from all AUs. Based on the visual representation in the graphs below, TDS concentrations are dependent on the lake level and flow in the riverine portions, with AU_01 and AU_06 having the highest concentrations. Trend analysis indicates increasing trends in AU_01 ($t = 2.92$, $p = 0.004$) over time, decreasing trends in AU_01 ($t = -5.20$, $p = 0.000$) and AU_04 ($t = -3.78$, $p = 0.000$) with respect to lake level, and a decreasing in AU_06 ($t = -6.01$, $p = 0.041$) with respect to flow.

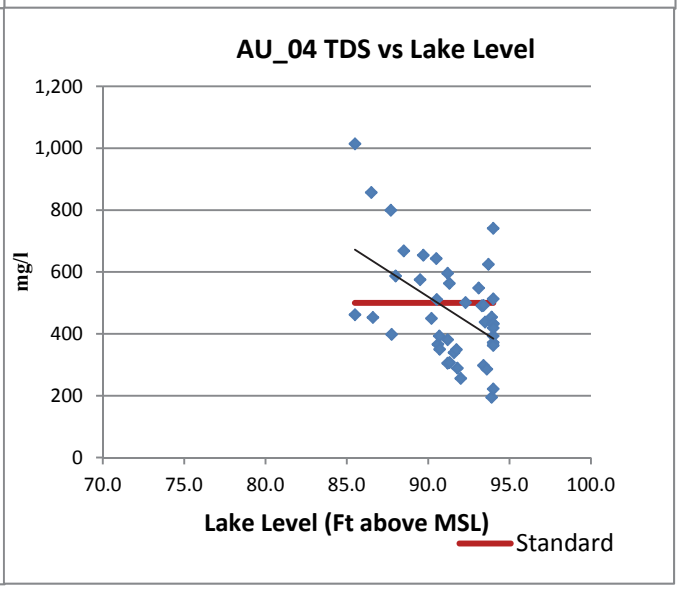

AU_01 TDS
mg/l
1,000
900
800
700
600
500
400
300
200
100
0
2000
2005
2010
2016
Assessment Data
Standard

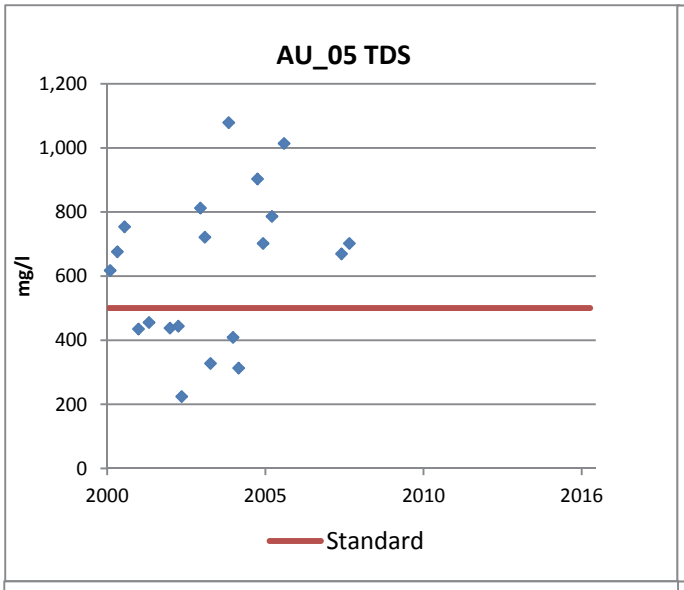

AU_01 TDS vs Lake Level
mg/l
1,000
900
800
700
600
500
400
300
200
100
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)
Standard

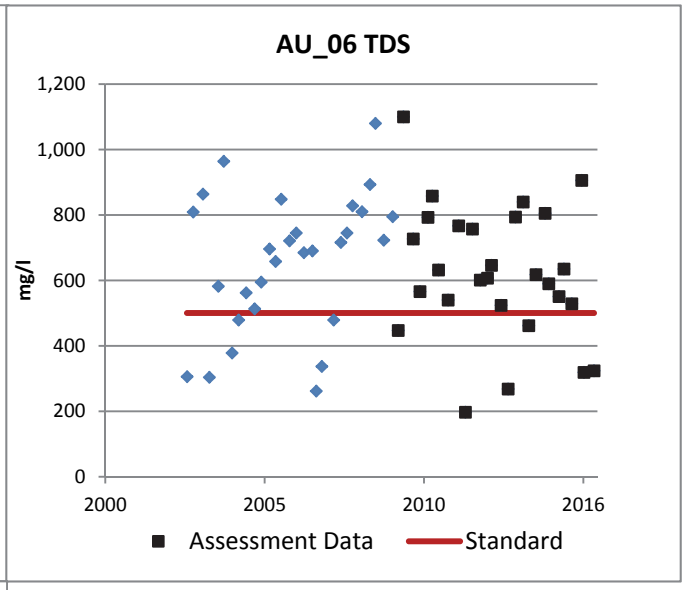

AU_02 TDS
mg/l
1,000
900
800
700
600
500
400
300
200
100
0
2000
2005
2010
2016
Standard

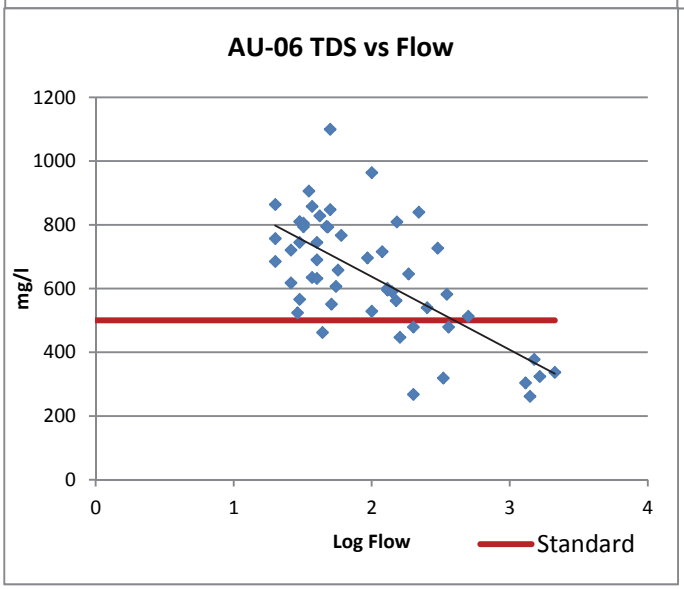

AU_03 TDS
mg/l
800
700
600
500
400
300
200
100
0
2000
2005
2010
2016
Standard


AU_04 TDS
mg/l
1,200
1,000
800
600
400
200
0
2000
2005
2010
2016
Assessment Data
Standard


AU_04 TDS vs Lake Level
mg/l
1,200
1,000
800
600
400
200
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)
Standard

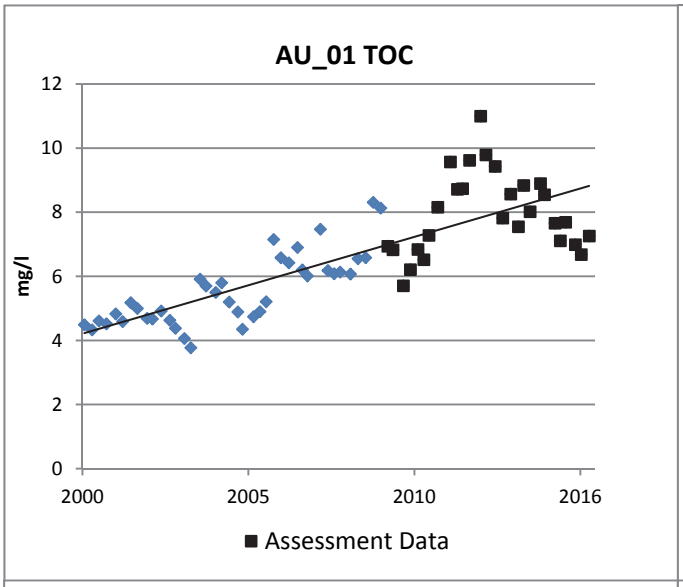


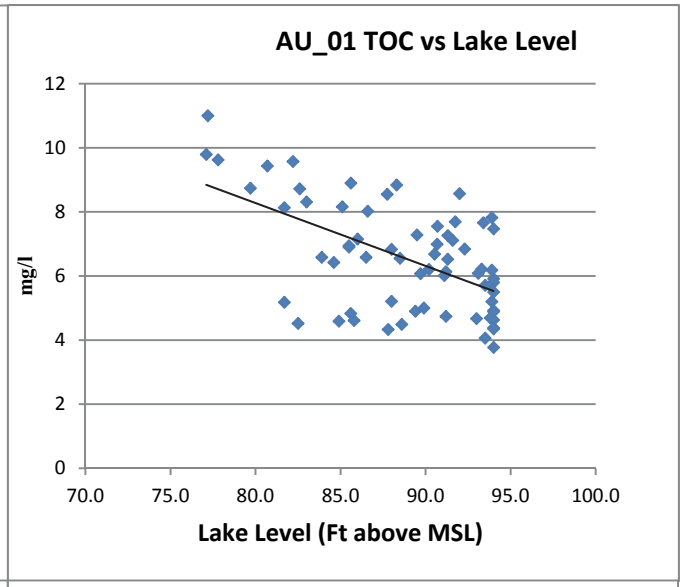


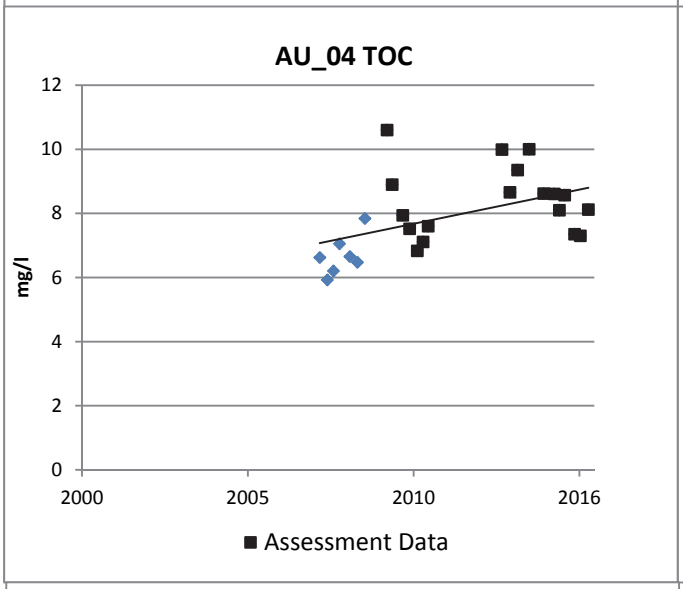


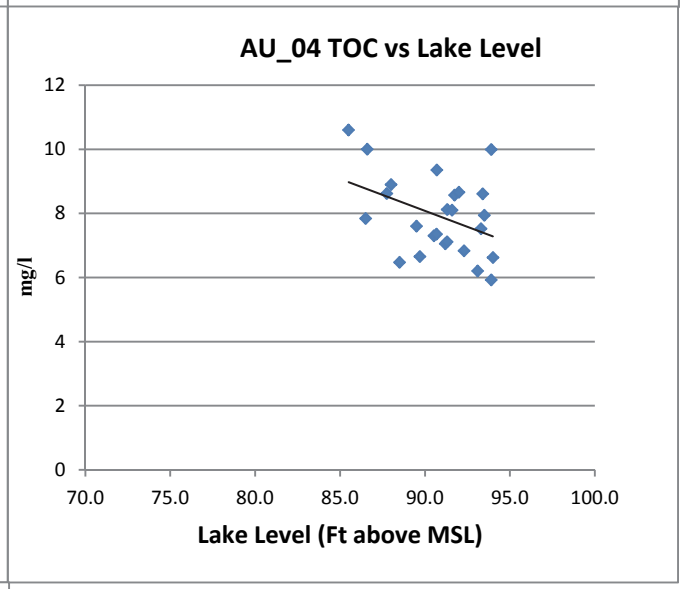
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	5.71	11.0	7.76
AU_04		N/A	18	6.83	10.6	8.34
AU_06		N/A	28	6.98	12.8	8.62

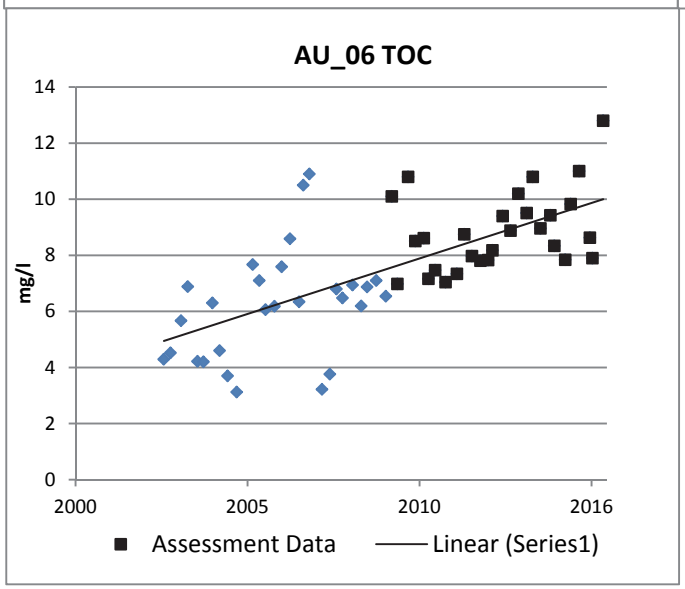
Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 11.33, p = 0.000), AU_04 (t = 2.73, p = 0.012), and AU_06 (t = 7.04, p = 0.000) over time. The trend analysis also indicates decreasing trends in AU_01 (t = -3.32, p = 0.001) and AU_04 (t = -2.22, p = 0.032) with respect to the lake level.

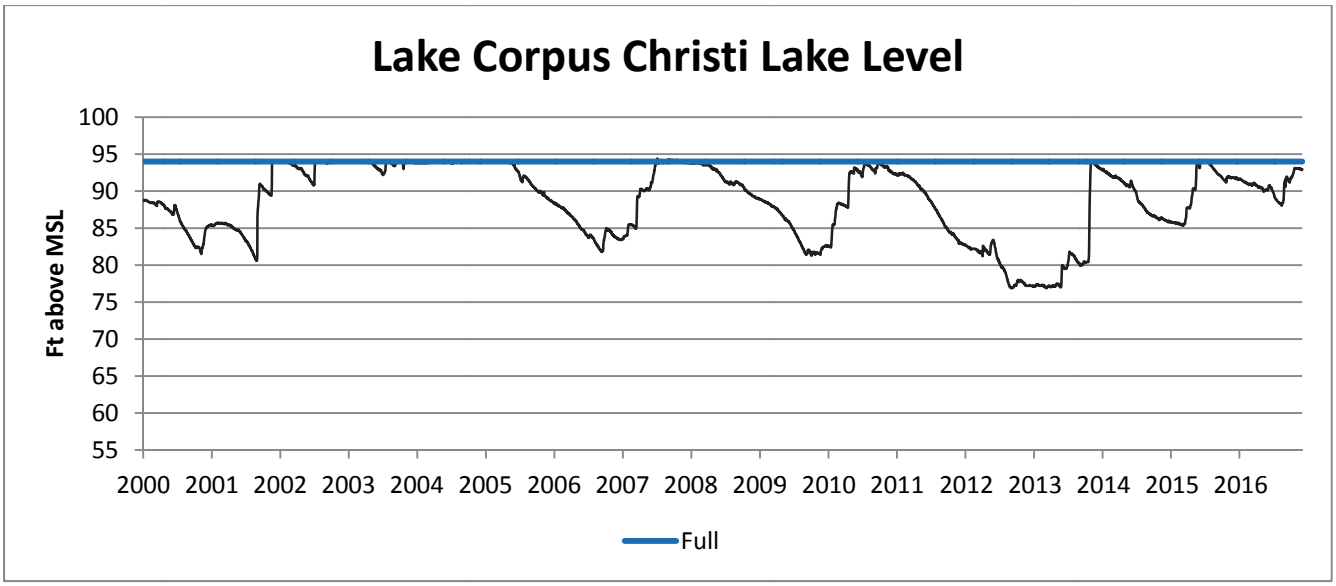

AU_01 TOC
mg/l
12
10
8
6
4
2
0
2000
2005
2010
2016
Assessment Data


AU_01 TOC vs Lake Level
mg/l
12
10
8
6
4
2
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)


AU_04 TOC
mg/l
12
10
8
6
4
2
0
2000
2005
2010
2016
Assessment Data


AU_04 TOC vs Lake Level
mg/l
12
10
8
6
4
2
0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
Lake Level (Ft above MSL)

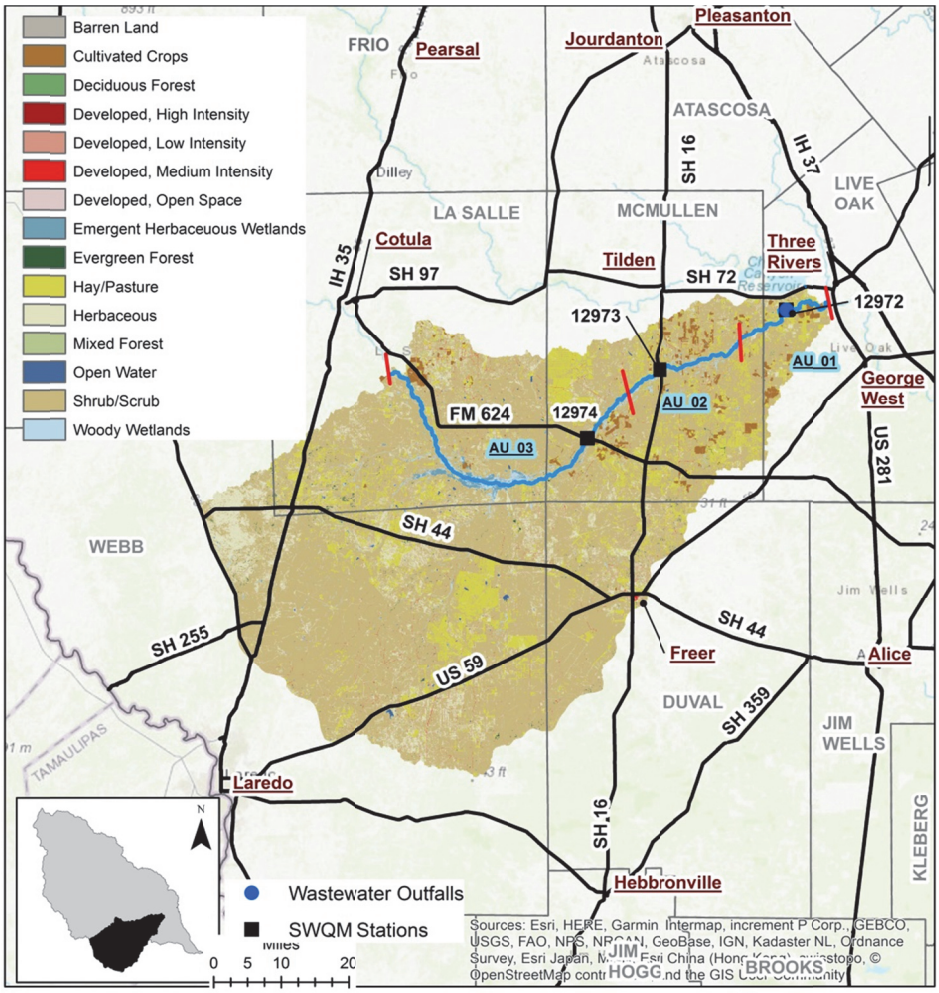

AU_06 TOC
mg/l
14
12
10
8
6
4
2
0
2000
2005
2010
2016
Assessment Data
Linear (Series1)



Wesley E. Seale Dam at Lake Corpus Christi

NUECES RIVER ABOVE FRIO RIVER – SEGMENT 2104

Segment 2104, Nueces River above Frio River, flows 91 miles from Holland Dam in La Salle County to its confluence with the Frio River in Live Oak County. It is divided into three AUs. **AU-01** is from the downstream end of the segment to the confluence with Dragon Creek. **AU_02** is from the confluence with Dragon Creek to the confluence with Guadalupe Creek. **AU_03** is from the confluence with Guadalupe Creek to Holland Dam. Its watershed is 1,876,877 acres. The area is dominated by large ranches.



Special Studies

AU_01 and AU_02 have been assessed as having concerns for impaired macrobenthic community. AU-02 has also been assessed as have a concern for impaired fish community. TCEQ is conducting two aquatic life biological sampling events. The first one was held in June 2017. The second one was delayed due to Hurricane Harvey and is tentatively scheduled for September 2018. A mussels study was also conducted on the segment in August 2017. The results will be available to reassess these impairments and concerns in the 2020 assessment.

Water Quality Analysis

The analysis for AU_01 is based on data from **Station 12972**, at FM 1042. The analysis for AU_02 is based on data from **Station 12973** at SH 16 and **Station 17897** on the Smith Lease approximately 13.9 km downstream of SH 16. There is insufficient data for the statistical or trend analysis in AU_03 since routine monitoring ended in 2004.

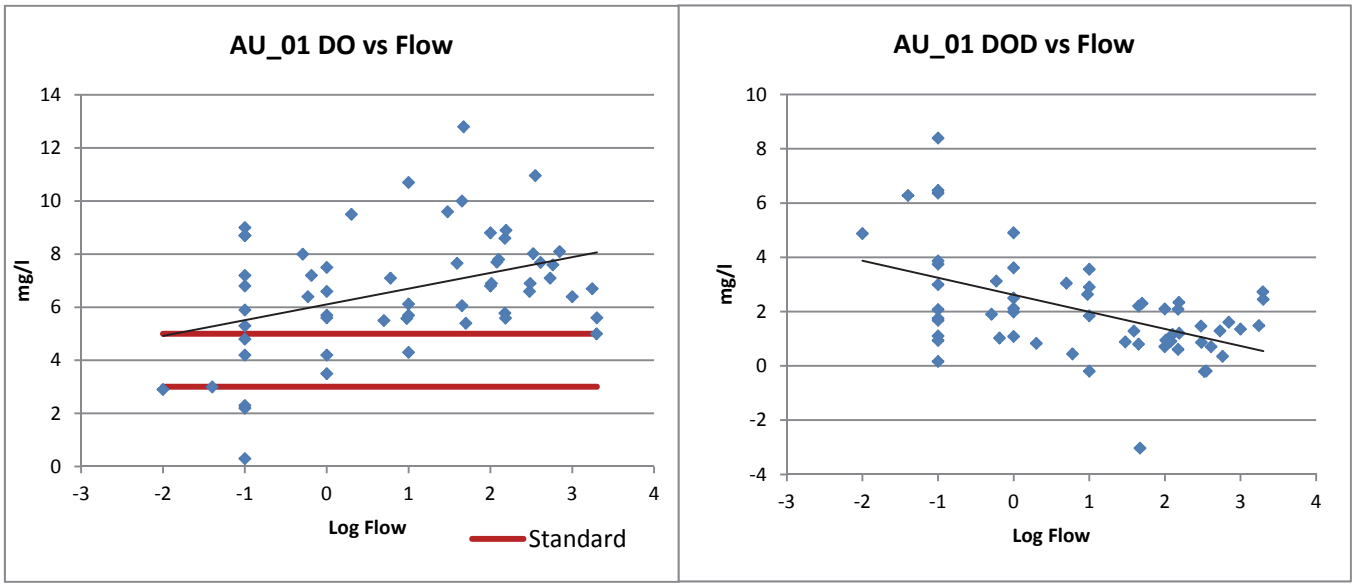
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	38	0.3	12.8	6.8	4	8
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	FS	31	0.8	13.4	6.4	2	7
	Screening Level 5.0 mg/l	NC						

While the data analysis indicates > 10% of the DO values are below the standard in AU_0, the, 24-hour DO measurements conducted in 2010 – 2012 met the standards. The low DO assessment for AU_03 will continue to

be carried forward until there is enough flow to conduct additional 24-hour DO to fully evaluate the concern. The two 24-hour DO measurements conducted in 2016 met the standards.

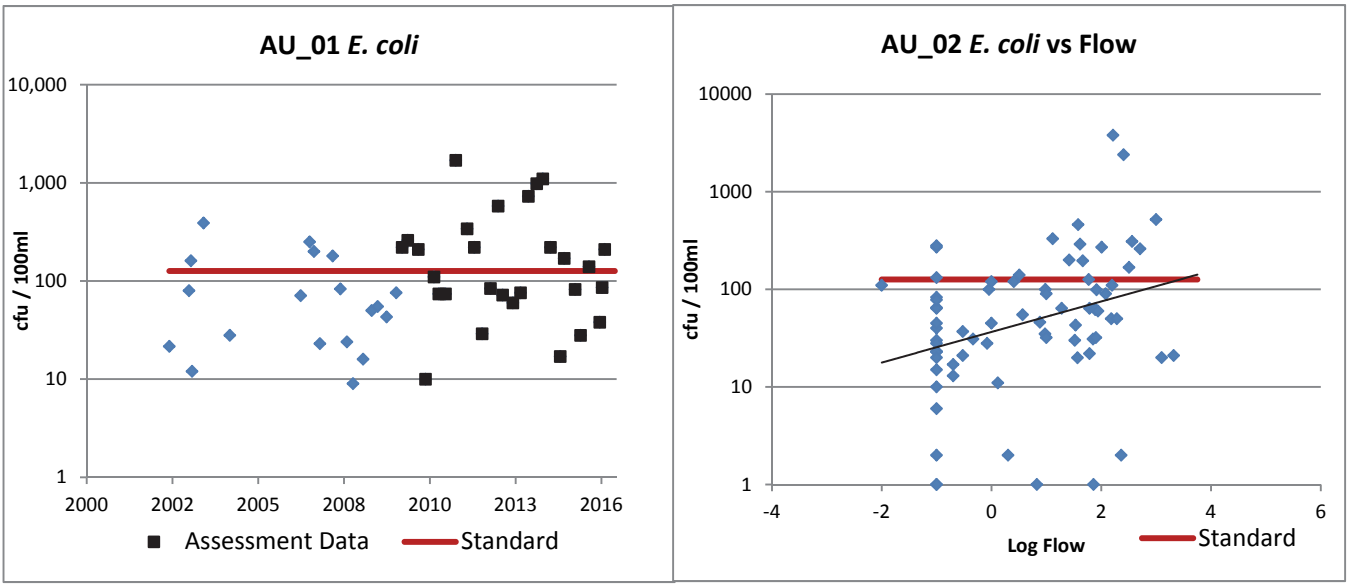
Trend analysis indicates an increasing trend in DO levels in AU_01 (t = 3.46, p = 0.001) and a decreasing DOD trend (t = -3.87, p = 0.000) with respect to flow.



Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	28	10	1700	135	0	14
AU_02		FS	28	<1	2400	44.4	1	6

The data analysis indicates that geomean in AU_01 may be exceeding the bacteria standard for contact recreation. Trend analysis indicates an increasing trend in *E. coli* concentrations in AU_02 (t = 2.69, p = 0.008) with respect to flow, but the geomean calculated for this data analysis is below the standard. There is a WWTP just upstream of this sampling location, and wildlife in the surrounding rural lands may be contributing to the high bacteria levels.



General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	39	11.3	31.3	23.5	0
AU_02		FS	31	8.1	30.3	22.5	0

Trend analysis did not indicate any trends in water temperature in either AU over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	39	7.2	8.2	7.7	0	0
AU_02		FS	31	7.0	9.0	7.9	0	0

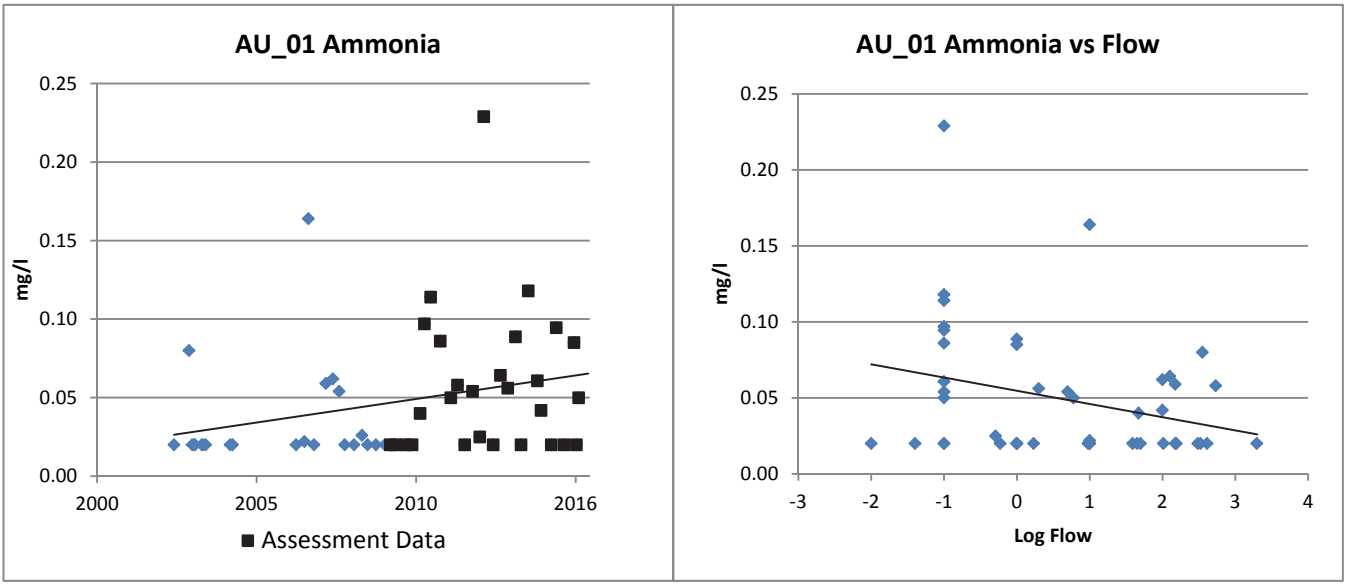
Trend analysis did not indicate any trends in pH levels in either AU over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	57	188	128
AU_02		N/A	28	115	255	155

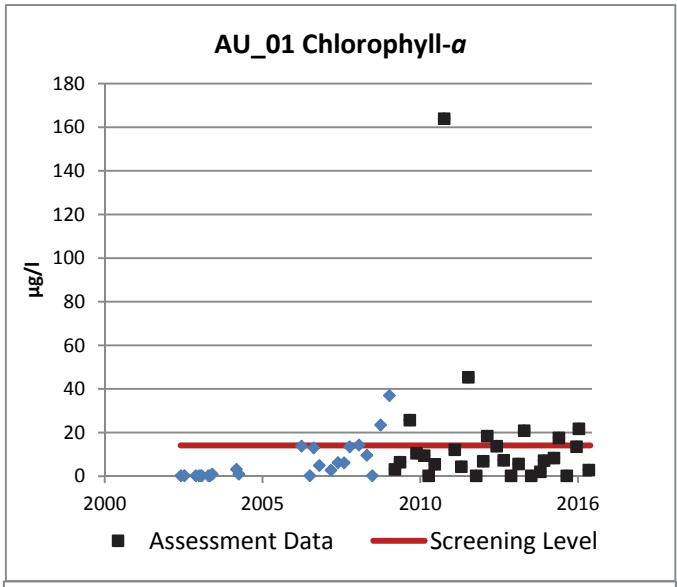
Trend analysis did not indicate any trends in alkalinity in either AU over time or with respect to flow.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	28	<0.02	0.229	0.05	10	0
AU_02		NC	28	<0.02	0.182	0.02	17	0

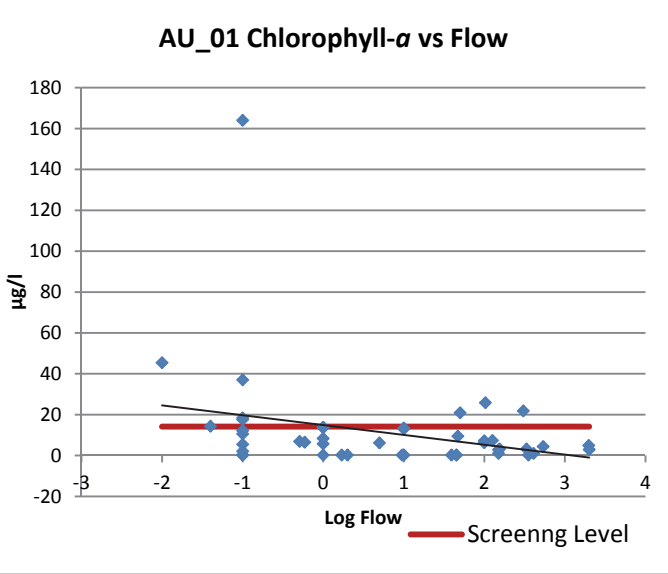
Trend analysis indicates an increasing trend in ammonia levels in AU_01 (t = 2.68, p = 0.010) over time. However, all measured values are below the screening level. Trend analysis also indicates a decreasing trend in AU_01 (t = -2.89, p = 0.005) with respect to flow. The monitoring station is located just downstream of a WWTP which is a possible source of the ammonia.

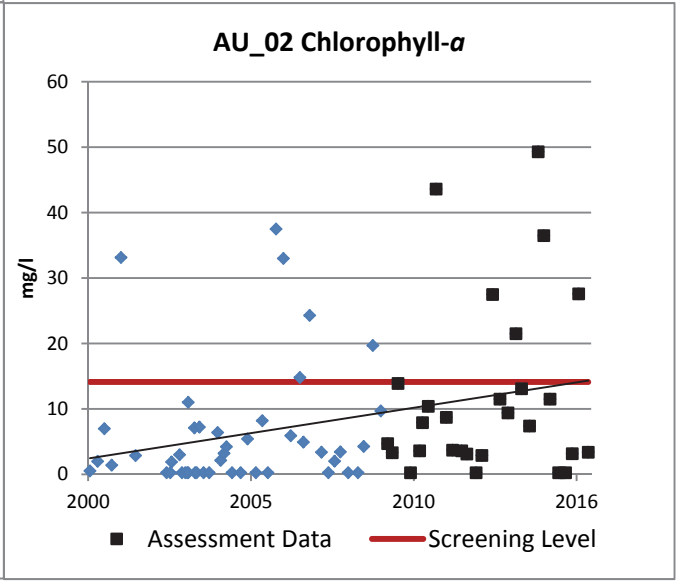


Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	28	<0.25	164	7.27	5	7
AU_02		NC	28	<0.25	49.3	7.6	4	6



AU_01 has been assessed as having a concern for chlorophyll-*a*. The data analysis indicates that >20% of the values in AU_02 exceed the screening level. Trend analysis indicates a decreasing trend in AU_01 (t = -2.30, p = 0.025) with respect to flow, and an increasing trend in AU_02 (t = 2.69, p = 0.009) over time.

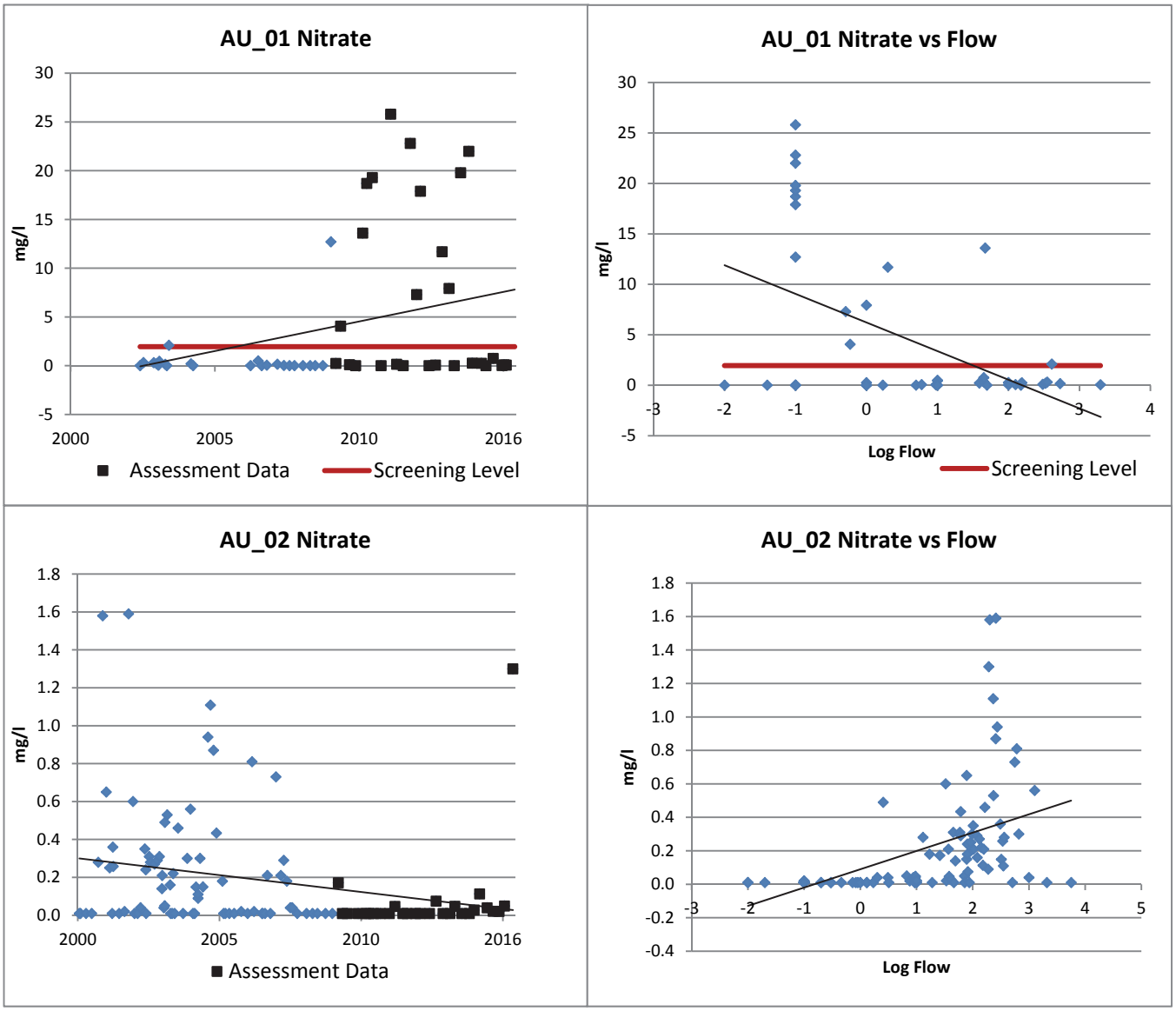




Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	CS	28	<0.01	25.8	0.26	7	12
AU_02		NC	28	<0.01	1.3	0.01	17	0

AU_01 has been assessed as having a concern for nitrate. The time period of the higher readings coincides with the active period of the Eagle Ford Shale oil and gas operations, which have since returned to below the screening level.

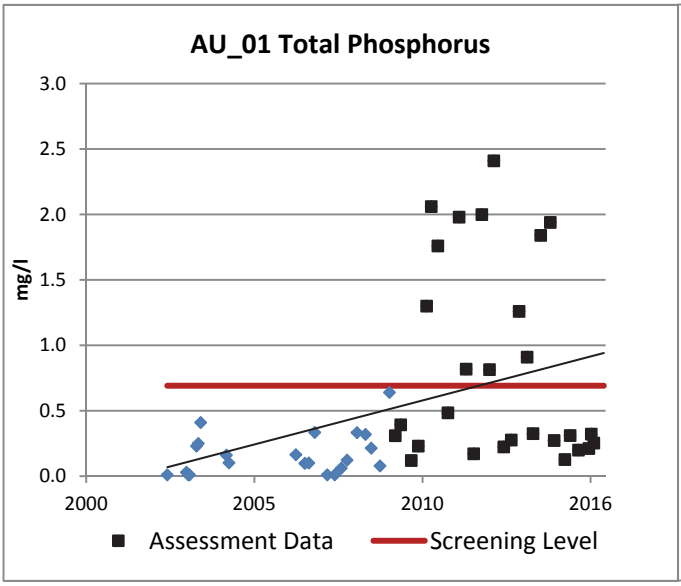
Trend analysis indicates an increasing trend in nitrate concentrations in AU_01 (t = 2.39, p = 0.021) and a decreasing trend AU_02 (t = -2.24, p = 0.027) over time. It also shows a decreasing trend in AU_01 (t = -2.89, p = 0.005) and an increasing trend in AU_02 (t = 2.24, p = 0.027) with respect to flow. All concentrations in AU_02 are below the screening level.

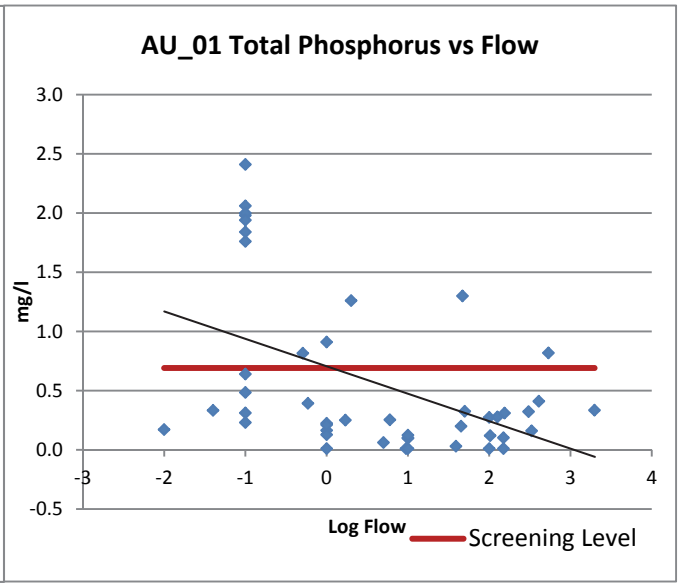


Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	CS	28	0.12	2.41	0.036	0	12
AU_02		NC	28	<0.01	0.448	0.136	3	0

AU_01 has been assessed as having a concern for total phosphorus. The time period of the higher readings coincides with the active period of the Eagle Ford Shale oil and gas operations, which have since returned to below the screening level.

Trend analysis indicates an increasing trend in for total phosphorus concentrations in AU_01 ($t = 3.04$, $p = 0.004$) and a decreasing trend ($t = -2.14$, $p = 0.036$) with respect to flow.

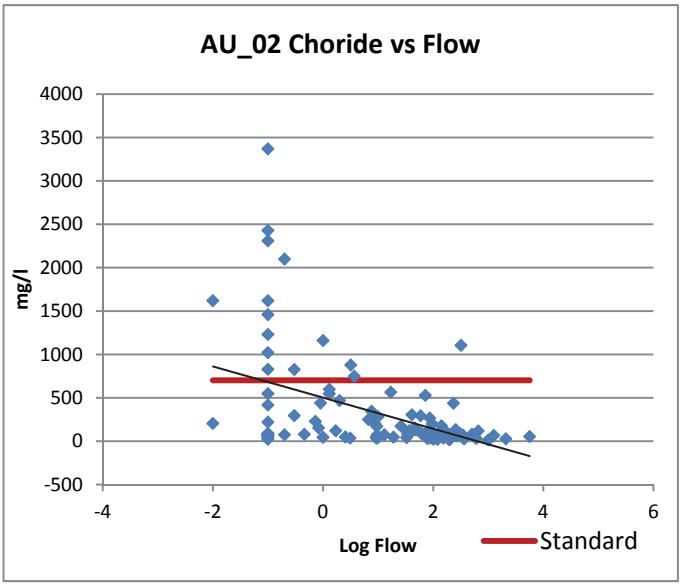




TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	6.47	14.8	9.03
AU_02		N/A	28	1.8	125	22.8

Trend analysis did not indicate any trends in TSS concentrations in either AU over time or with respect to flow.

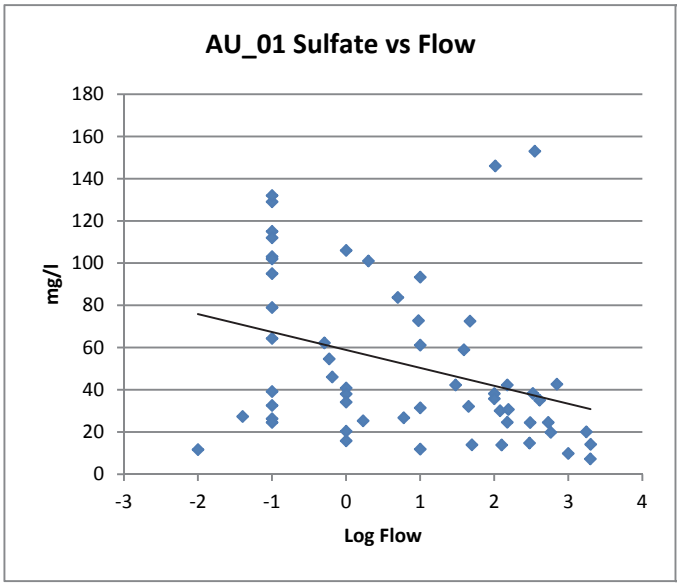
Chloride		Status	# samples	Min	Max	Average	ND	>700
AU_01	700 mg/l	FS	39	17.0	2100	172	0	1
AU_02		FS	28	14.0	2430	343	0	4

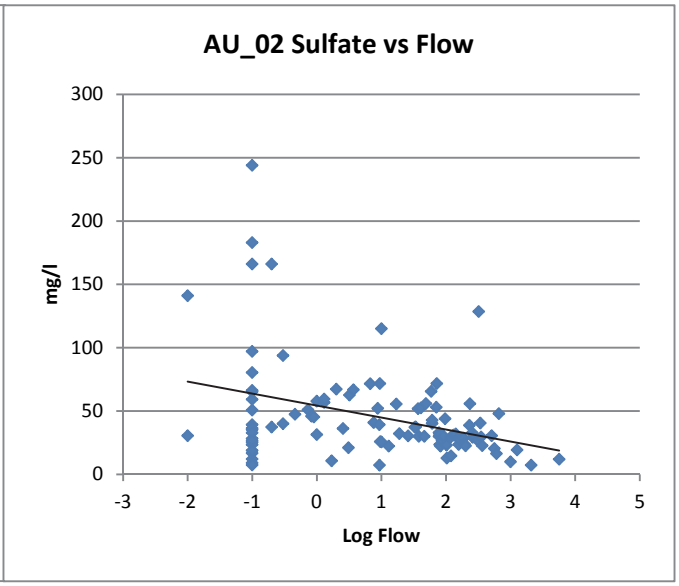


Trend analysis indicates a decreasing trend in chloride concentrations in AU_02 (t = -2.32, p = 0.022) with respect to flow.

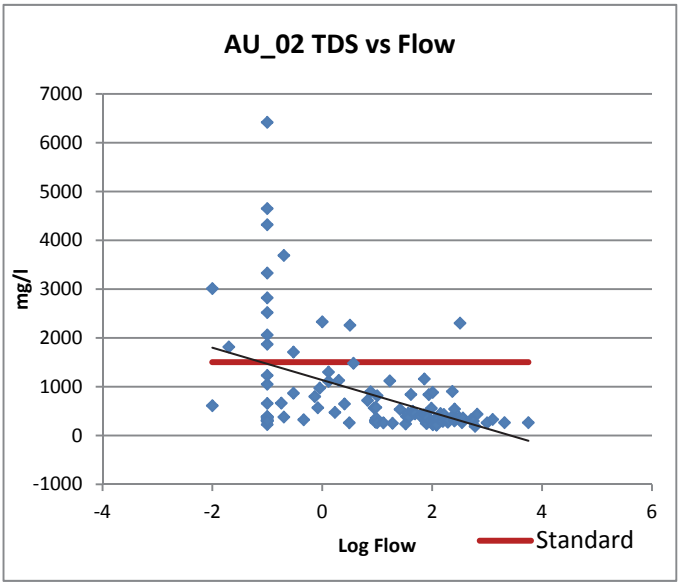
Sulfate		Status	# samples	Min	Max	Average	ND	>300
AU_01	300 mg/l	FS	39	9.75	146	52.9	0	0
AU_02		FS	28	7.34	66.2	34.8	0	0

Trend analysis indicates a decreasing trend in sulfate concentrations in AU_01 (t = -2.89, p = 0.005) and in AU_02 (t = -2.10, p = 0.038) with respect to flow. All concentrations are below the standard.





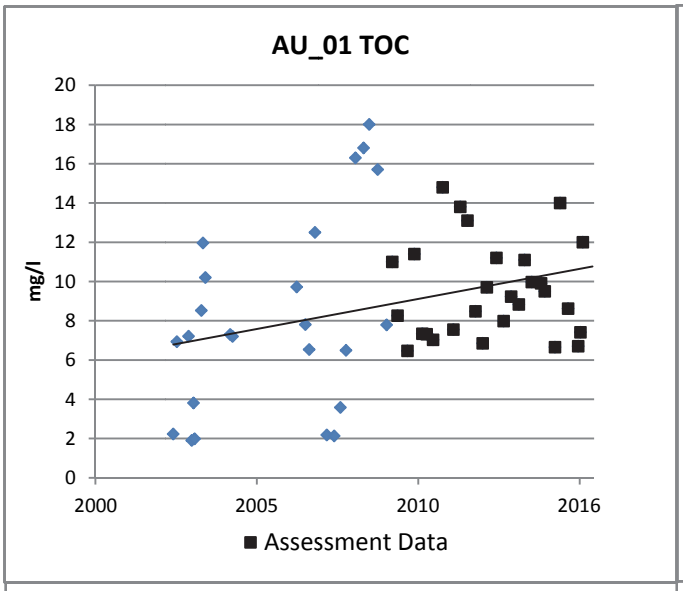
TDS		Status	# samples	Min	Max	Average	ND	>1500
AU_01	1500 mg/l	FS	39	251	4210	569	0	1
AU_02		FS	30	260	4320	846	0	4

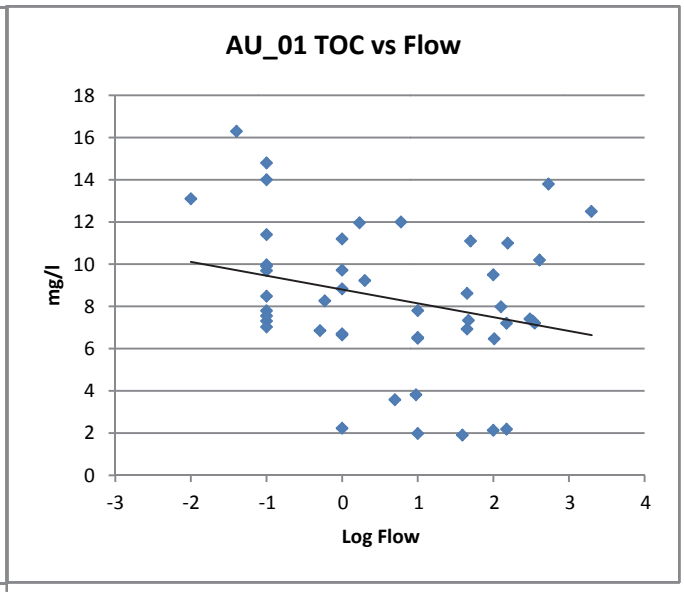


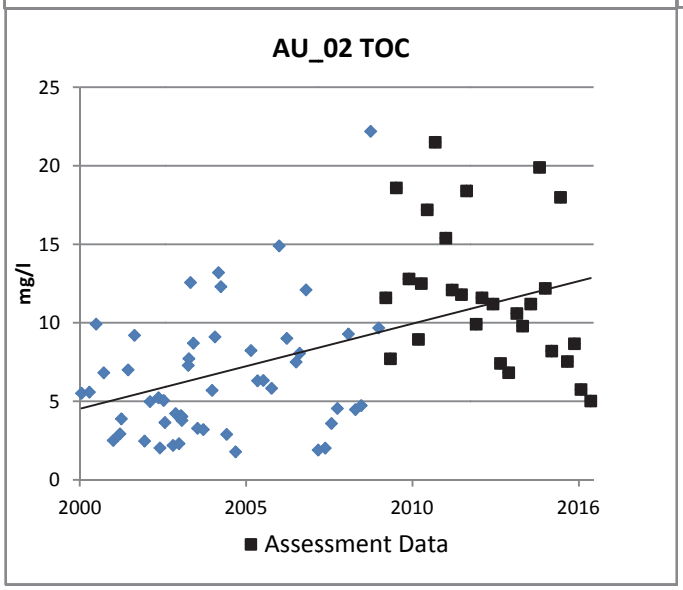
Trend analysis indicates a decreasing trend in TDS concentrations in AU_02 (t = -2.69, p = 0.008) with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	6.47	14.8	9.03
AU_02		N/A	28	5.03	21.5	11.4

Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 2.36, p = 0.022) and in AU_02 (t = 5.06, p = 0.000) over time. Trend analysis also indicates a decreasing trend in AU_01 (t = -3.06, p = 0.003) with respect to flow.





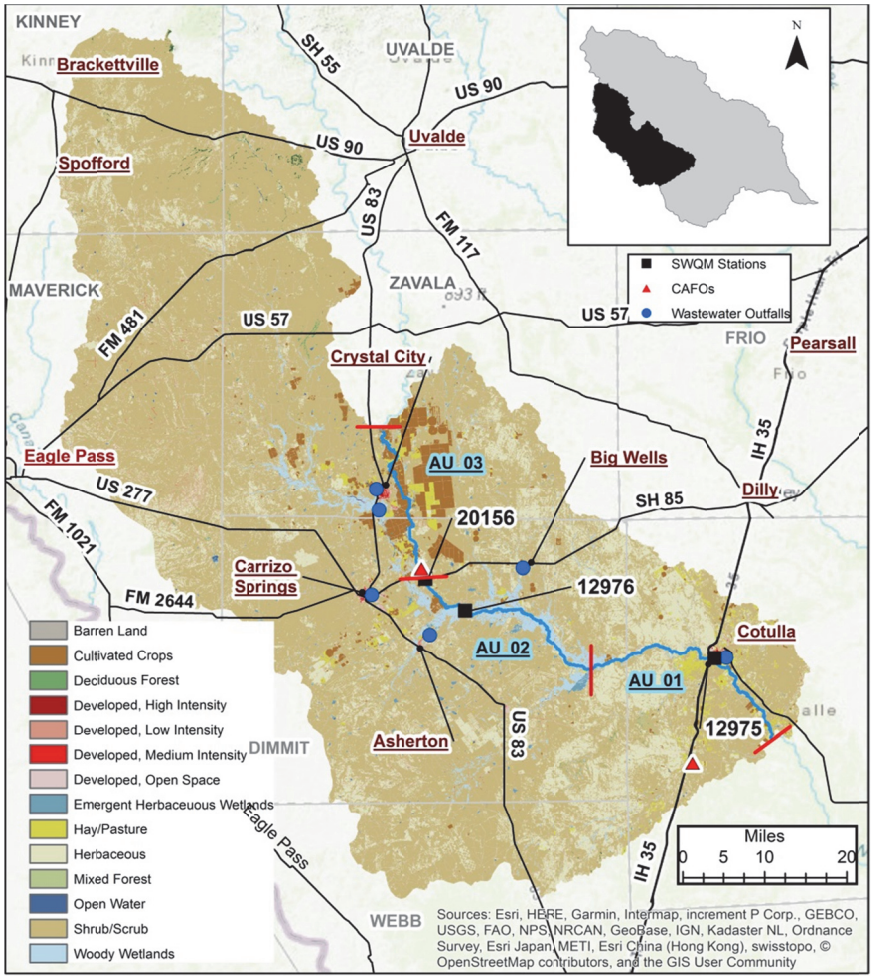


Sampling location for Station 12972 at FM 1040

NUECES RIVER ABOVE HOLLAND DAM – SEGMENT 2105

Segment 2105, Nueces River above Holland Dam, flows 78 miles from FM 1025 in Zavala County to Holland Dam in La Salle County. It is divided into three AUs. **AU_01** is from the downstream end of the segment to the confluence with Sauz Mocho Creek. **AU-02** is from the confluence with Sauz Mocho Creek to the confluence with Line Oak Slough. **AU_03** is from the confluence of Live Oak Slough to the upstream end. Its watershed is 2,200,065 acres.

The Cities of Crystal City, Carrizo Springs, Asherton, Big Wells, and Cotulla are all in this watershed. Each of these cities has WWTPs that discharge into the river.



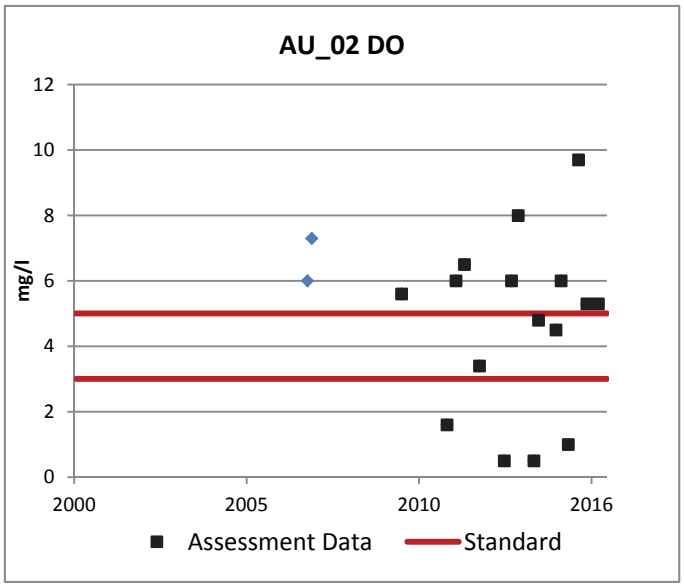
Water Quality Analysis

The analysis for AU_01 is based on data from **Station 12975** at IH 35 south of Cotulla. The analysis for AU_02 is based on data from **Station 12976** at FM 90. There is insufficient data for trend analysis in AU_02. There are no sampling sites in AU_03.

Sampling location for Station 12976 at FM 90

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	24	1.5	18.9	3.8	1	6
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	NS	16	0.5	9.7	5.3	4	7
	Screening Level 5.0 mg/l	CS						

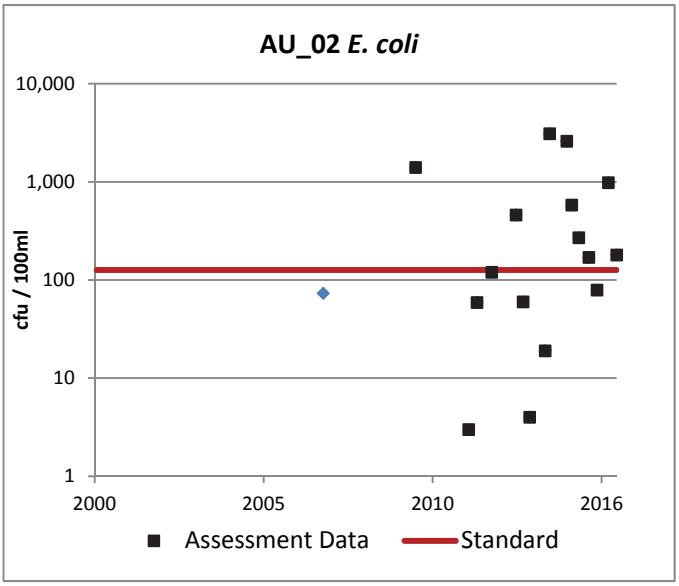


AU_02 is listed as having an impairment for low DO based on the grab minimum. The low DO assessment was assessed in the 2012 Integrated Report for AU_02, and will continue to be carried forward until enough 24-hour DO measurements can be conducted to fully evaluate the impairment. The two 24-hour DO measurements conducted in 2016 met the standards.

Trend analysis did not indicate any trends in DO levels or DOD in AU-01 over time or with respect to flow.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	24	<10	9900	114	3	9
AU_02		FS	16	3	3100	160	0	8



The data analysis indicates that AU_02 is exceeding the bacteria standard for contact recreation. The sampling station is located downstream of several of the WWTPs and a CAFO.

Trend analysis did not indicate and trends in *E. coli* concentrations in AU-01 over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	24	7.8	32.5	20.8	1
AU_02		FS	16	9.6	29.5	24.0	0

Trend analysis did not indicate any trends in water temperature in AU-01 over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	24	7.3	8.3	7.6	0	0
AU_02		FS	15	7.2	8.0	7.7	0	0

Trend analysis did not indicate any trends in pH levels in AU-01 over time or with respect to flow.

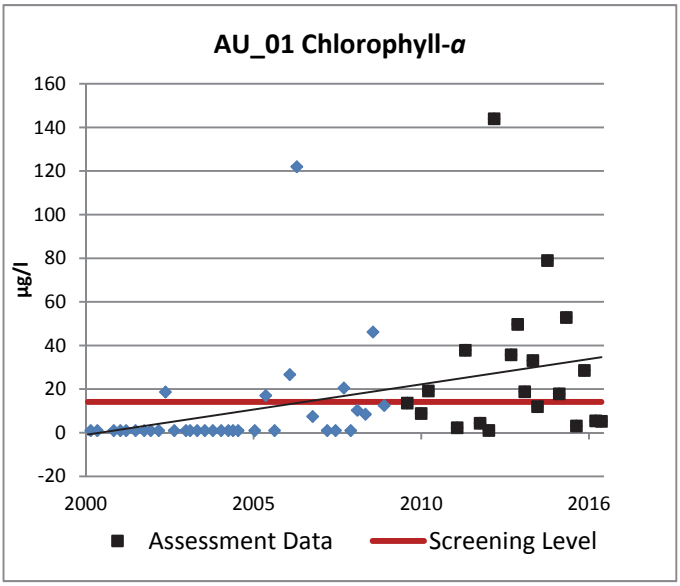
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	80	308	150
AU_02		N/A	16	110	250	166

Trend analysis did not indicate any trends in alkalinity in AU-01 over time or with respect to flow.

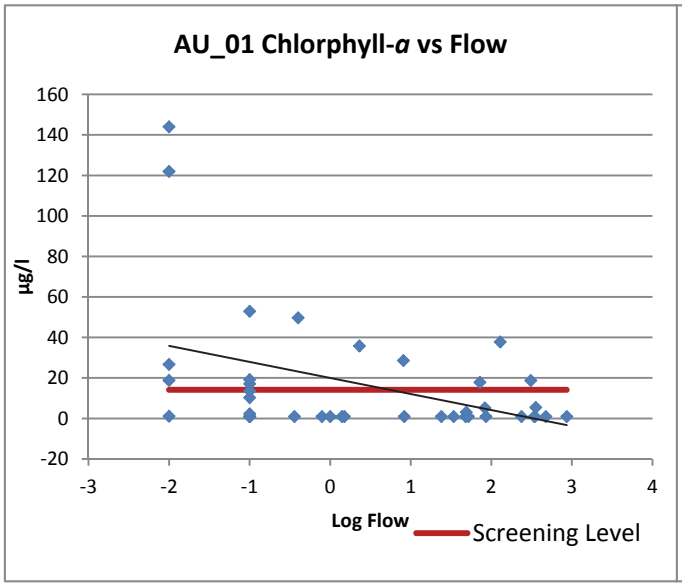
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	22	<0.02	1.96	0.06	16	1
AU_02		NC	15	<0.02	0.06	0.02	11	0

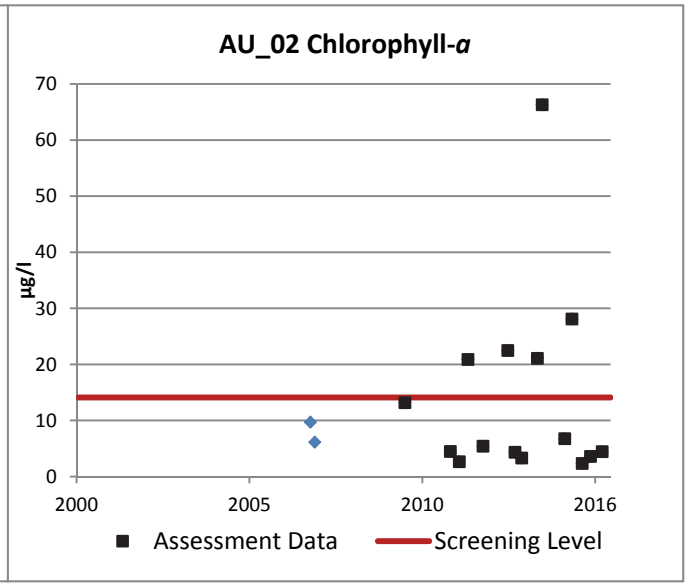
Trend analysis did not indicate any trends in ammonia concentrations in AU-01 over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	20	1.09	144	10.3	0	11
AU_02		CS	15	2.4	66.3	5.42	0	5



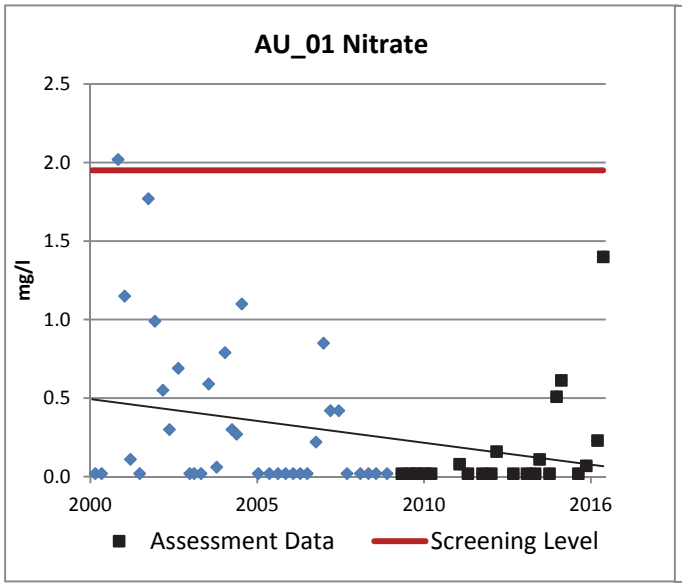
Both AUs have been assessed as having concerns for chlorophyll-*a*. Trend anlaysis indicates an increasing trend in AU_01 (t = 2.98, p = 0.004) over time and a decreasing trend (t = -2.68, p = 0.010) with respect to flow.

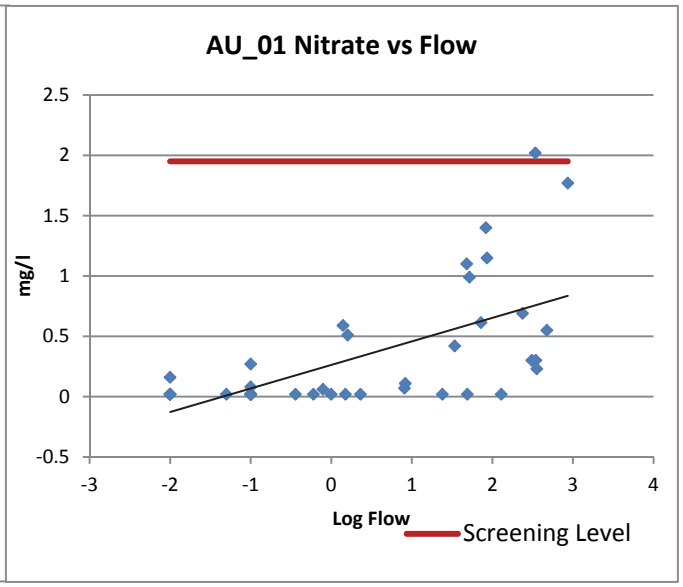




Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	21	<0.02	1.4	0.02	13	0
AU_02		NC	17	<0.02	1.29	0.02	9	0

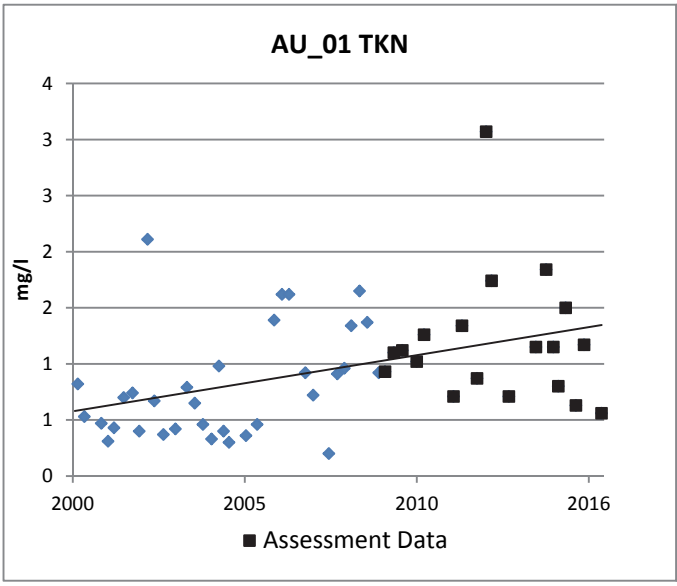
Trend anlaysis indicates a decreasing trend in nitrate concentrations in AU_01 (t = -2.13, p = 0.037) over time and an increasing trend (t = 4.42, p = 0.000) with respect to flow.

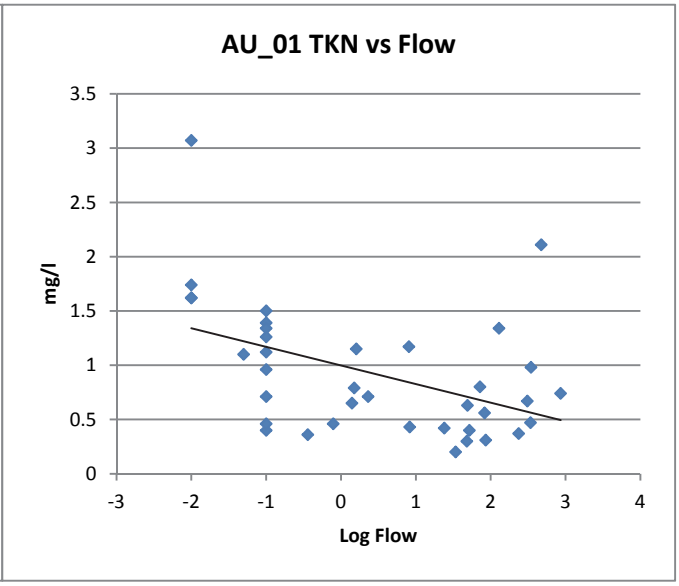




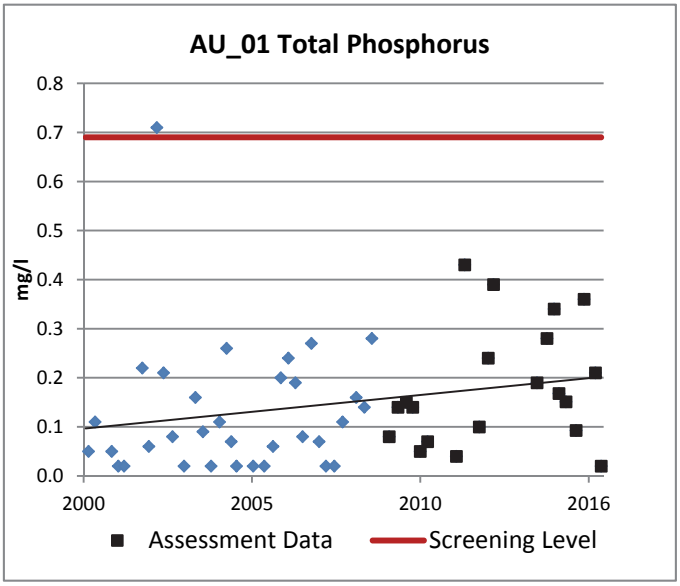
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	0.56	3.07	1.15
AU_02		N/A	15	0.4	1.6	0.82

Trend anlaysis indicates an increasing trend in TKN concentrations in AU_01 (t = 3.36, p = 0.001) over time and a decreasing trend (t = -2.20, p = 0.032) with respect to flow.





Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	20	<0.02	0.43	0.15	1	0
AU_02		NC	12	<0.06	0.54	0.12	2	0



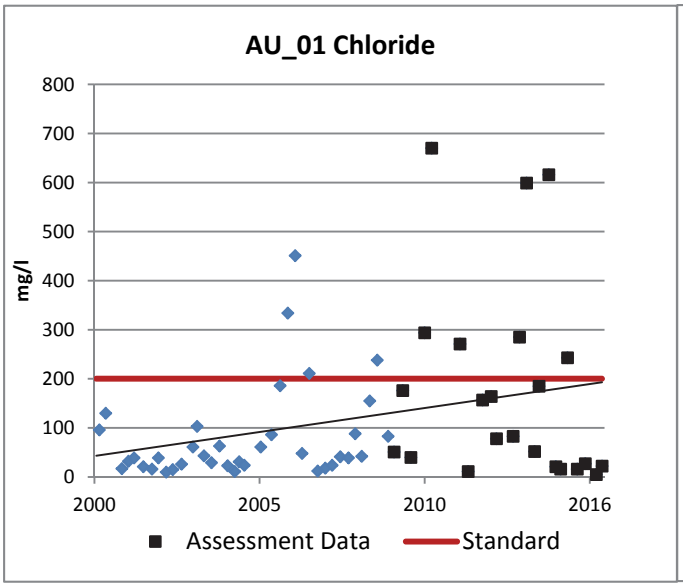
Trend anlaysis indicates an increasing trend in total phosphorus concentrations in AU_01 (t = 2.01, p = 0.049) over time. However, all of the measured values are well below the screening level.

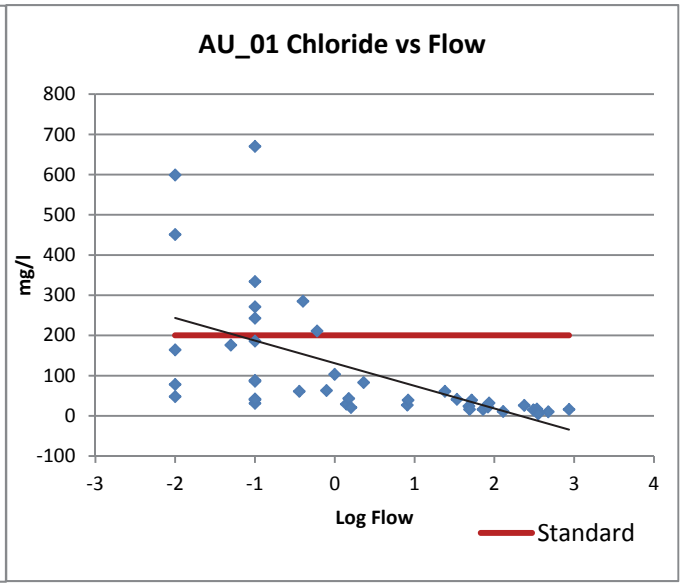
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	7	319	37
AU_02		N/A	15	4	248	30

Trend analysis did not indicate any trends in TSS concentrations in AU-01 over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>200
AU_01	200 mg/l	FS	23	<5	670	110	1	7
AU_02		FS	17	<5	74	20.2	2	0

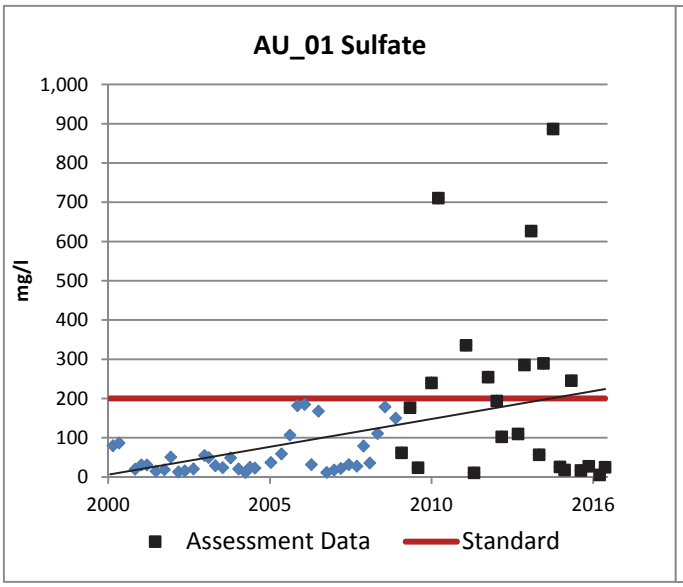
Trend anlaysis indicates an increasing trend in chloride concentrations in AU_01 (t = 2.33, p = 0.023) over time and a decreasing trend (t = -4.56, p = 0.000) with respect to flow.

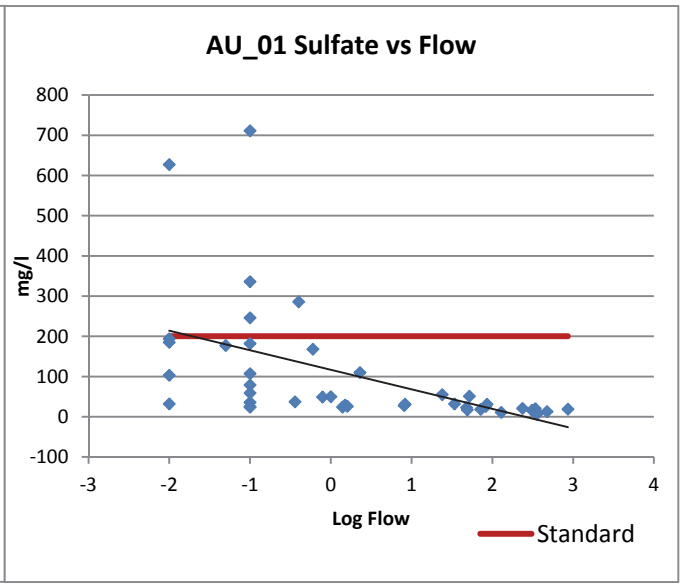




Sulfate		Status	# samples	Min	Max	Average	ND	>200
AU_01	200 mg/l	FS	23	6	887	103	0	9
AU_02		FS	17	<5	101	22.2	2	0

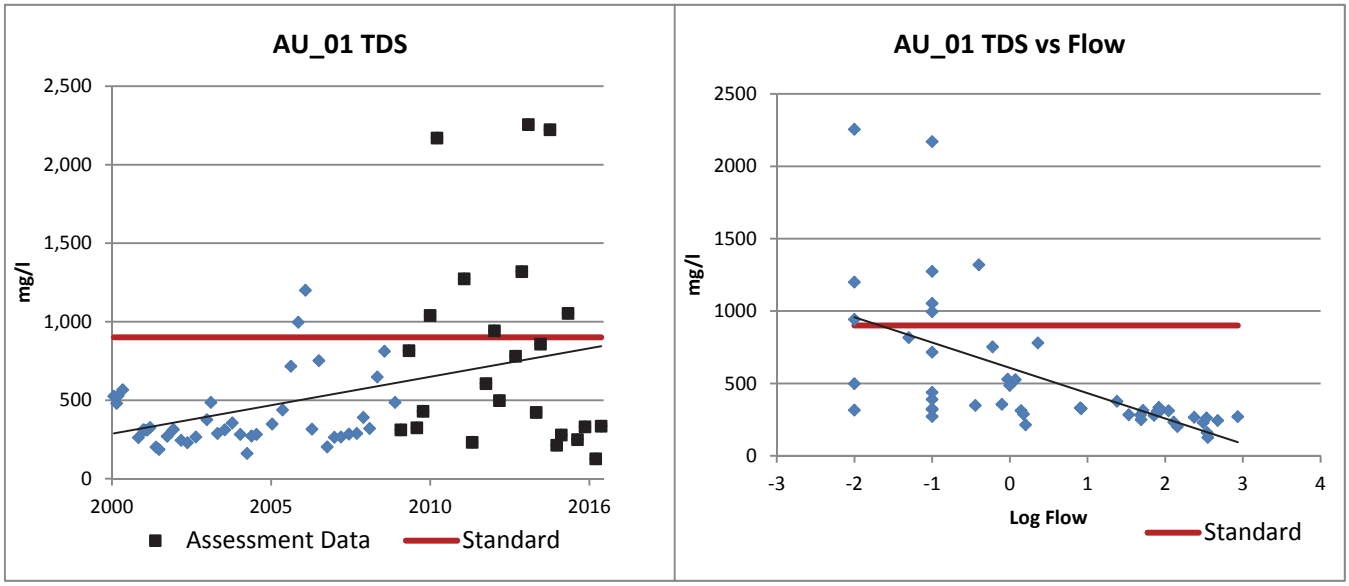
Trend anlaysis indicates an increasing trend in sulfate concentrations in AU_01 (t = 3.15, p = 0.003) over time and a decreasing trend (t = -3.91, p = 0.000) with respect to flow.





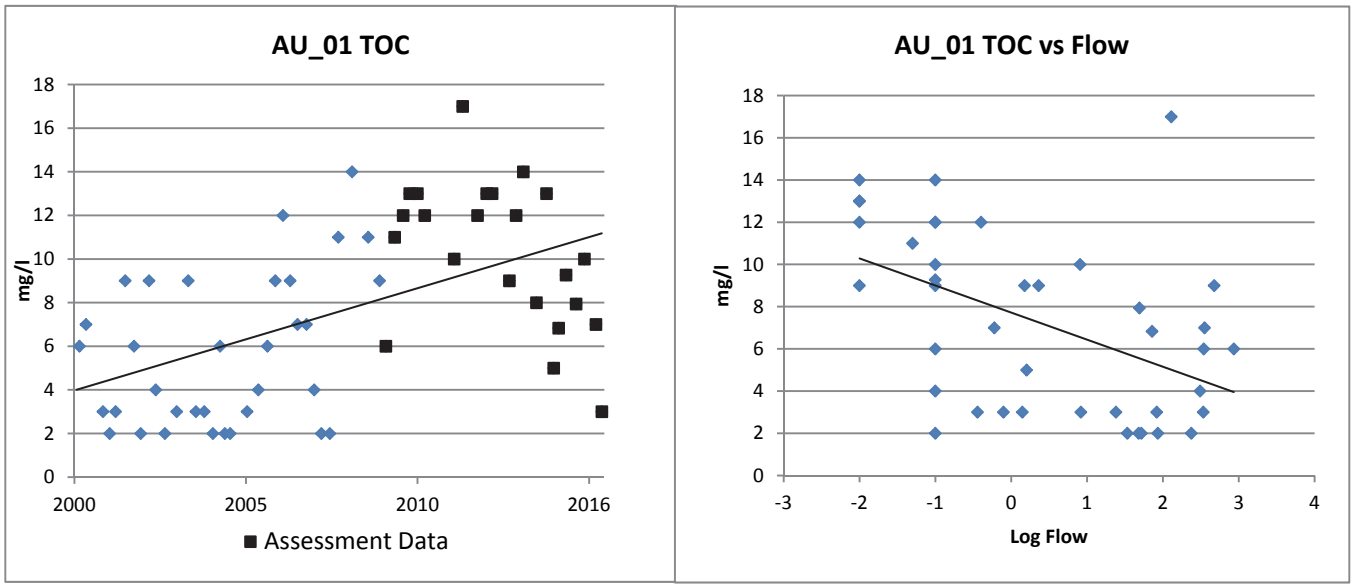
TDS		Status	# samples	Min	Max	Average	ND	>900
AU_01	900 mg/l	FS	24	127	2256	495	0	8
AU_02		FS	15	140	644	274	0	4

Trend anlaysis indicates an increasing trend in TDS concentrations in AU_01 (t = 3.18, p = 0.002) over time and a decreasing trend (t = -4.38, p = 0.000) with respect to flow.



TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	3	17	10
AU_02		N/A	16	4	16	8.4

Trend anlaysis indicates an increasing trend in TOC concentrations in AU_01 (t = 4.58, p = 0.000) over time and a decreasing trend (t = -2.89, p = 0.006) with respect to flow.

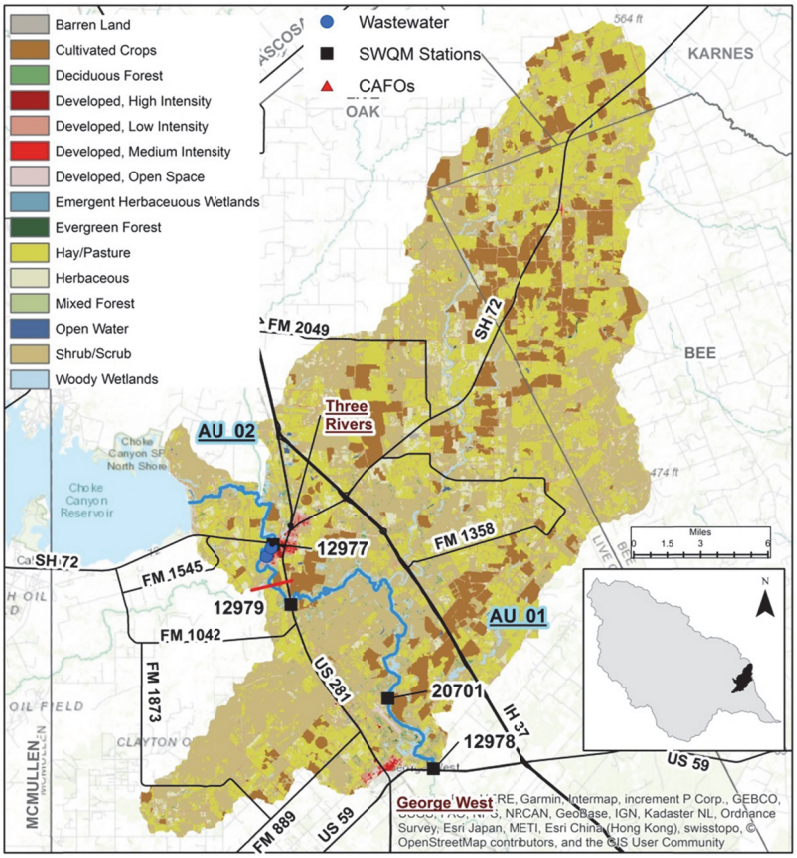


NUECES RIVER / LOWER FRIO RIVER – SEGMENT 2106

Segment 2106, Nueces River / Lower Frio River, flows 27 miles from Choke Canyon Reservoir Dam to just upstream of US 59. It is divided into two AUs. **AU_01** is the Nueces River from the downstream end to the confluence with the Frio River. **AU_02** is the Frio River from the confluence with the Nueces River to the Choke Canyon Reservoir Dam. Its watershed is 204,055 acres**.**

The City of Three Rivers and the Valero Refinery WWTPs discharge to the Frio River below SH 72.

Due to the hydrologic difference between the two AUs, AU_01 being the Nueces River and AU_02 being the Frio River, a standards revision has been proposed for chloride, sulfate, and TDS, with different values for each AU. The revision is under review by the EPA. The AUs will be assessed separately for these parameters.



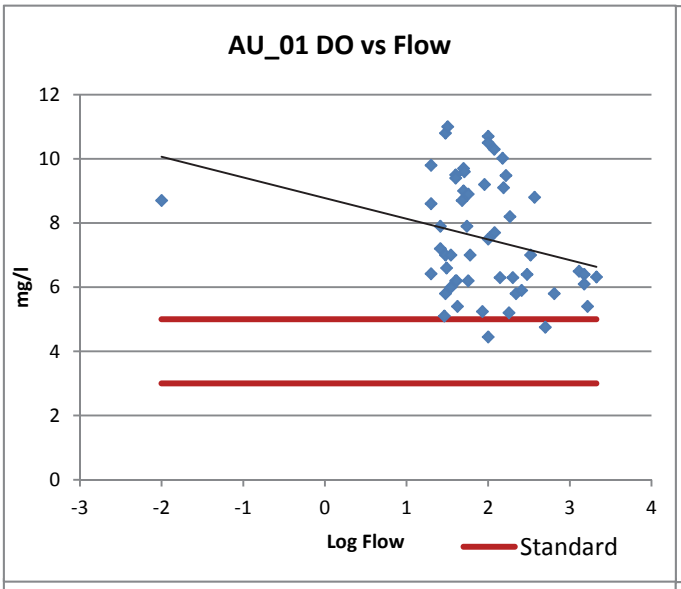
Water Quality Analysis

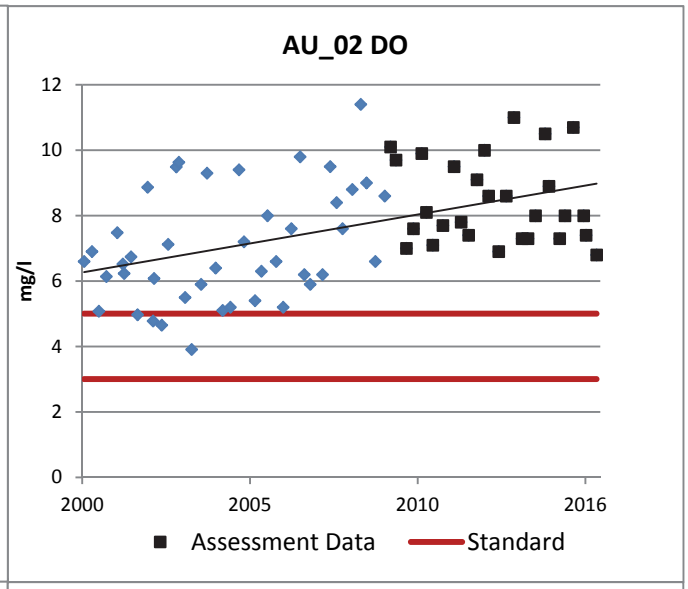
The analysis for AU_01 is based on data from **Station 12978** at US 59 and **Station 20701** near Airport Road near George West**.** The analysis for AU_02 is from 12977 at SH 72 at Tips Park.

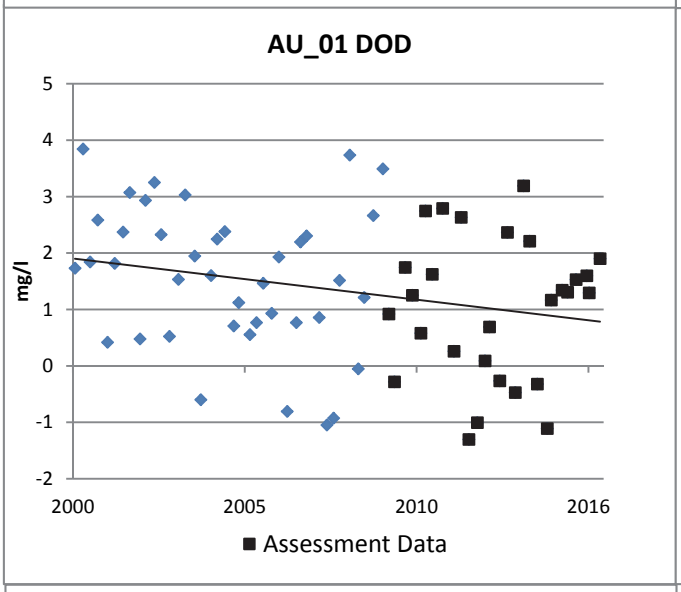
Aquatic Life Use Assessment

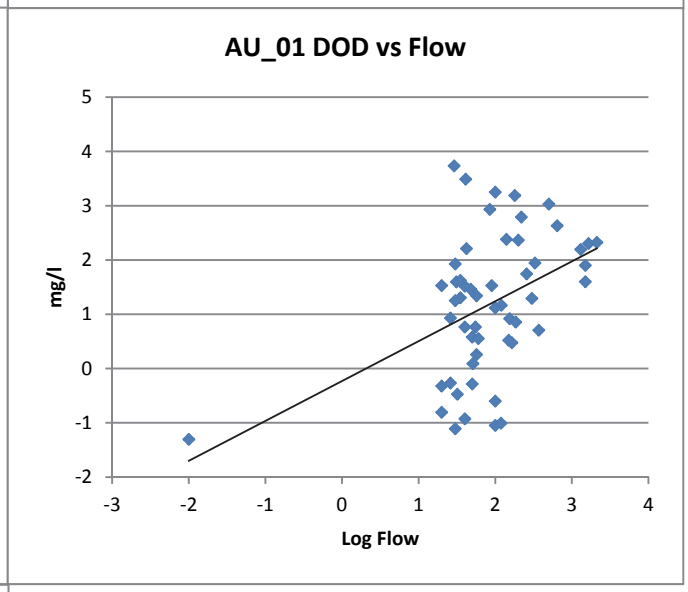
DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	28	5.2	11.0	7.4	0	0
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	FS	28	6.8	11.0	8.0	0	0
	Screening Level 5.0 mg/l	NC						

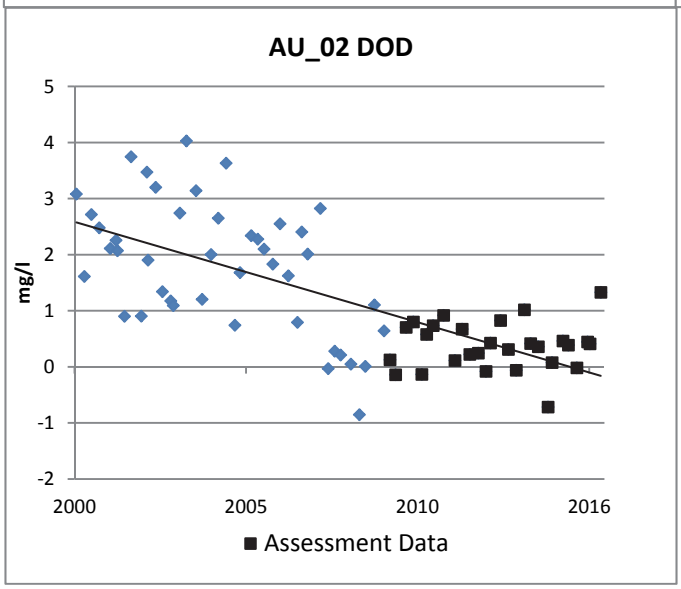
Trend analysis indicates an increasing trend in DO levels in AU_02 (t = 4.44, p = 0.000) over time and a decreasing trend in AU_01 (t = -2.06, p = 0.045) with respect to flow. Trend analysis also indicates decreasing trends in DOD in AU_01 (t = -2.13, p = 0.037) and in AU_02 (t = -8.19, p = 0.000) over time and an increasing trend in AU_01 (t = 3.49, p = 0.001) with respect to flow.


AU_01 DO vs Flow
mg/l
Log Flow
Standard


AU_02 DO
mg/l
Assessment Data
Standard

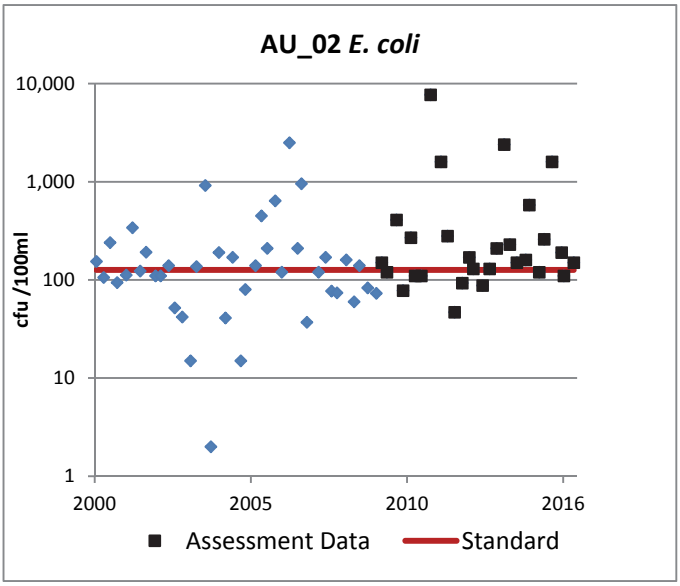

AU_01 DOD
mg/l
Assessment Data


AU_01 DOD vs Flow
mg/l
Log Flow


AU_02 DOD
mg/l
Assessment Data

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	28	6	13,000	96.4	0	11
AU_02		NS	28	47	7700	232	0	19



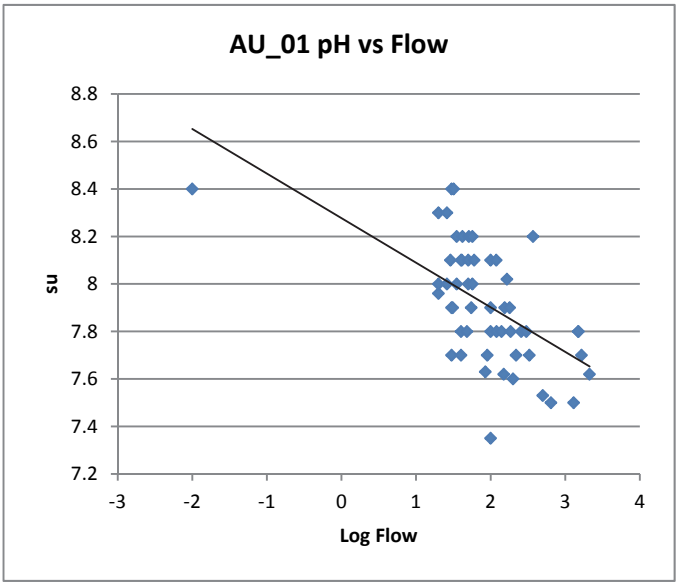
AU_02 is listed as being impaired for bacteria for contact recreation and the concentrations continue to be above the standard. The river upstream of the sampling site passes through primarily rural lands. Therefore, wildlife, feral hogs, and livestock may be contributing to the loading. Trend analysis did not indicate any trends in either AU.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	28	11.6	32.6	24.2	1
AU_02		FS	28	10.7	30.6	23.5	0

Trend analysis did not indicate any trends in water temperature in either AU over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	28	7.5	8.4	8.0	0	0
AU_02		FS	28	7.7	8.5	8.1	0	0

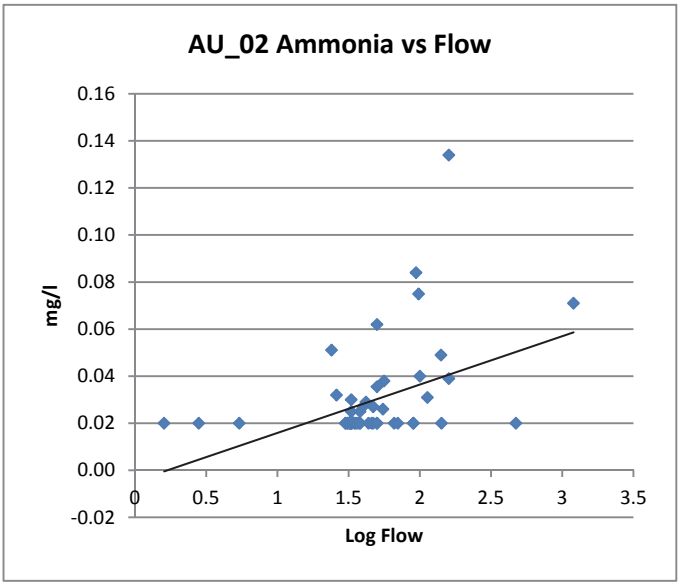


Trend analysis indicates a decreasing trend in pH levels in AU_01 ($t = -5.12$, $p = 0.000$) with respect to flow. However, even the lowest values are well within the standard range.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	85.8	214	160
AU_02		N/A	28	120	339	158

Trend analysis did not indicate any trends in alkalinity in either AU over time or with respect to flow.

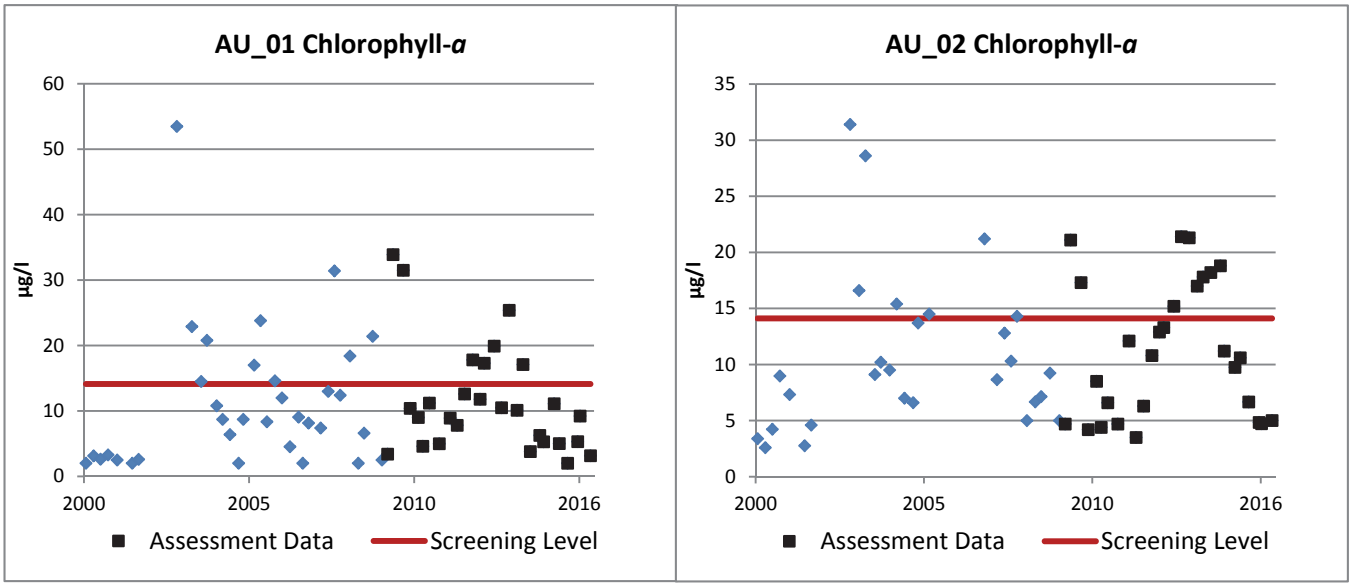
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	28	<0.02	0.176	0.02	17	0
AU_02		NC	28	<0.02	0.134	0.02	15	0



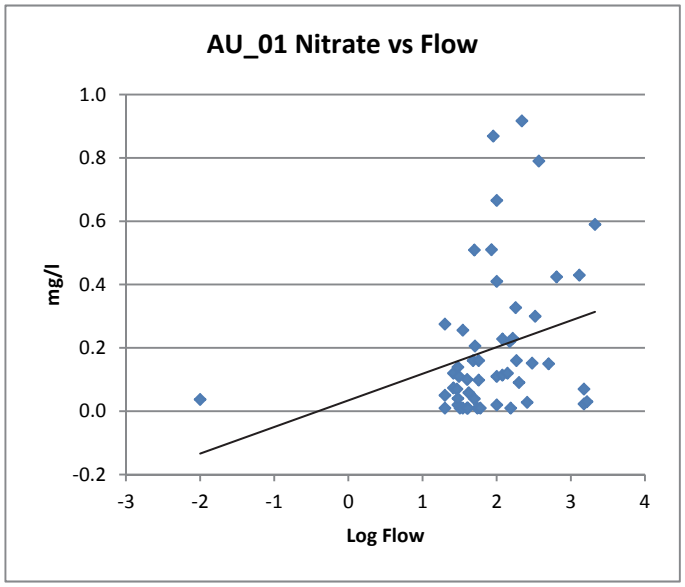
Trend analysis indicates an increasing trend in ammonia levels in AU_02 (t = 2.97, p = 0.004) with respect to flow. However, even the highest values are well below the screening level.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	28	<2	33.9	9.66	1	7
AU_02		CS	28	3.5	21.4	10.7	0	9

Both AUs have been assessed as having concerns for chlorophyll-*a*. Trend analysis did not indicate any trends levels in either AU over time or with respect to flow.



Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	28	<0.01	0.917	0.112	3	0
AU_02		NC	28	<0.02	0.978	0.067	10	0

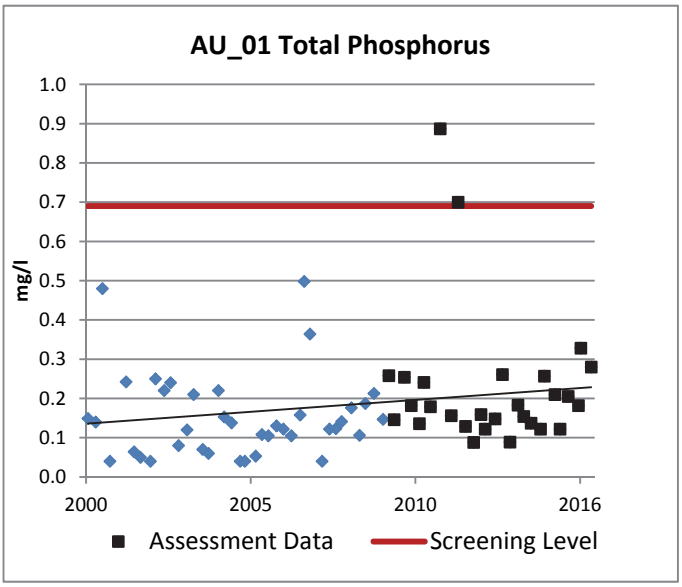


Trend analysis indicates an increasing trend in nitrate levels in AU_01 (t = 2.11, p = 0.039) with respect to flow. However, even the highest values are well below the screening level

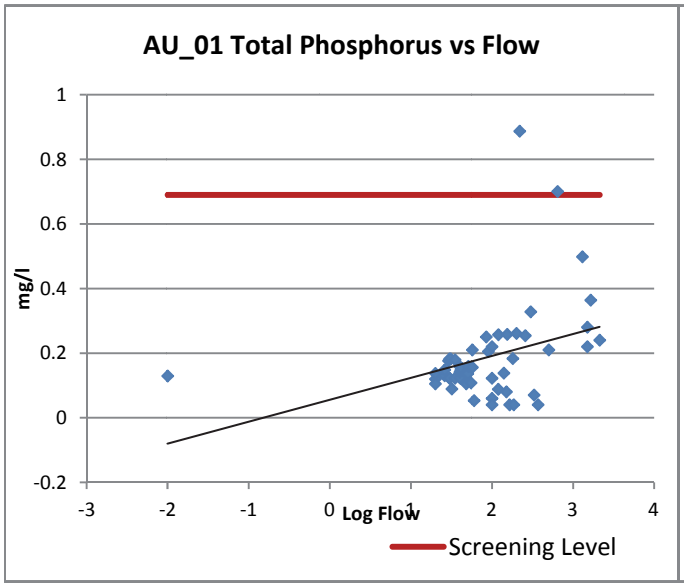
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	0.89	3.99	1.46
AU_02		N/A	21	0.79	3.18	1.48

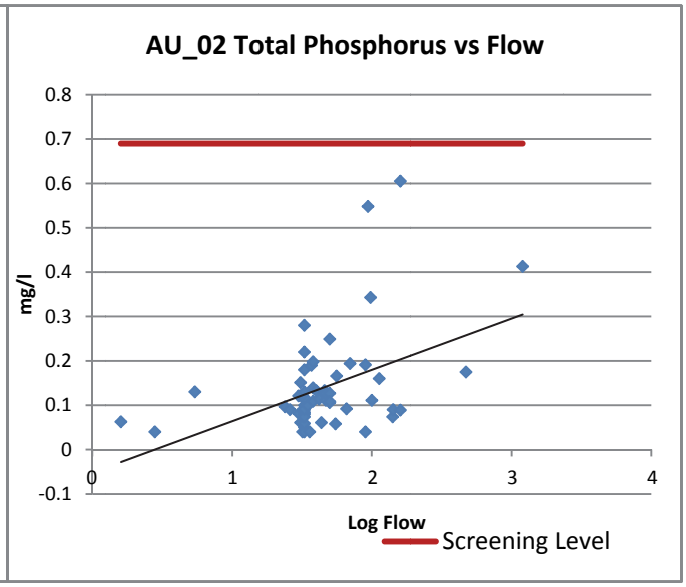
There is insufficient TKN data for trend analysis in both AUs.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	28	0.09	0.89	0.18	0	2
AU_02		NC	28	<0.04	0.60	0.12	1	0

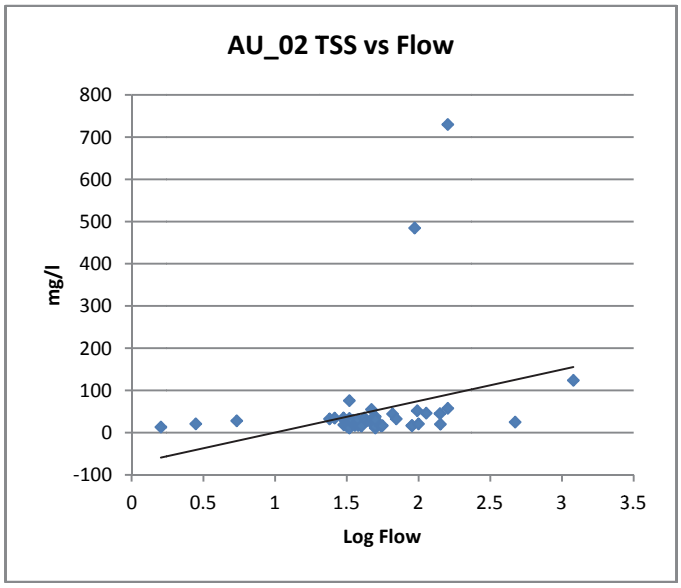


Trend analysis indicates an increasing trend in total phosphorus levels in AU_01 (t = 2.06, p = 0.043) over time. Trend analysis also indicates increasing trends in AU_01 (t = 2.69, p = 0.010) and in AU_02 (t = 3.18, p = 0.002) with respect to flow. However, nearly all of the readings are well below the screening level.





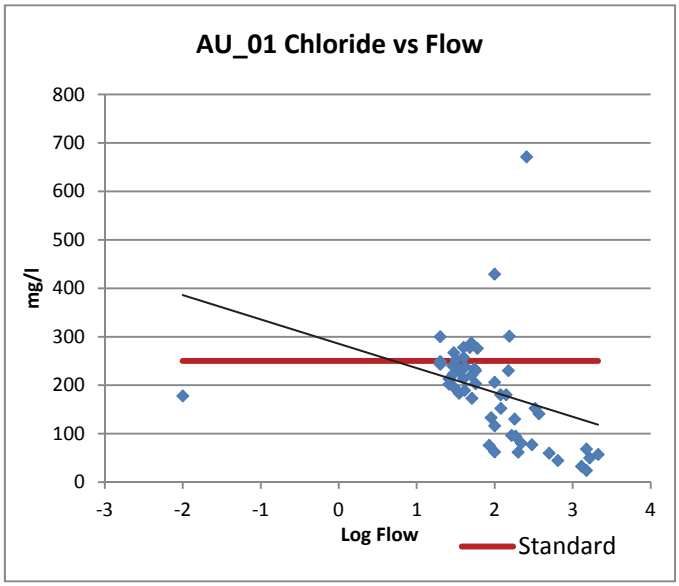
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	12.4	730	46.3
AU_02		N/A	28	13.2	730	32.2



Trend analysis indicates an increasing trend in TSS levels in AU_02 ($t = 2.07$, $p = 0.043$) with respect to flow.

Sampling location for Station 12977 at SH 72 at Tips Park

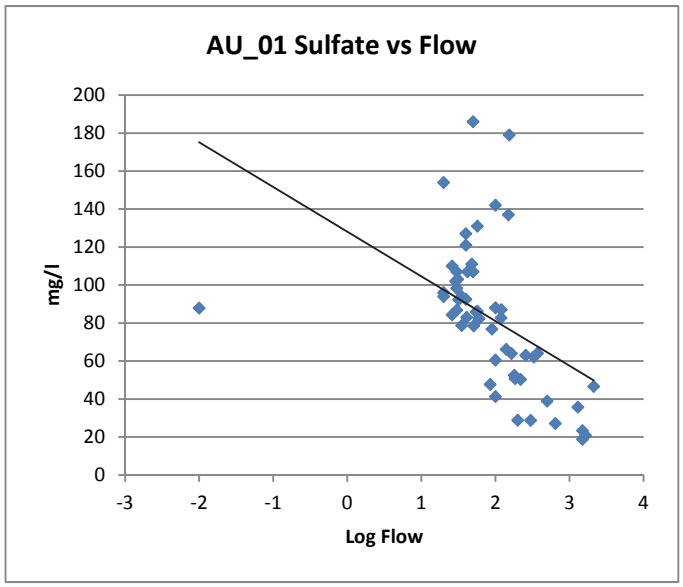
Chloride		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	24.1	671	201	0	6
AU_02		FS	28	76.9	464	186	0	3



The data analysis indicates that chloride currently meets the proposed standard in AU_01 (350 mg/l) and in AU_02 (285 mg/l).

Trend analysis indicates a decreasing trend in chloride levels in AU_01 (t = -2.71, p = 0.009) with respect to flow.

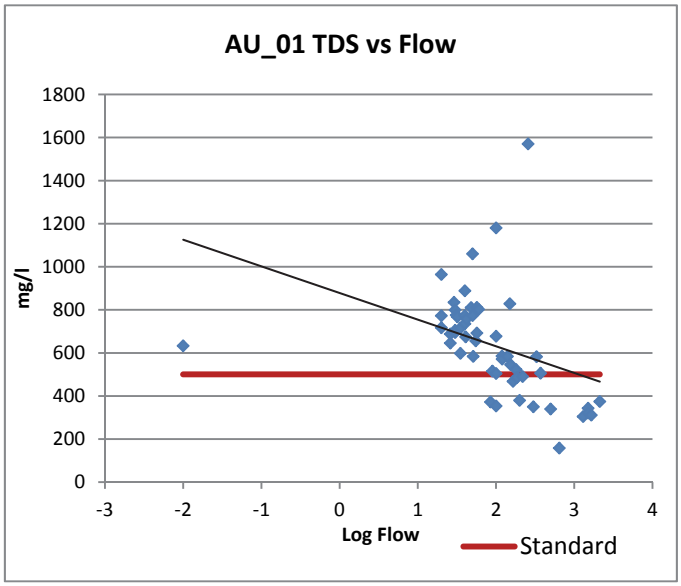
Sulfate		Status	# samples	Min	Max	Average	ND	>250
AU_01	250 mg/l	FS	28	18.8	186	80.0	0	0
AU_02		FS	28	45.9	388	108	0	1



The data analysis indicates sulfate that currently meets the proposed standard in AU_01 (165 mg/l) and in AU_02 (145 mg/l).

Trend analysis indicates a decreasing trend in sulfate levels in AU_01 (t = -3.89, p = 0.000) with respect to flow. All values are below the standard.

TDS		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	NS	28	158	1570	661	0	23
AU_02		NS	28	442	1010	672	0	24

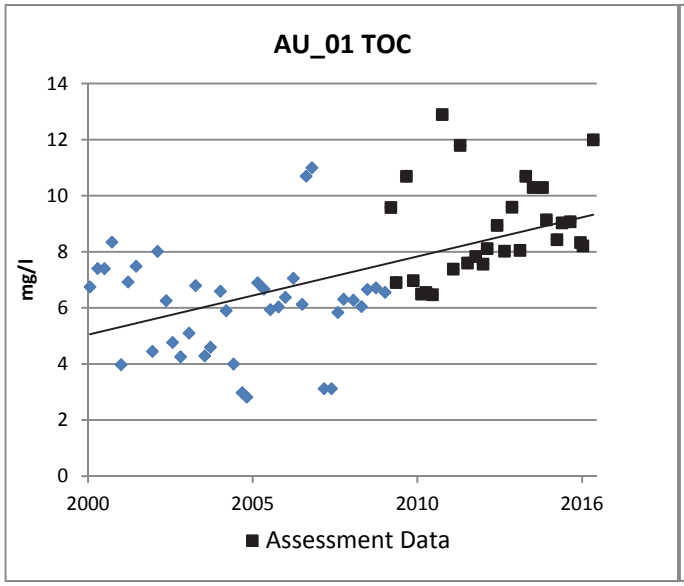


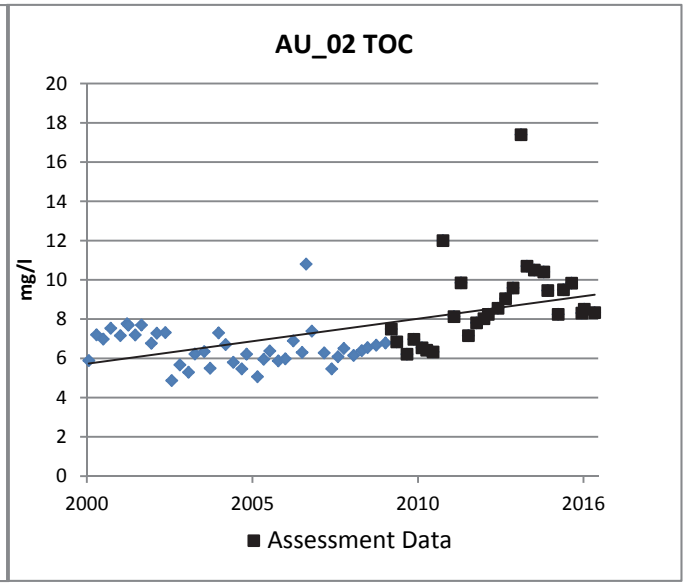
The data analysis indicates that TDS currently meets the proposed standard in AU_01 (950 mg/l) and AU_02 (735 mg/l). The non-supporting status in the Draft 2016 Integrated Report is based on the current standard of 500 mg/l.

Trend analysis indicates a decreasing trend in TDS levels in AU_01 (t = -3.07, p = 0.003) with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	6.48	12.9	8.39
AU_02		N/A	28	6.21	17.4	8.32

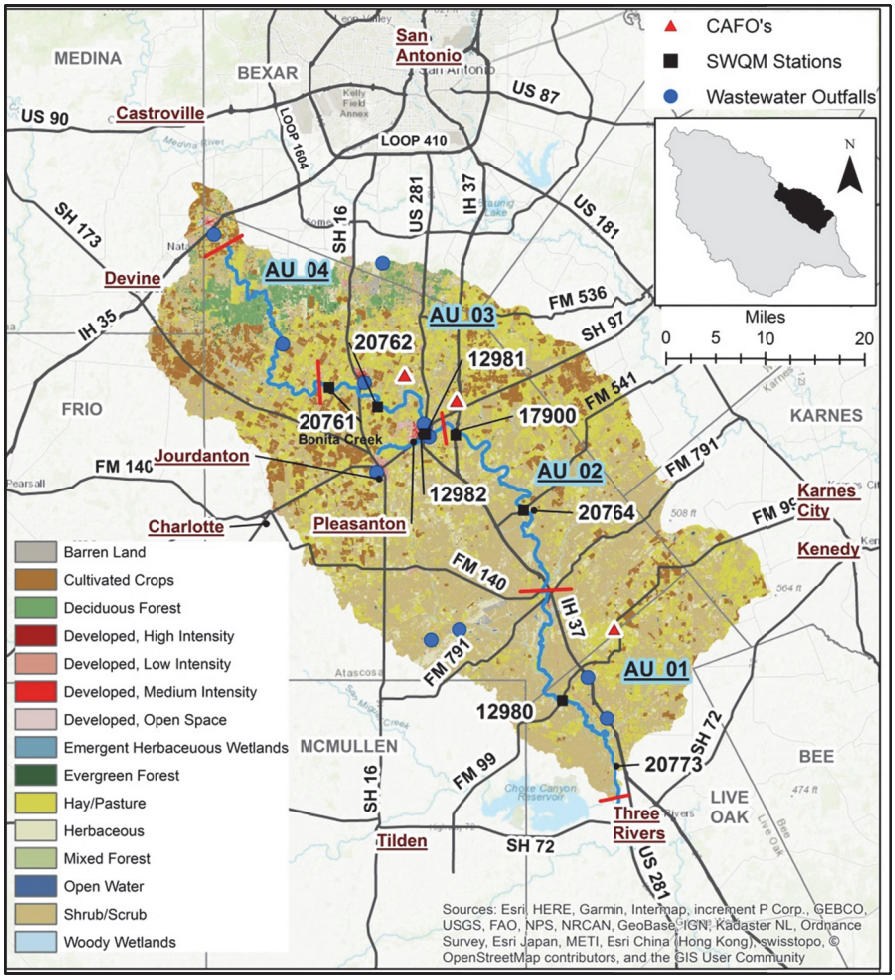
Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 5.45, p = 0.000) and in AU_02 (t = 5.13, p = 0.000) over time.





ATASCOSA RIVER – SEGMENT 2107

Segment 2107, Atascosa River, flows 103 miles from the confluence of the West Prong Atascosa River and the North Prong Atascosa River in Atascosa County to the confluence with the Frio River in Live Oak County. It is divided into four AUs. **AU_01** is from the downstream end to the confluence with Borrego Creek. **AU_02** is from the confluence with Borrego Creek to the confluence with Galvan Creek. **AU_03** is from the confluence with Galvan Creek to the confluence with Palo Alto Creek. **AU_04** is from the confluence with Palo Alto Creek to the upper end of the segment. Its watershed is 886,750 acres.



Special Studies

Sampling for a TMDL to address the bacteria impairment on this segment was conducted between 2002 and 2004. The sampling confirmed the impairment and an RUAA was conducted by Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University in 2006 and 2007.

The TMDL and other extensive sampling that has taken place on this segment has resulted in some proposed standards revisions as wells as changes to the segment descriptions. The revisions are under review by the EPA.

- Segment 2107 is proposed to be what is currently AU_01, from the confluence with the Frio River in Live Oak County to the confluence with Borrego Creek in Atascosa County,
- a new Segment 2118 will be what is currently AU_02, from the confluence with Borrego Creek in Atascosa County to the confluence with Galvan Creek in Atascosa County, and the 24-Hr DO average standard will be 4.0 mg/l instead of 5.0 mg/l,
- what is currently AU_03, from the confluence with Galvan Creek in Atascosa County to the confluence with Palo Alto Creek in Atascosa County, will be moved to Appendix D of the Texas Water Quality Standards; the 24-Hr DO average standard will be 3.0 mg/l instead of 5.0 mg/l and the minimum DO grab standard will be 2.0 mg/l instead of 3.0 mg/l, and
- what is currently AU_04, from the confluence with Palo Alto Creek in Atascosa County to the headwaters in Atascosa County, will be considered the undescribed portion; the 24-Hr DO average standard will be 2.0 mg/l instead of 5.0 mg/l and the minimum DO grab standard will be 1.5 mg/l instead of 3.0 mg/l.

Additional proposed standards revisions for Segment 2107 include chloride from 600 mg/l to 400 mg/l, sulfate from 500 mg/l to 300 mg/l, and TDS from 1,500 mg/l to 1,650 mg/l. The proposed standards for Segment 2118 for chloride, sulfate, and TDS are 350 mg/l, 700 mg/l, and 1,550 mg/l, respectively.

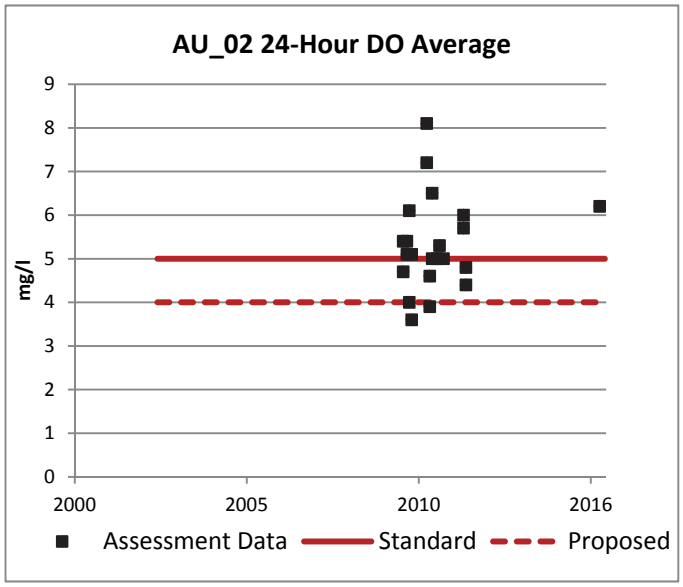
Water Quality Analysis

The analysis for AU_01 is based on data from **Station 12980** at FM 99. The analysis for AU_02 is from **Station 17900** at IH 17 and **Station 20764** at FM 541. The analysis for AU_03 is from **Station 12982** at US 281, with additional 24-Hour DO data from **Station 12981** at the railroad bridge east of Pleasanton, **Station 20761** at FM 2146, and **Station 20762** at Granato Road / Taylor Road. There is insufficient data for trend analysis in AU_02. There is insufficient data in AU_04 for either statistical or trend analysis, and the Draft 2016 Integrated report does not list any concerns or impairments.

AU_02 and AU_03 are listed as having being impaired for macrobenthic community and fish community, and are assessed as having concerns for impaired habitat.

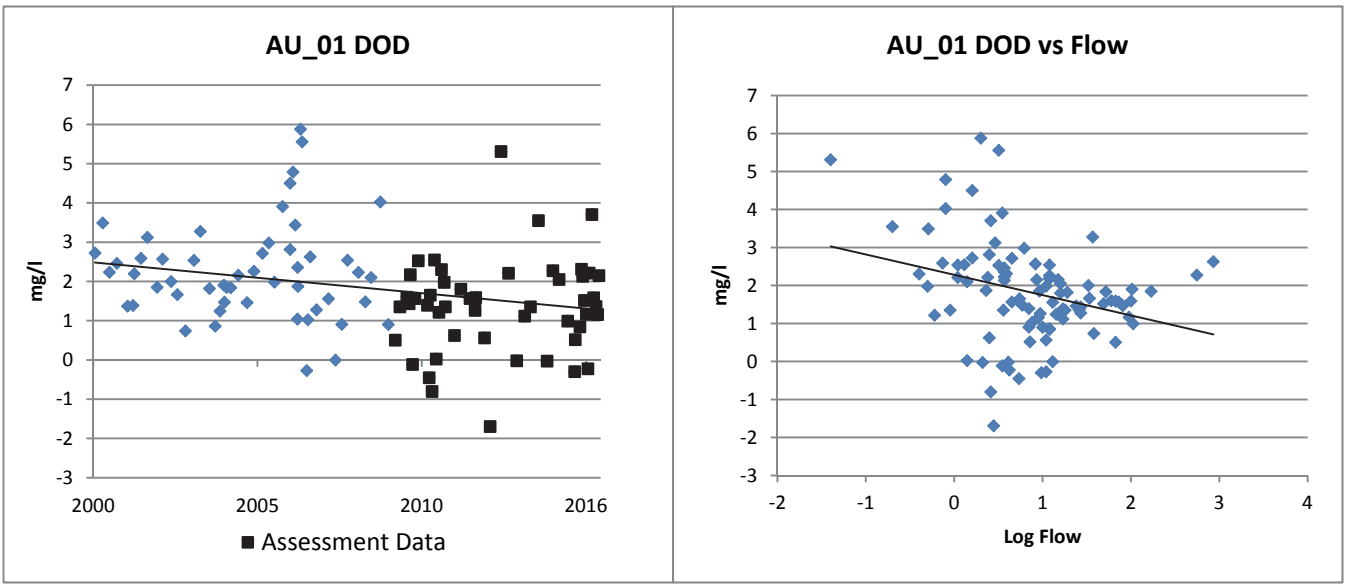
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	49	2.6	11.9	6.9	1	2
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	NS	12	2.7	10.9	5.8	1	2
	Screening Level 5.0 mg/l	NC						
AU_03	Minimum 3.0 mg/l	FS	22	3.3	11.4	7.8	0	2
	Screening Level 5.0 mg/l	NC						



AU_02 is listed as being impaired for low DO based on the 24-hour average measurements. The data analysis indicates that the average 24-hour DO measurements currently meet the proposed standard (4 mg/l).

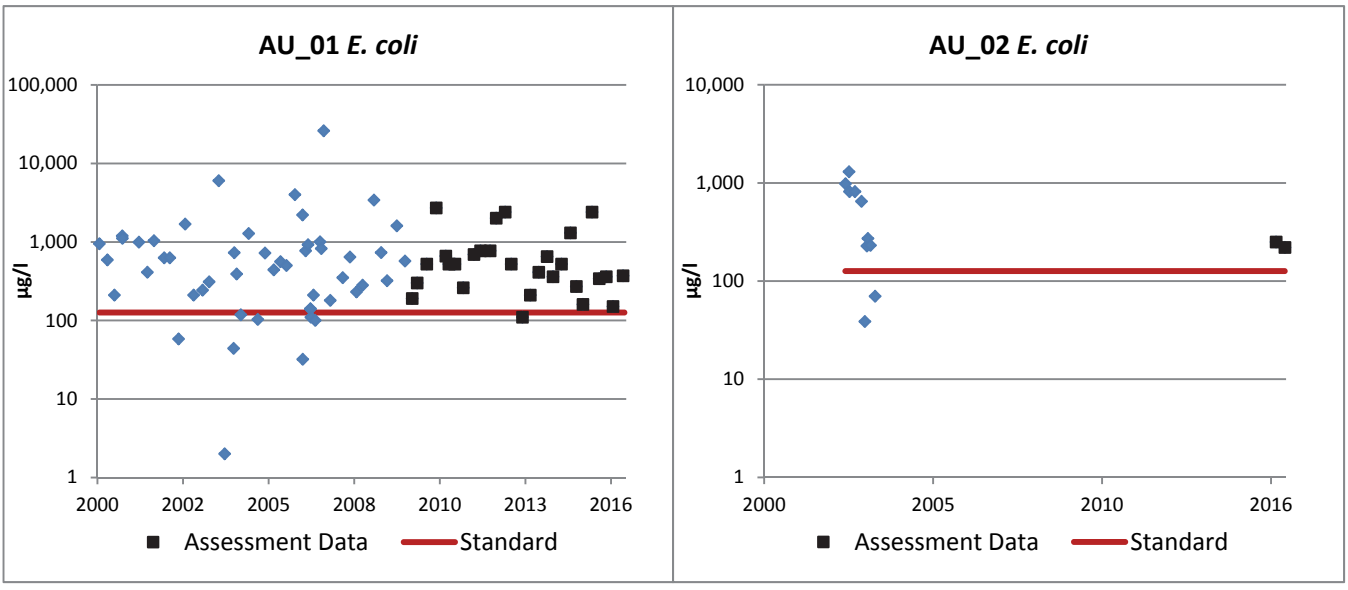
Trend analysis indicates decreasing DOD trends in AU_01 ($t = -2.88$, $p = 0.005$) over time and ($t = -2.33$, $p = 0.021$) with respect to flow.



Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	28	110	2700	501	0	27
AU_02		NS	2	220	250	234	0	2
AU_03		FS	21	<1	660	53.6	1	7

AU_01 and AU_02 are listed as being impaired for bacteria for contract recreation. The measurements in AU_01 continue to be above the standard. There is insufficient data for meaningful analysis in AU_02, but the two measurements taken in 2016 both exceeded the standard.



General Use

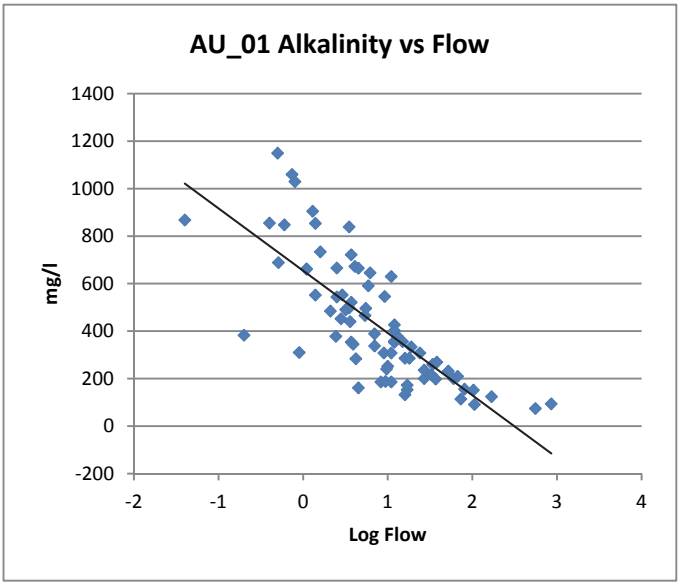
Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	50	7.8	30.9	23.9	0
AU_02		FS	12	19.2	28.5	26.9	0
AU_03		FS	22	9.7	33.9	23.8	2

Trend analysis did not indicate any trends in water temperature in AU_01 or AU_03 over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	50	7.4	9.1	8.2	0	1
AU_02		FS	12	7.5	8.2	7.8	0	0
AU_03		FS	22	7.3	8.8	7.9	0	0

Trend analysis did not indicate any trends in pH levels in AU_01 or AU_03 over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	36	74	1150	364
AU_02		N/A	10	160	323	210
AU_03		N/A	22	128	312	180

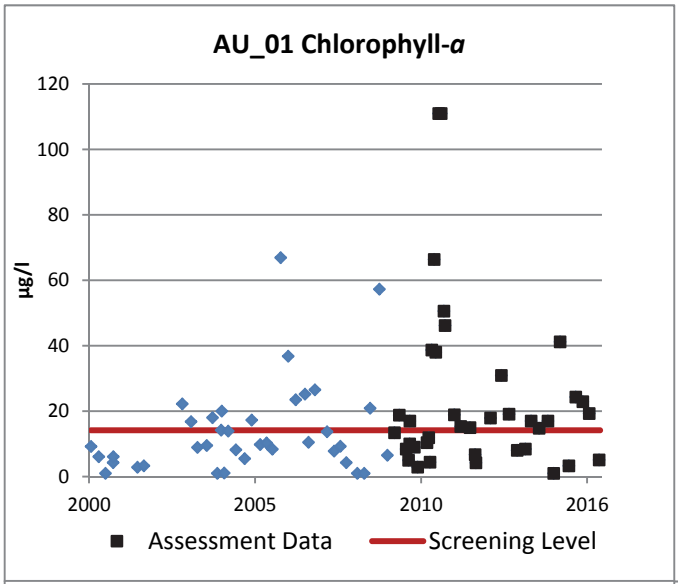


Trend analysis indicates a decreasing trend in alkalinity in AU_01 (t = -5.73, p = 0.000) with respect to flow.

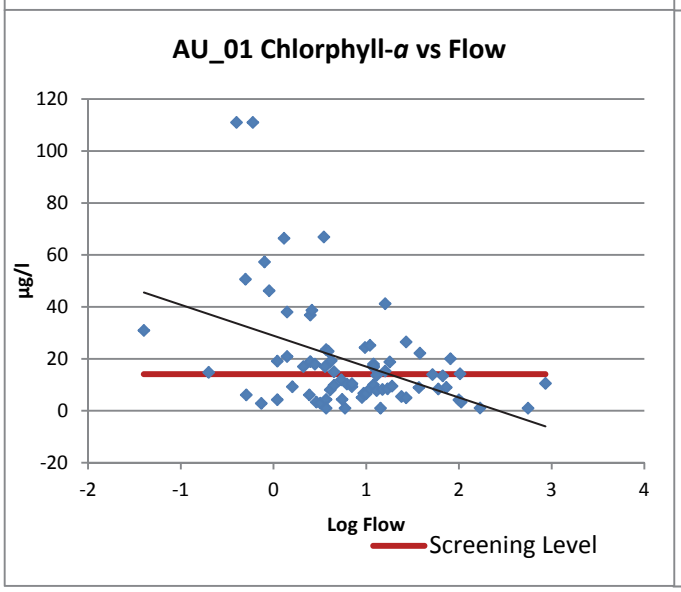
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	38	<0.02	0.082	0.02	23	0
AU_02		NC	12	<0.1	0.223	0.1	8	0
AU_03		NC	20	<0.02	0.37	0.02	11	1

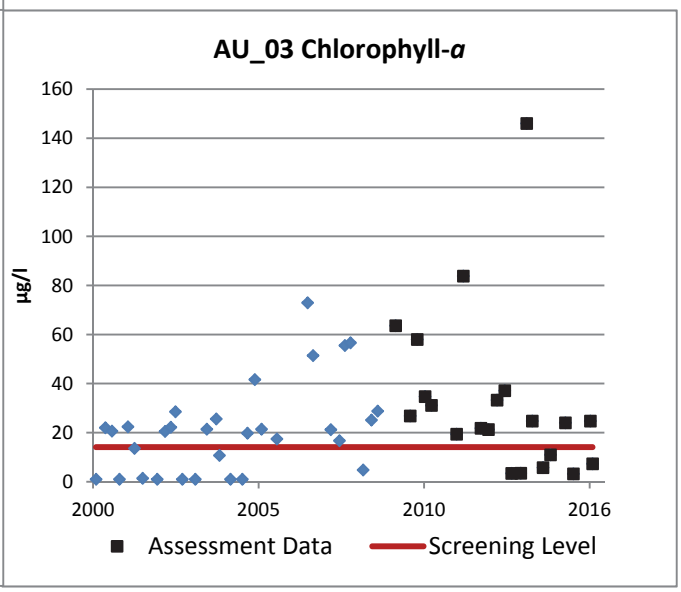
Trend analysis did not indicate any trends in ammonia concentrations in AU_01 or AU_03 over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	38	<1	111	16.2	1	22
AU_02		NC	10	<0.25	33.9	3.9	4	2
AU_03		CS	21	3.21	146	24.7	0	15



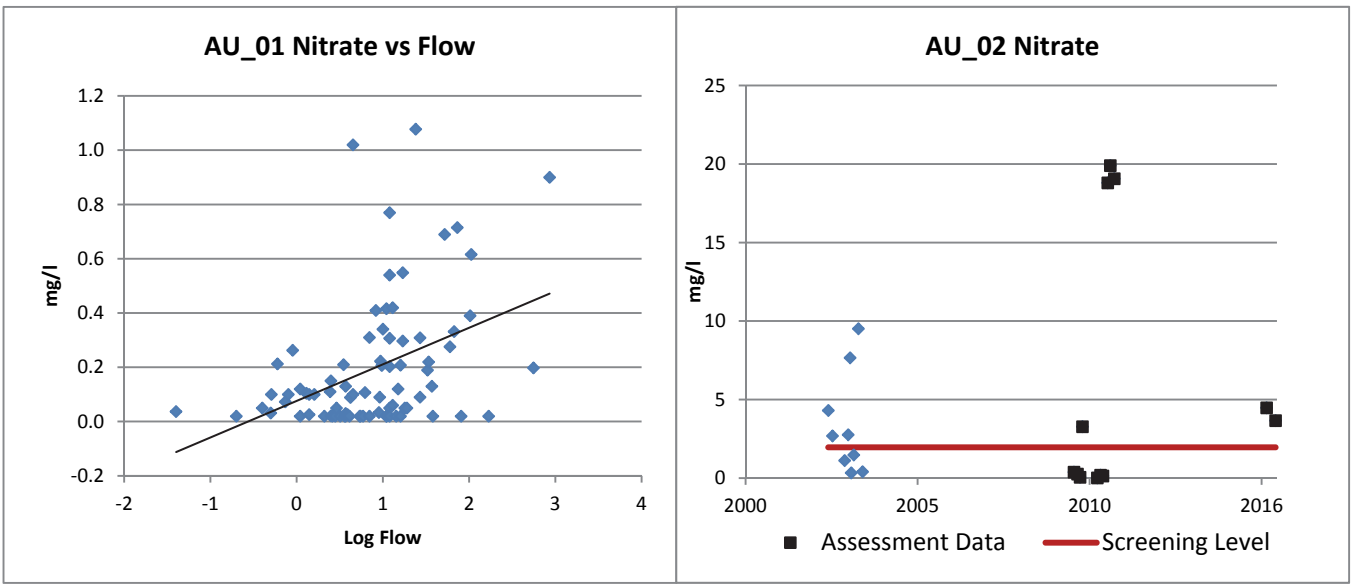
Chlorophyll-*a* has been assessed as being a concern in AU_01 and AU_03. Trend analysis indicates a decreasing trend in chlorophyll-*a* concentrations in AU_01 (t = -3.74, p = 0.000) with respect to flow.



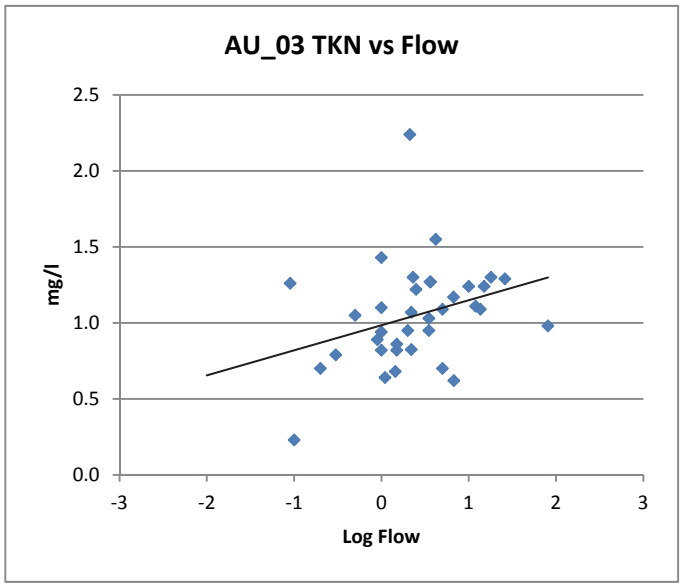


Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	38	<0.02	1.02	0.04	13	0
AU_02		CS	12	0.01	19.9	1.82	0	6
AU_03		NC	21	<0.02	0.07	0.02	19	0

AU_02 has been assessed as having a concern for nitrate. The three extremely high values in 2011 were collected during the active Eagle Ford Shale period, and appear to now be lower, but still above the screening level. Trend analysis indicates an increasing trend in nitrate concentrations in AU_01 (t = 3.77, p = 0.000) with respect to flow, but the measurements are well below the screening level.



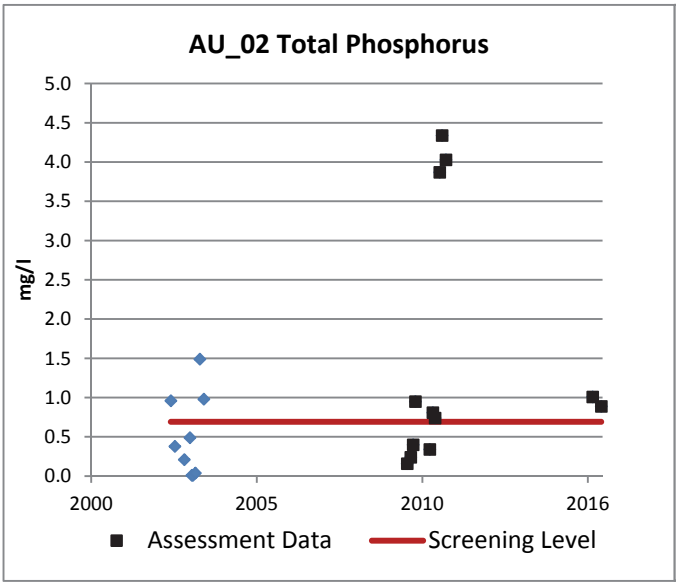
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	31	0.78	3.5	1.54
AU_02		N/A	11	0.38	2.1	0.95
AU_03		N/A	18	0.42	1.76	0.86

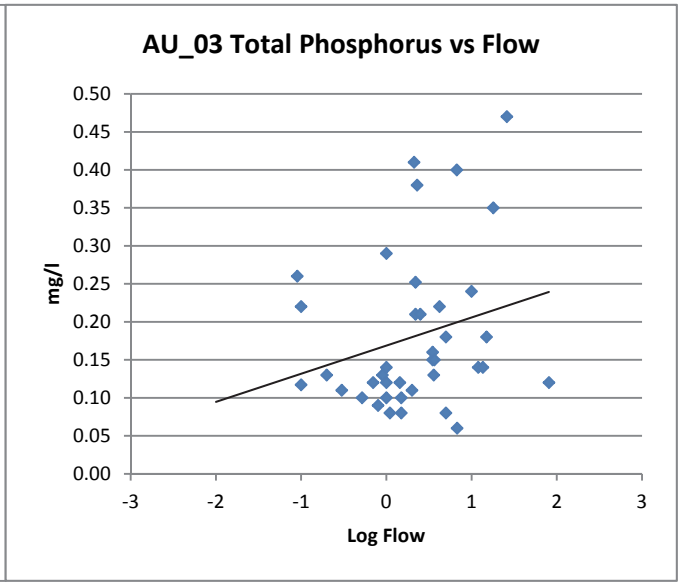


Trend analysis indicates an increasing trend in TKN concentrations in AU_03 (t = 3.22, p = 0.002) with respect to flow.

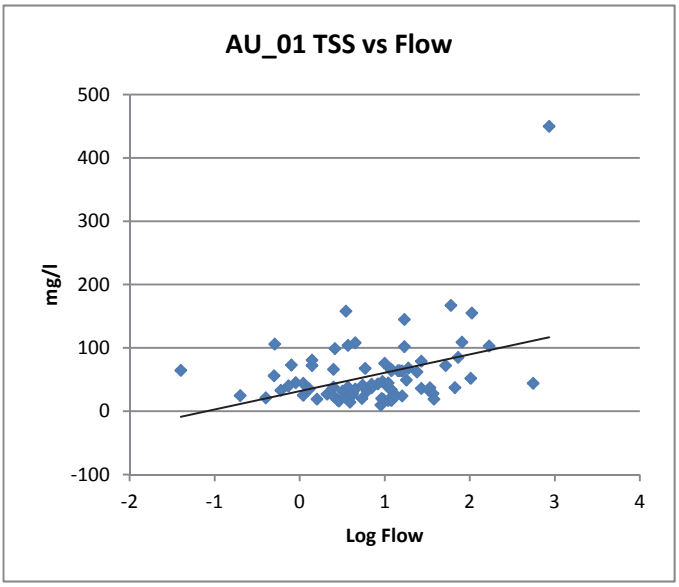
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	38	0.138	0.89	0.336	0	3
AU_02		CS	12	0.16	4.34	0.85	0	8
AU_03		NC	19	0.05	0.29	0.17	0	0

AU_02 has been assessed as having a concern for total phosphorus. The three extremely high values in 2011 were collected during the active Eagle Ford Shale period, and appear to now be lower, but still above the screening level. Trend analysis indicates an increasing trend in total phosphorus concentrations in AU_03 (t = 2.42, p = 0.019) with respect to flow, but the measurements are well below the screening level.





TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	38	9.8	167	39.1
AU_02		N/A	12	6	269	17
AU_03		N/A	21	<5	120	12.6

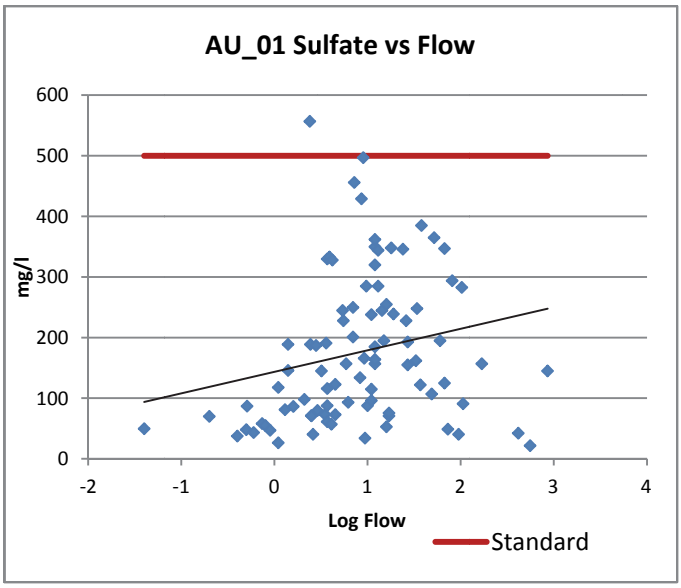


Trend analysis indicates an increasing trend in TSS concentrations in AU_01 (t = 3.21, p = 0.002) with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>600
AU_01	600 mg/l	FS	47	16	724	237	0	1
AU_02		FS	10	119	316	220	0	0
AU_03		FS	20	41	354	164	0	0

Data analysis indicates that the chloride measurements are currently meeting the proposed revised standards in AU_01 (400 mg/l) and in AU_02 (350 mg/l). Trend analysis did not indicate in trends in chloride concentrations in AU_01 or AU_03 over time or with respect to flow.

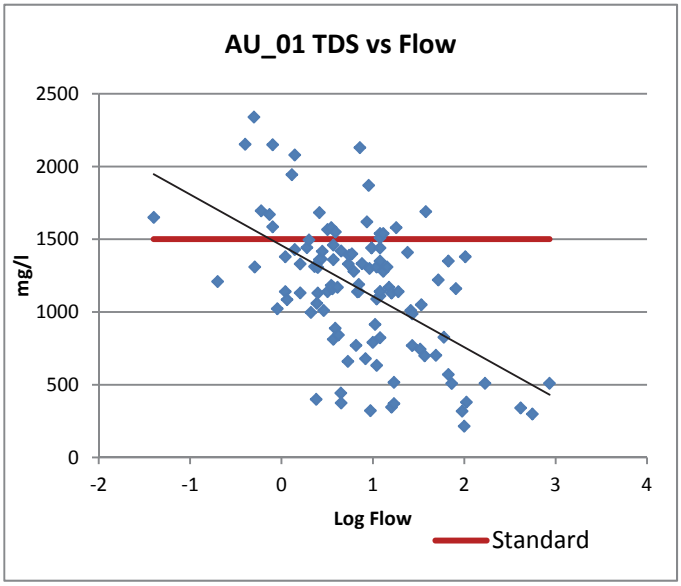
Sulfate		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	FS	47	21.8	557	169	0	1
AU_02		FS	10	72.5	389	232	0	0
AU_03		FS	20	38	445	236	0	0



Data analysis indicates that the sulfate measurements are currently meeting the proposed revised standards in AU_01 (300 mg/l) and in AU_02 (700 mg/l). Trend analysis indicates an increasing trend in sulfate concentrations in AU_01 ($t = 2.87$, $p = 0.005$) with respect to flow.

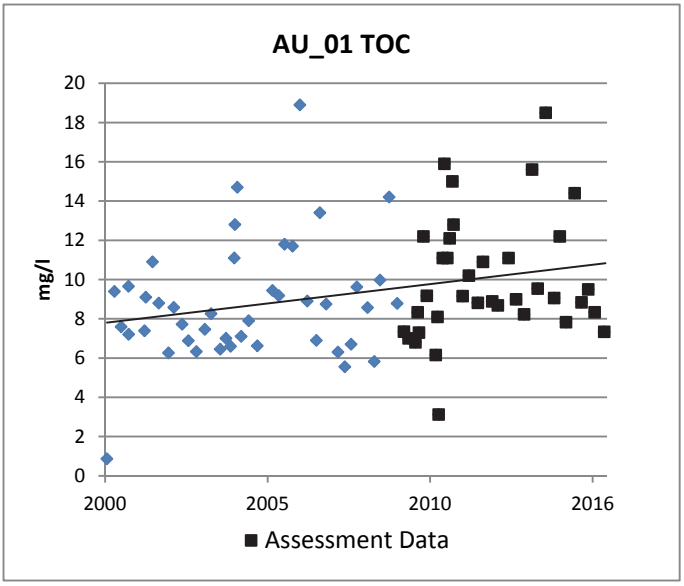
Sampling location for Station 12980 at FM 99

TDS		Status	# samples	Min	Max	Average	ND	>1500
AU_01	1500 mg/l	FS	43	299	2340	1192	0	8
AU_02		FS	12	640	1443	1052	0	0
AU_03		FS	22	368	1456	948	0	0



Data analysis indicates that the TDS measurements are currently meeting the proposed revised standards in AU_01 (1600 mg/l) and in AU_02 (1550 mg/l). Trend analysis indicates a decreasing trend in TDS concentrations in AU_01 (t = -5.373, p = 0.000) with respect to flow.

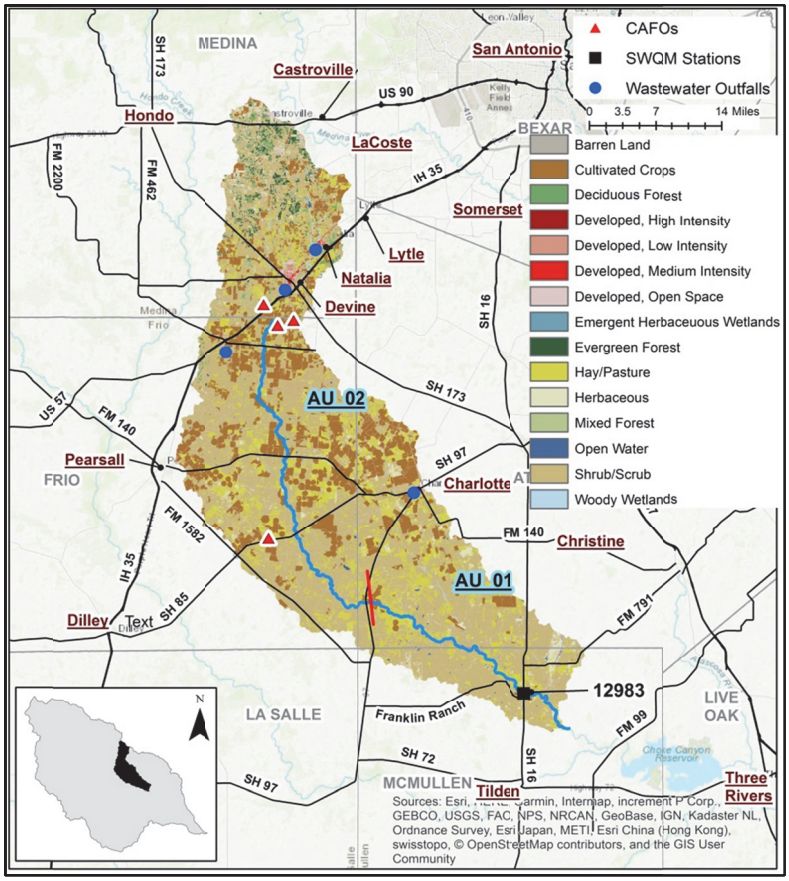
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	36	3.12	18.5	9.11
AU_02		N/A	10	4.7	7.7	6.75
AU_03		N/A	21	5	19	8



Trend analysis indicates an increasing trend in TOC concentrations in AU_01 (t = 2.53, p = 0.013) over time.

SAN MIGUEL CREEK – SEGMENT 2108

Segment 2018, San Miguel Creek, flows 69 miles from the confluence of San Francisco Perez Creek and Chacon Creek in Frio County to Choke Canyon Reservoir. It is divided into two AUs. **AU_01** is from Choke Canyon Reservoir to the confluence with Live Oak Creek. **AU_02** is from the confluence with Live Oak Creek to the upstream end. Its watershed is 535,610 acres. The cities of Charlotte, Devine, Natalia, and the Moore Water Supply Corporation WWTPs ultimately discharge to San Miguel Creek.



Special Studies

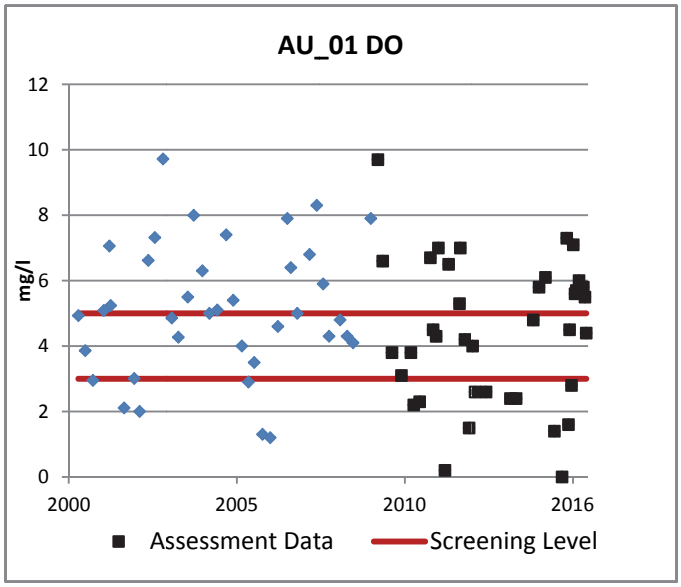
NRA conducted an RUAA on the creek in 2015 in order to determine if the primary contact recreation designation is appropriate for this water body. The results of the RUAA suggest that the secondary contact recreation 1 standard may be more appropriate for this creek. Funding for the study was provided by a grant from the TSSWCB. For more information visit the project website at https://www.nueces-ra.org/SMC/.

Water Quality Analysis

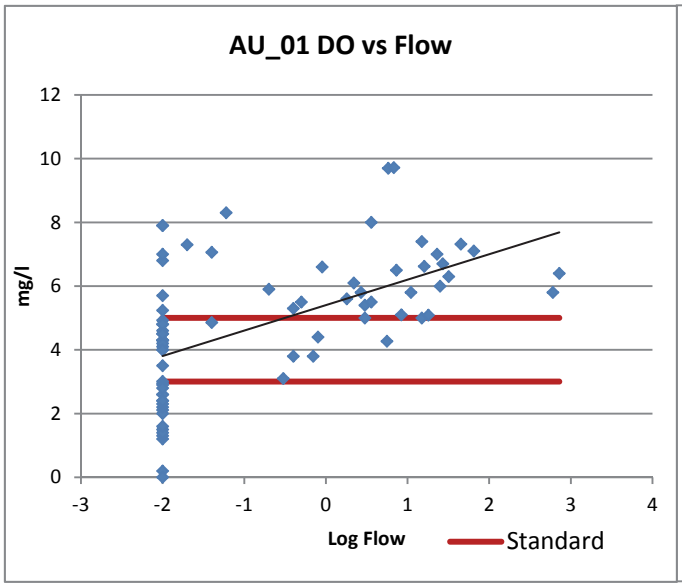
The analysis for AU_01 is based on data from **Station 12983** at SH 16. There are no sampling stations on AU_02.

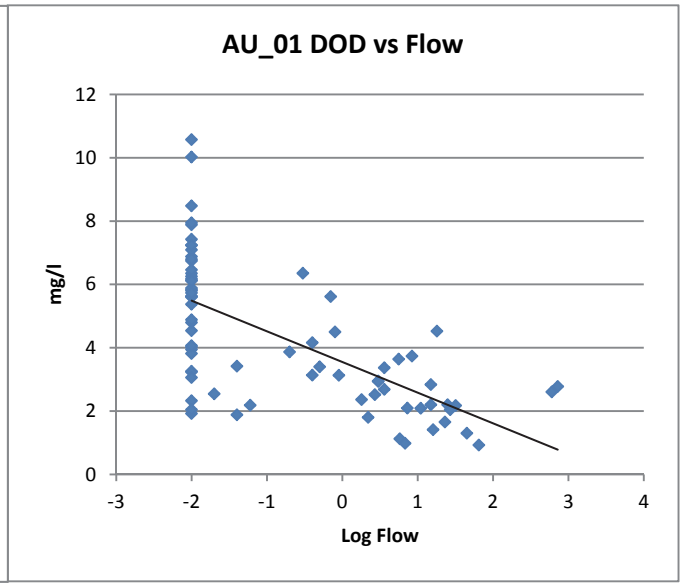
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	39	0.0	9.7	4.5	12	22
	Screening Level 5.0 mg/l	CS						



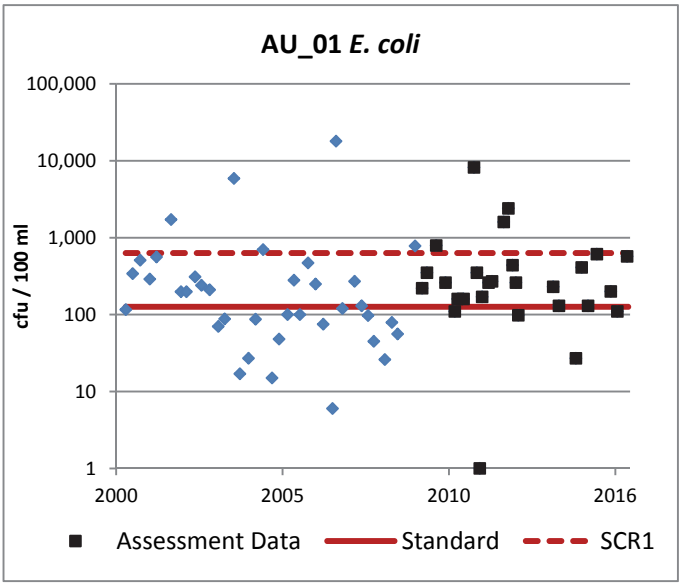
AU_01 has been assessed as having a concern for low DO at the grab screening level. Trend analysis indicates an increasing trend in DO levels (t = 4.28, p = 0.000) and a decreasing trend in DOD (t = - 5.24, p = 0.000) with respect to flow. The full range of values exist at no flow (Log Flow = -2 on the graphs), but the trends still exist for all other values.





Recreation Use

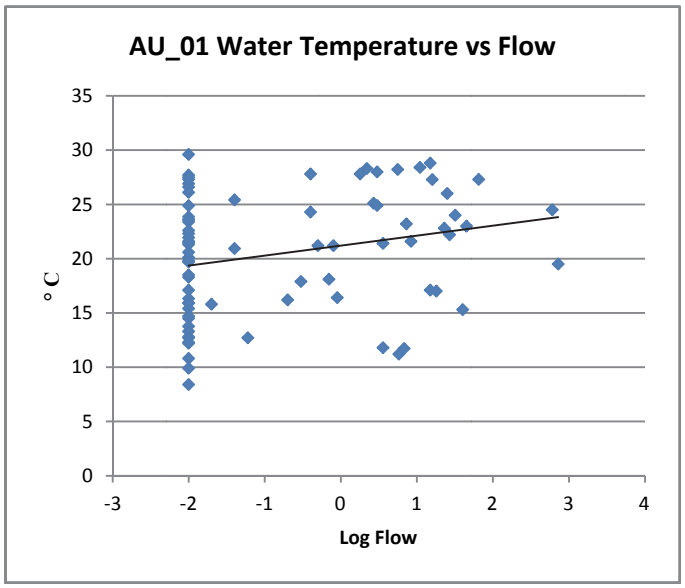
E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	27	<1	8200	241	1	22



The segment is listed as being impaired for bacteria for contact recreation. The bacteria levels are currently meeting the proposed secondary contact recreation standard (630 cfu / 100 ml). Trend analysis did not indicate any trends over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	40	8.4	29.6	21.9	0



Trend analysis indicates an increasing trend in water temperature (t = 2.23, p = 0.028) with respect to flow. The full range of values exist at no flow (Log Flow = -2 on the graphs), but the trends still exist for all other values. All values are below the standard.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	40	6.9	7.8	7.5	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	73.2	342	154

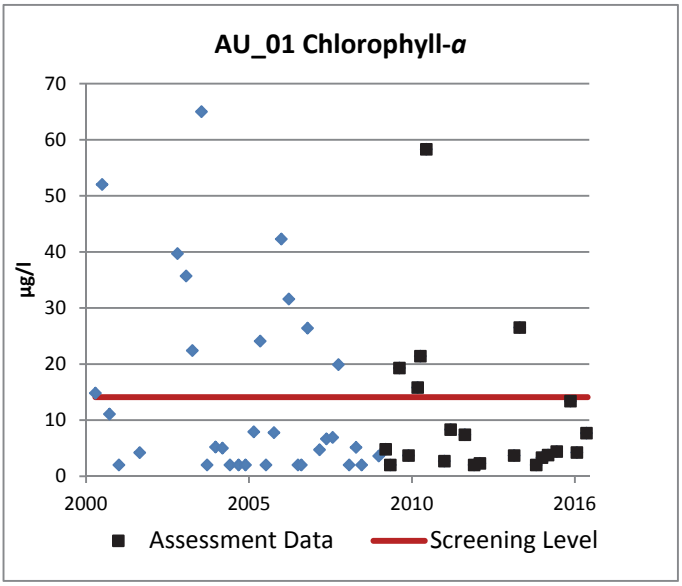
Trend analysis did not indicate any trends in alkalinity over time or with respect to flow.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	21	<0.02	0.124	0.02	10	0

Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

Mann Farm RUAA survey site

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	21	<2	58.3	4.4	3	5



The segment is assessed as having a concern for chlorophyll-*a*. Although the plotted values appear to be decreasing, trend analysis did not indicate any trends over time or with respect to flow.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	21	<0.01	0.918	0.01	13	0

Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	13	0.58	1.63	1.21

There is insufficient TKN data for trend analysis.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	21	<0.04	0.68	0.18	5	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	3.48	109	11.2

Trend analysis did not indicate any trends in TSS concentrations over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>700
AU_01	700 mg/l	FS	32	8.24	1010	315	0	3

Trend analysis did not indicate any trends in chloride concentrations over time or with respect to flow.

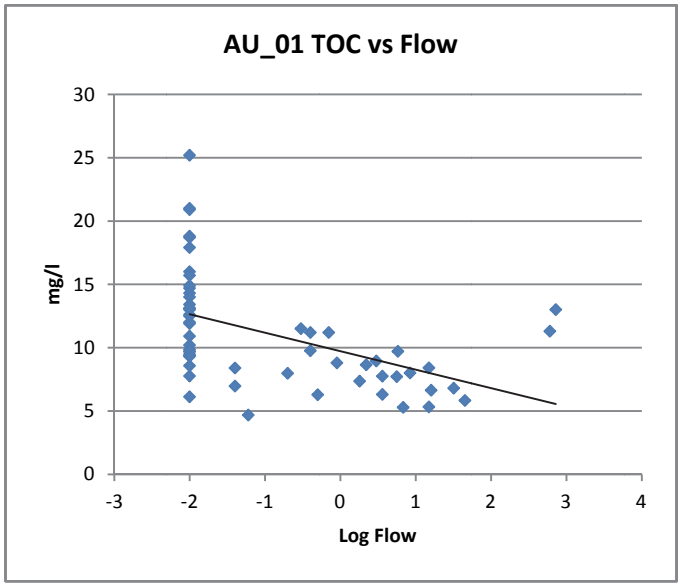
Sulfate		Status	# samples	Min	Max	Average	ND	>700
AU_01	700 mg/l	FS	32	16.9	1170	322	0	2

Trend analysis did not indicate any trends in sulfate concentrations over time or with respect to flow.

TDS		Status	# samples	Min	Max	Average	ND	>2000
AU_01	2000 mg/l	FS	40	117	3590	997	0	5

Trend analysis did not indicate any trends in TDS concentrations over time or with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	6.28	21	11.2

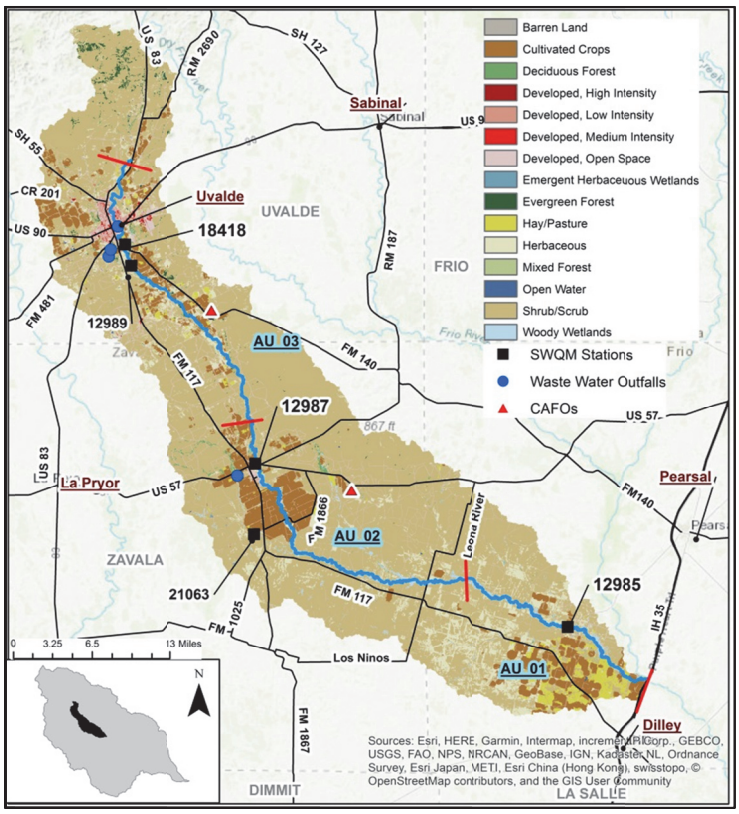


Trend analysis indicates a decreasing trend in TOC concentrations (t = -2.79, p = 0.007) with respect to flow. The full range of values exist at no flow (Log Flow = -2 on the graphs), but the trends still exist for all other values.

Sampling location for Station 12983 at SH16

LEONA RIVER – SEGMENT 2109

Segment 2109, Leona River, flows 85 miles from US 83 in Uvalde County to the confluence of the Frio River in Frio County. It is divided into three AUs. **AU_01** is from the confluence with the Frio River to the confluence with Yoledigo Creek. **AU_02** is from the confluence with Yoledigo Creek to the confluence with Camp Lake Slough. **AU_03** is from the confluence with Camp Lake Slough to the upstream end. Its watershed is 429,555 acres. The cities of Uvalde and Batesville WWTPs discharge to the Leona River.



Special Studies

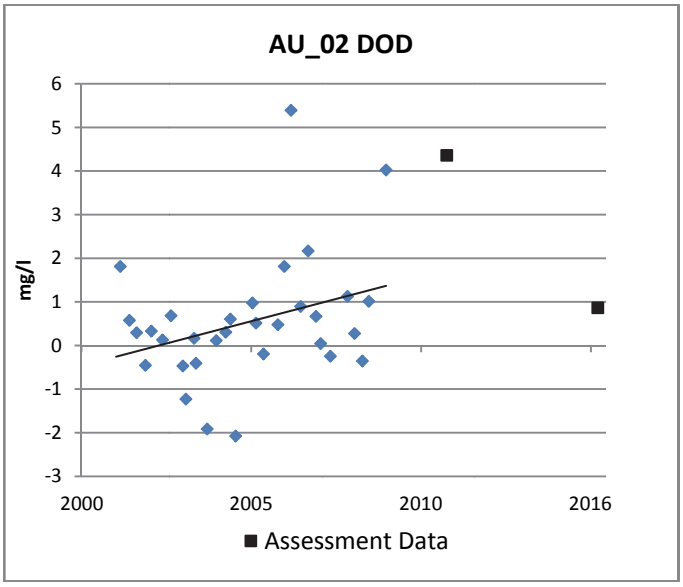
An RUAA was conducted by TIAER from January 2011 through December 2012. The interviews indicated that contact recreation (wading by children) does occur. No recreational activities were observed during the field surveys or site visits. However, the local residents want to see efforts made to improve the water quality water for recreational purposes. Visit http://www.leonariver.org/ for more information.

Water Quality Analysis

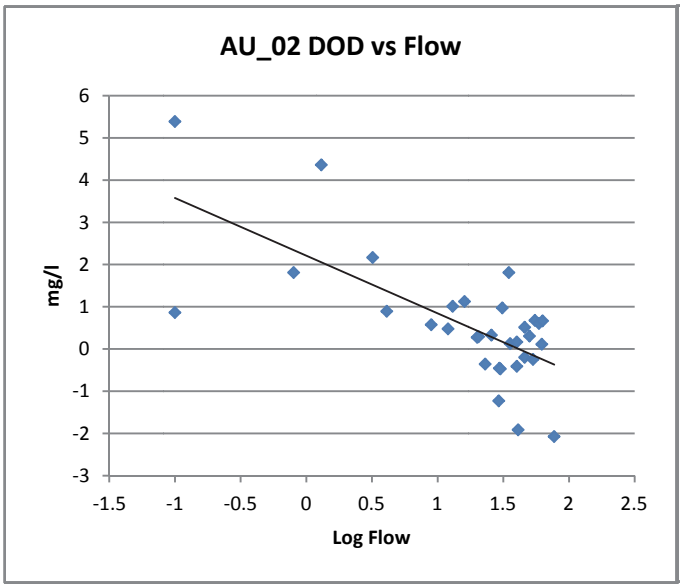
The analysis for AU_01 is based on data from **Station 12985** at FM 1581. The analysis for AU_02 is based on data from **Station 12987** at US 57. For AU_01 and AU_02, there is insufficient data for statistical data analysis on the more recent data due to drought, but trend analysis was conducted on the earlier data. The analysis for AU_03 is based on data from **Station 12989** at Hoags Dam and **Station 18418** upstream of FM 140.

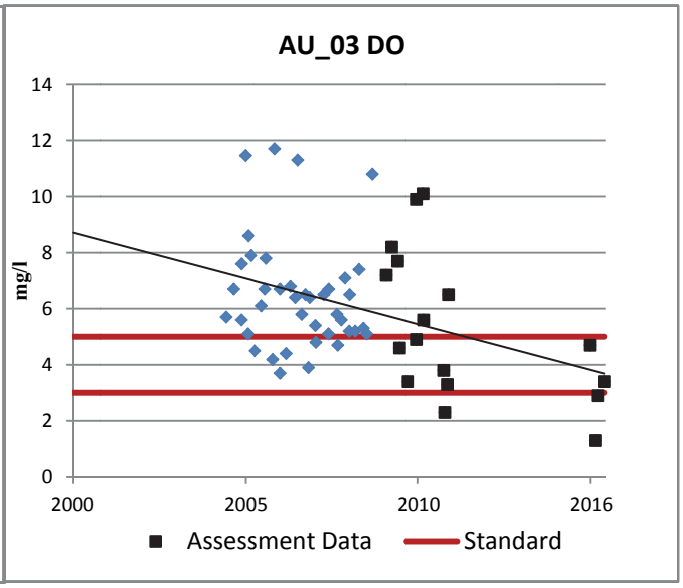
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_03	Minimum 3.0 mg/l	FS	17	1.3	10.1	4.7	3	10
	Screening Level 5.0 mg/l	NC						



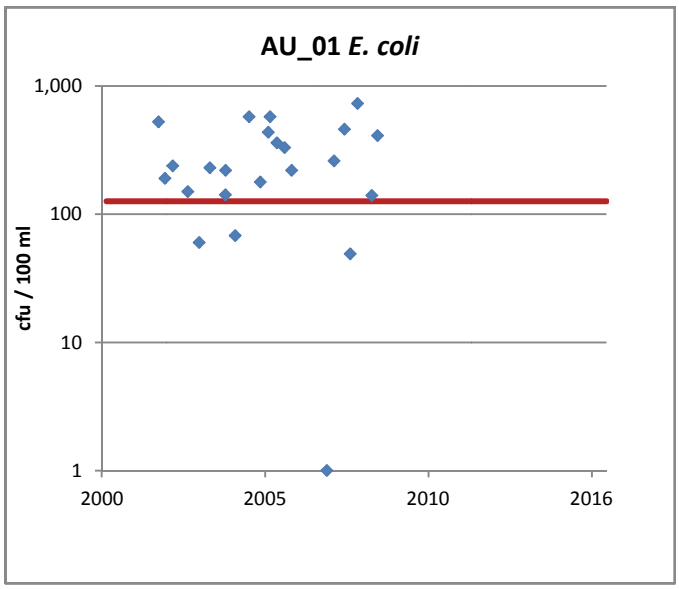
There is an increasing trend in DOD in AU_02 (t = 2.76, p = 0.010) over time and a decreasing trend (t = -7.67. p = 0.000) with respect to flow. There is a decreasing trend in AU_03 in DO levels (t = -3.20, p = 0.002) over time.





Recreation Use

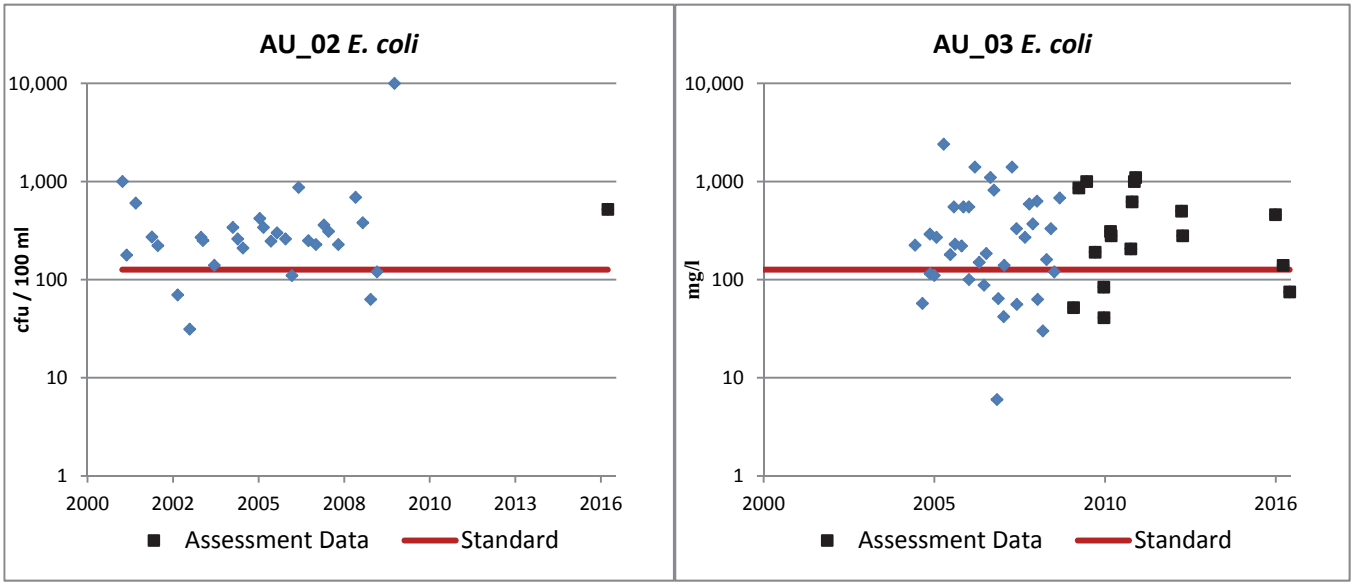
E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_03	Geomean 126 cfu/100 ml	NS	17	41	1100	272	0	14



All three AUs are listed as being impaired for bacteria for contact recreation. A revision to the secondary contact recreation standard is not likely based on stakeholder input on the RUAA. The ongoing drought on the river has limited the number of water quality samples that have been taken since 2009, especially in the lower portion of the segment.

Trend analysis did not indicate any trends in any of the AUs over time or with respect to flow.

Sampling location for Station 18418 upstream of FM 140



General Use

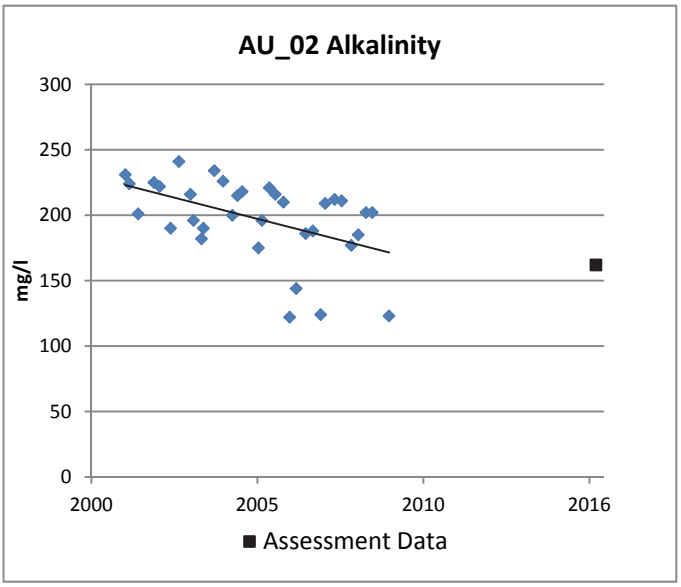
Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_03	32.2 °C	FS	17	8.1	28.1	21.4	0

Trend analysis did not indicate any trends in water temperature any of the AUs over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_03	6.5 – 9.0 su	FS	17	6.7	8.4	7.5	0	0

Trend analysis did not indicate any trends in pH levels in any of the AUs over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	12	99.9	298	229



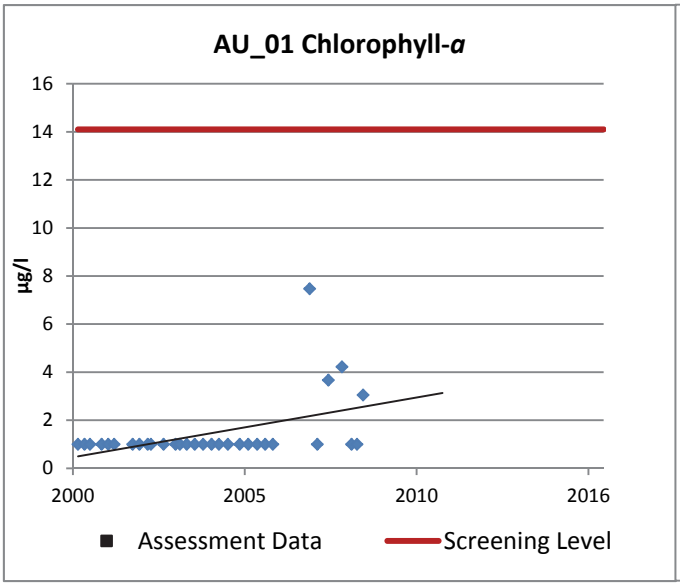
Trend analysis indicates a decreasing trend in alkalinity in AU_02 (t = -3.15, p = 0.003) over time. The trend analysis did not include the single data point in 2016 due to the data gap, but the value seems to confirm the trend.

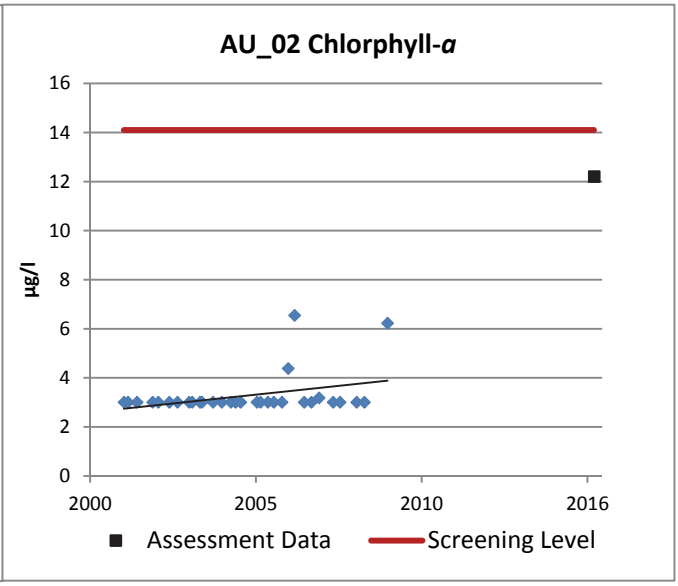
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_03	0.33 mg/l	NC	12	<0.02	0.27	0.02	9	0

Trend analysis did not indicate any trends in ammonia concentrations in AU_01 or AU_02 over time or with respect to flow.

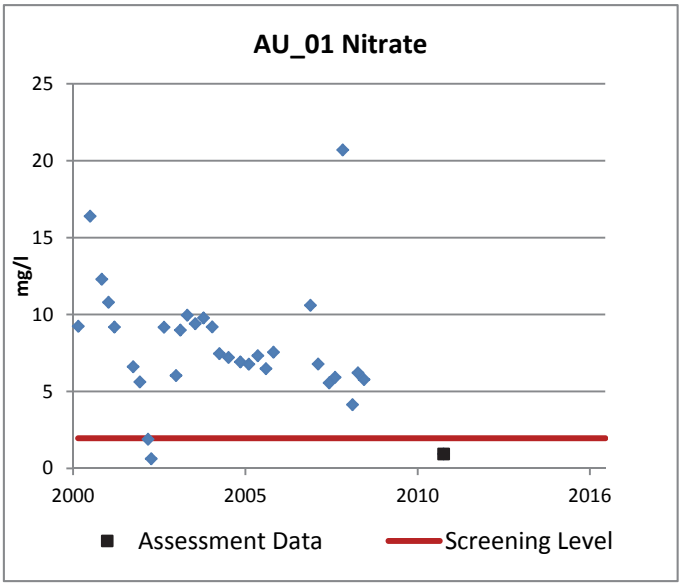
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_03	14.1 µg/l	NC	11	<2	16.7	3.0	6	1

Trend analysis indicates increasing trends in chlorophyll-*a* concentrations in AU_01 (t = 2.80, p = 0.009) and in AU_02 (t = 2.13, p =0.041) over time. These trends are due to the later measurements being above the detection limit. The trend analysis did not include the single data point in AU_02 in 2016 due to the data gap, but the value seems to confirm the trend.

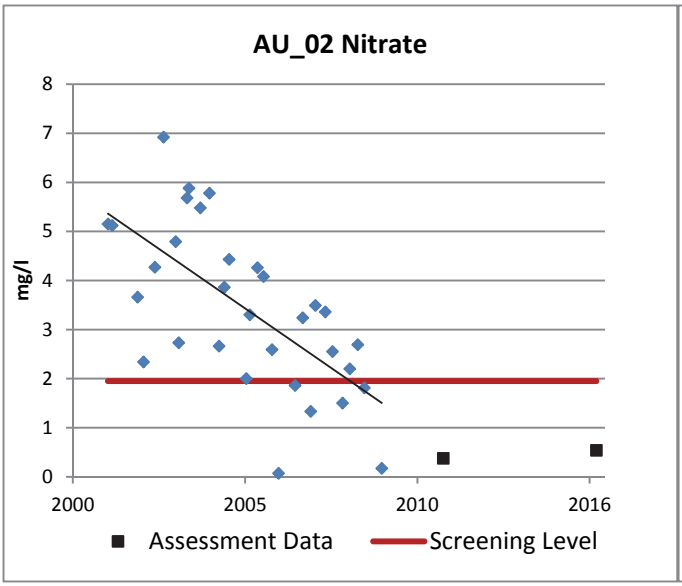


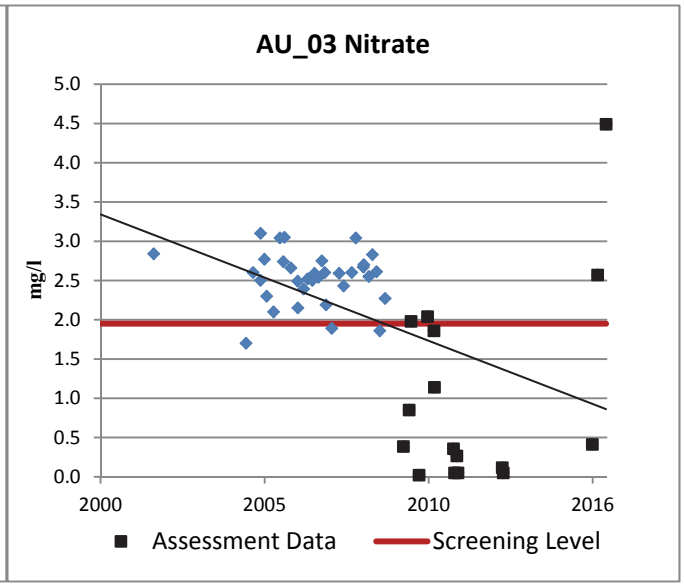


Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_03	1.95 mg/l	CS	16	<0.02	4.49	0.398	4	4



AU_01 and AU_03 have been assessed as having concerns for nitrate. Trend analysis indicates a decreasing trend in AU_02 (t -5.44, p = 0.000) and in AU_03 (t = -3.47, p = 0.001) over time, and an increasing trend in AU_02 (t= -3.88, p = 000) with respect to flow. The water quality samples with very low measurements on the graph of the AU_03 data were collected during no flow events.





TKN		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	ID			

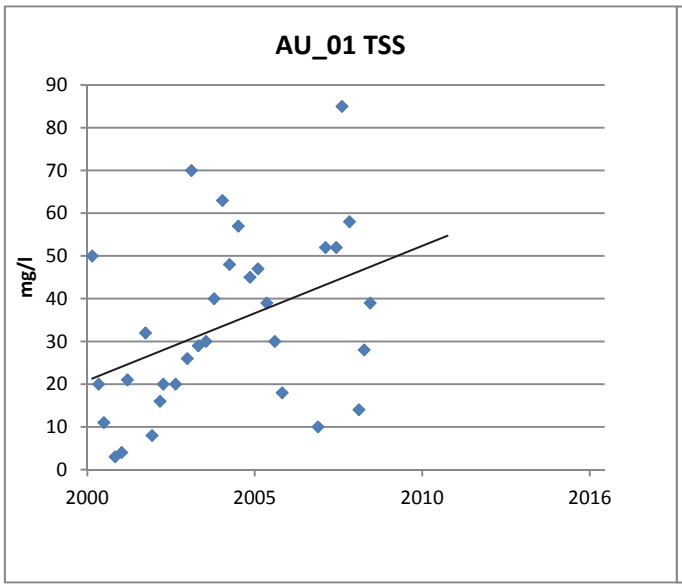
Trend analysis did not indicate any trends in TKN concentrations in any of the AUs over time or with respect to flow.

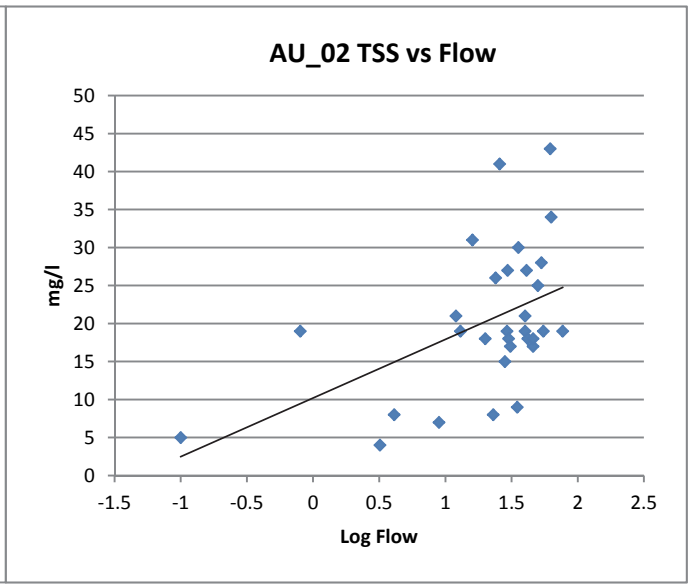
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_03	0.69 mg/l	NC	12	<0.04	0.38	0.04	6	0

Trend analysis did not indicate any trends in total phosphorus concentrations in any of the AUs over time or with respect to flow.

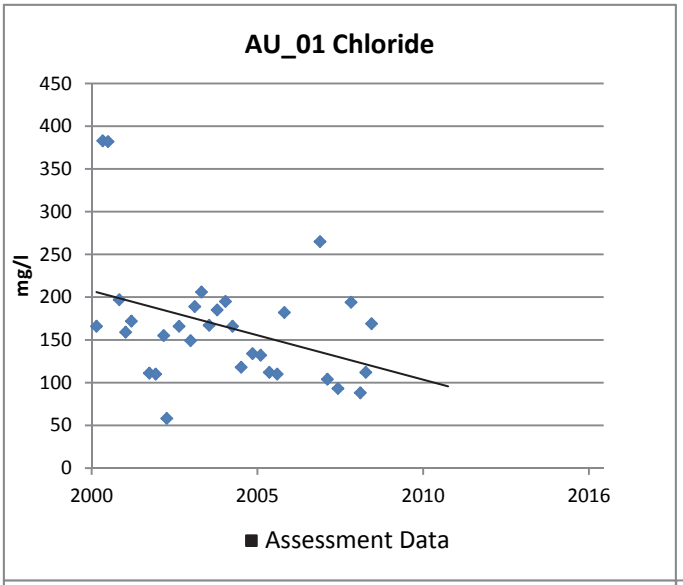
TSS		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	11	<1	23.9	3.9

Trend analysis indicates increasing trends in TSS concentrations in AU_01 (t = 2.40, p = 0.022) over time and in AU_02 (t = 3.15, p =0.002) with respect to flow.

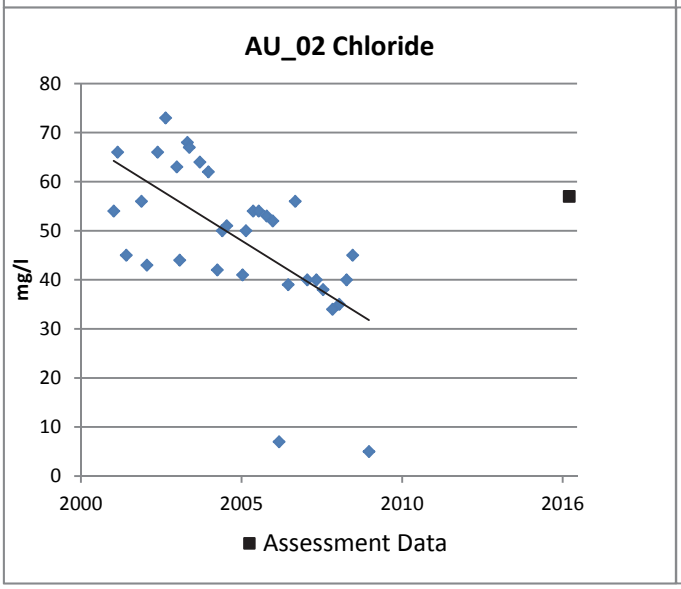


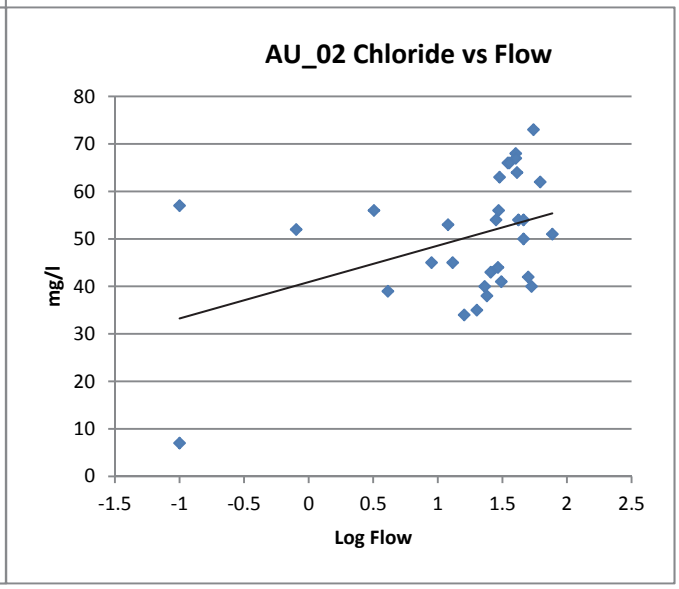


Chloride		Status	# samples	Min	Max	Average	ND	>650
AU_03	650 mg/l	FS	12	<5	79	41.1	1	0

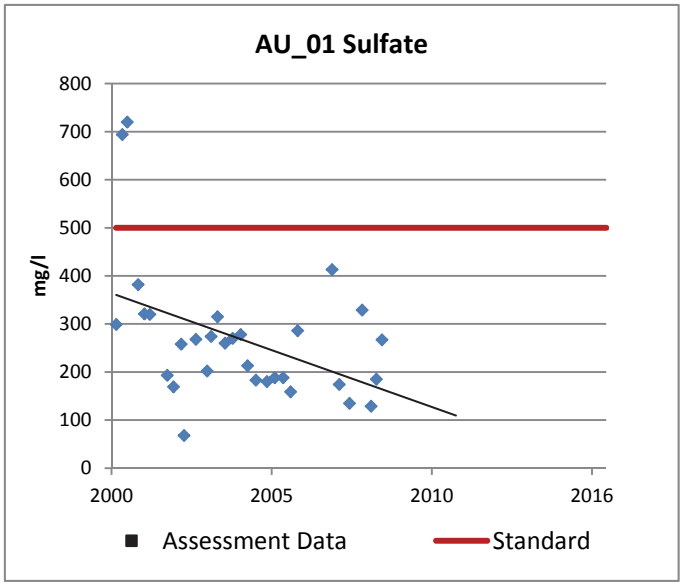


Trend analysis indicates decreasing trends in chloride concentrations in AU_01 (t = -2.14, p = 0.041) and in AU_02 (t = -4.41, p =0.000) over time. Trend analysis also shows an increasing trend in AU_02 (t = 2.06, p = 0.047) with respect to flow. All measured concentrations in all three AUs are well below the standard. The ongoing drought on the river has limited the number of water quality samples that have been taken since 2009, especially in the lower portion of the segment.





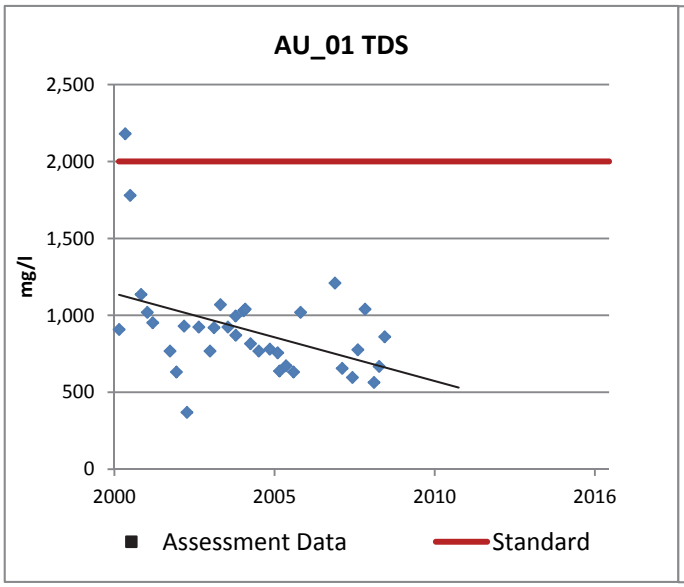
Sulfate		Status	# samples	Min	Max	Average	ND	>500
AU_03	500 mg/l	FS	11	6.05	42	27.9	0	0

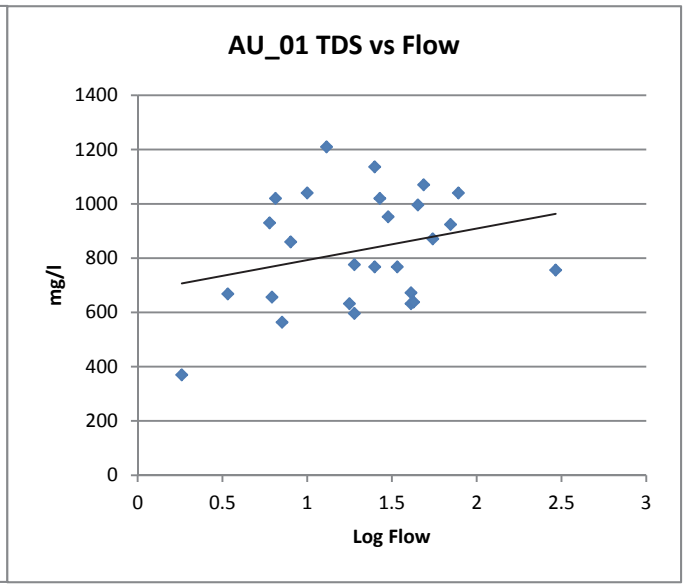


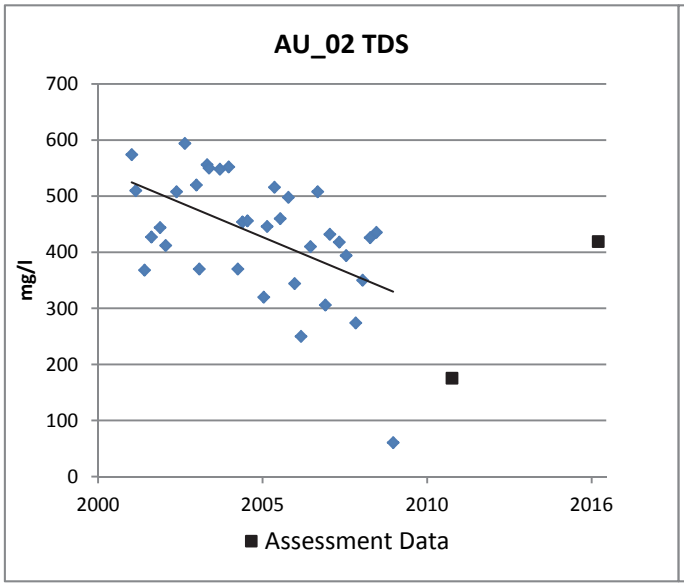
Trend analysis indicates a decreasing trend in sulfate concentrations in AU_01 (t = 2.58, p = 0.015) over time.

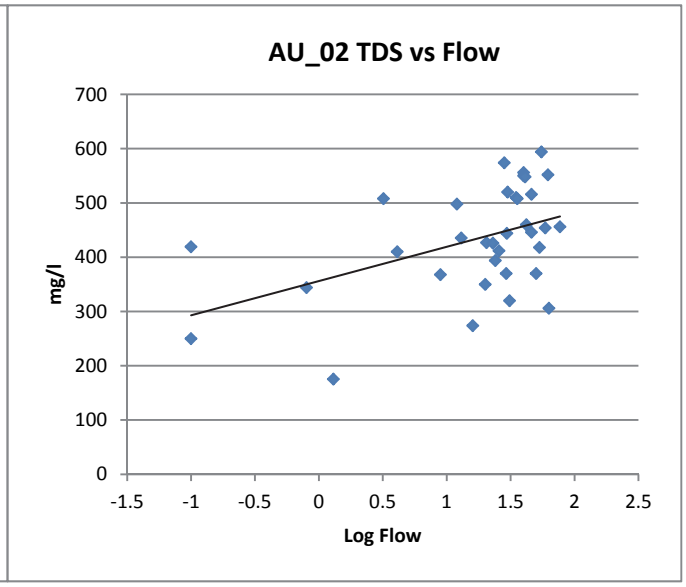
TDS		Status	# samples	Min	Max	Average	ND	>2000
AU_03	2000 mg/l	FS	17	138	962	366	0	0

Trend analysis indicates decreasing trends in TDS concentrations in AU_01 (t = -2.74, p = 0.010) and in AU_02 (t = -4.36, p =0.000) over time. Trend analysis also shows increasing trends in AU_01 (t = 2.61, p = 0.015) and in AU_02 (t = 3.59, p = 0.001) with respect to flow, but the measured concentrations are well below the standard. The ongoing drought on the river has limited the number of water quality samples that have been taken since 2009, especially in the lower portion of the segment.



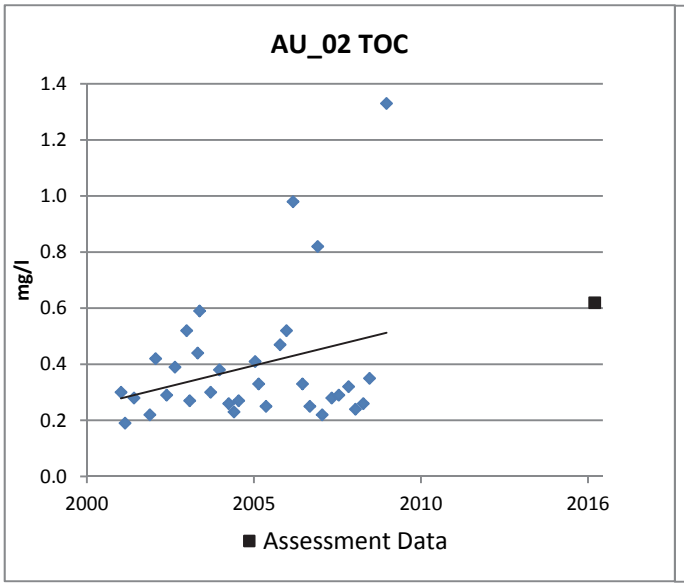


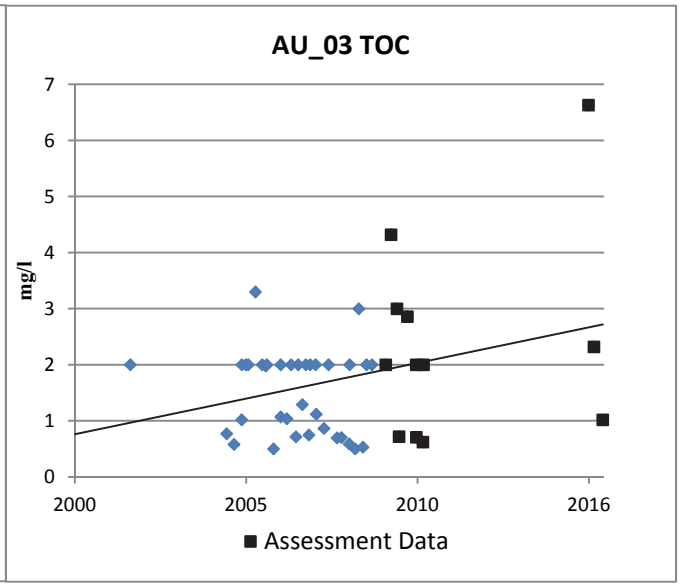




TOC		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	12	06.2	6.63	2.0

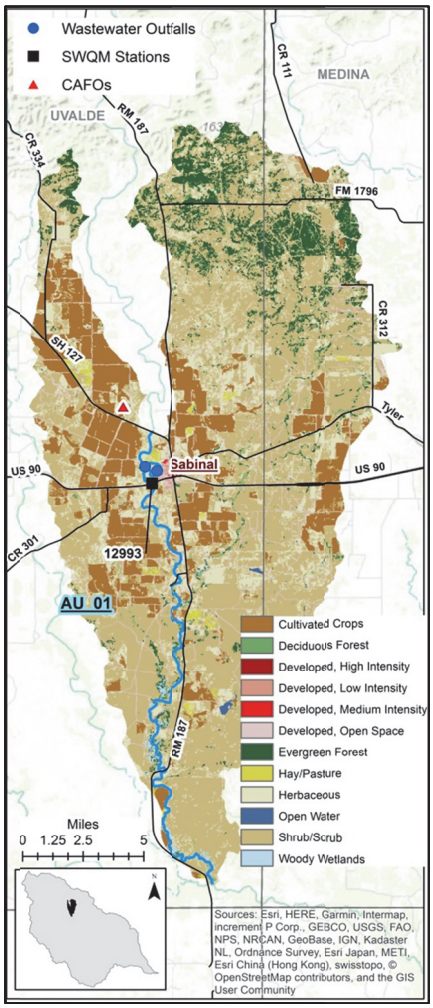
Trend analysis indicates an increasing trend in TOC concentrations in AU_02 (t = 2.03, p = 0.047) and in AU_03 (t = 2.16, p = 0.036) over time. The trend analysis did not include the single data point in AU_02 in 2016 due to the data gap, but the value seems to confirm the trend.





LOWER SABINAL RIVER – SEGMENT 2110

Segment 2110, Lower Sabinal River, flows 27 miles from a point 100m upstream of SH 127 to the confluence with the Frio River. Its watershed is 136,676 acres. It is a single assessment unit. The City of Sabinal is the only community in the watershed.



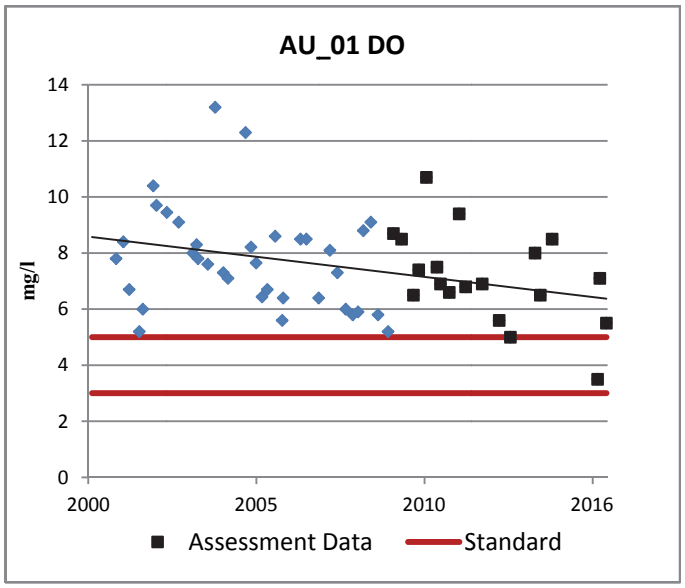
Water Quality Analysis

The analysis for this segment is based on data from **Station 12993** at US 90.

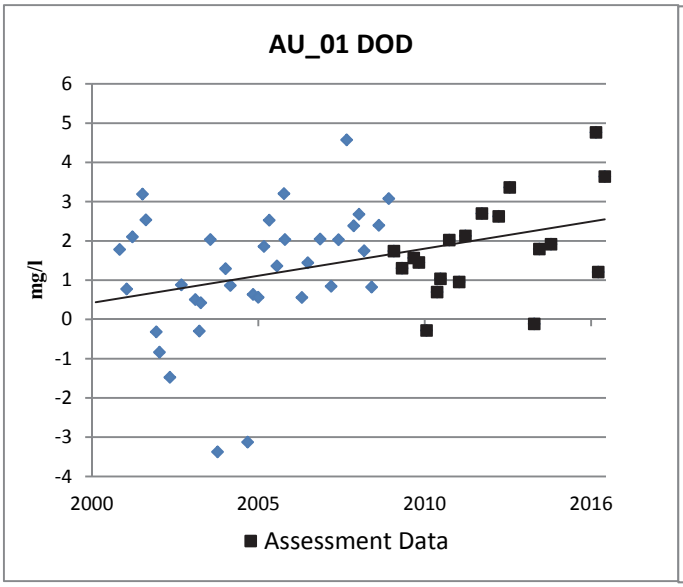
Sampling location for Station 12993 upstream at US 90

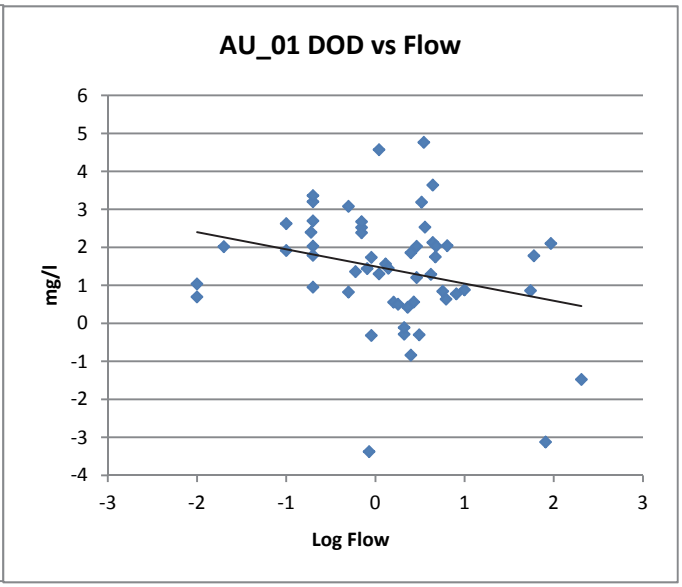
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	19	3.5	10.7	6.9	0	1
	Screening Level 5.0 mg/l	NC						



Trend analysis indicates a decreasing trend in DO levels (t = -2.55, p = 0.014), an increasing trend in DOD (t = 2.91, p = 0.005) over time, and a decreasing trend in DOD (t = -2.50, p = 0.015) with respect to flow.





Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	18	<10	410	61.6	2	6

Trend analysis did not indicate any trends in *E. coli* concentrations over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	19	12.9	28.4	23.0	0

Trend analysis did not indicate any trends in water temperature over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	19	7.2	8.0	7.6	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	18	208	266	242

Trend analysis did not indicate any trends in alkalinity over time or with respect to flow.

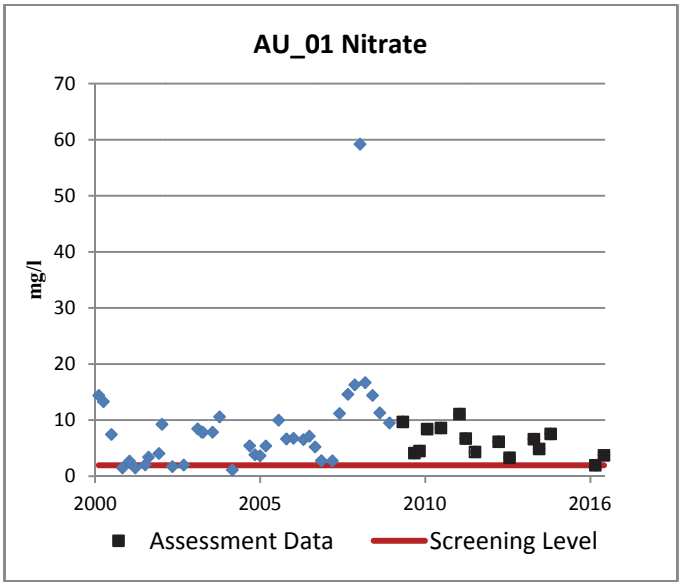
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	18	<0.05	0.09	0.05	13	0

Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	17	<1	149	1.79	5	2

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time or with respect to flow.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	CS	15	1.97	11.1	6.16	0	15



The segment has been assessed as having a concern for nitrate. The high levels are attributed to a WWTP that was located in the flood plain and subject to inundation. The plant has been moved, and the nitrate concentrations appeared to have slightly declined. Trend analysis did not indicate any trends over time or with respect to flow.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	17	<0.05	0.75	0.37

Trend analysis did not indicate any trends in TKN concentrations over time or with respect to flow.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	15	<0.02	0.114	0.02	6	0

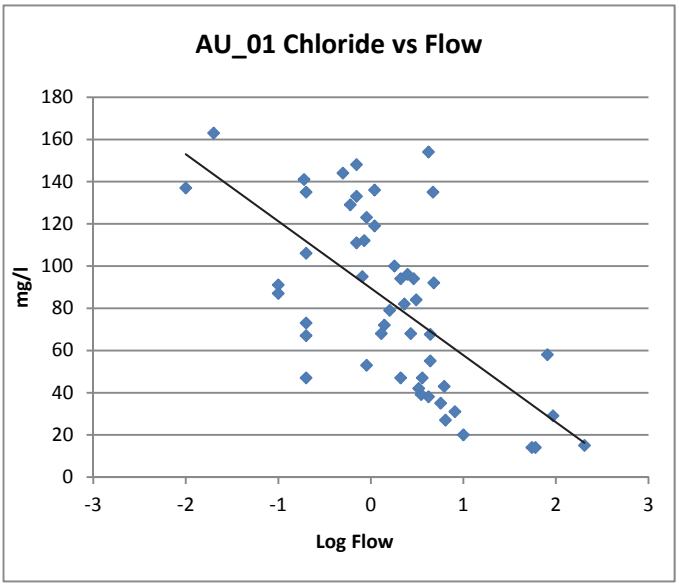
Trend analysis did not indicate any trends in total phosphorus concentrations over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	18	4	18	5

Trend analysis did not indicate any trends in TSS concentrations over time or with respect to flow.

Google Earth view of Station 12993 location

Chloride		Status	# samples	Min	Max	Average	ND	>200
AU_01	200 mg/l	FS	18	39.1	163	83.9	0	0

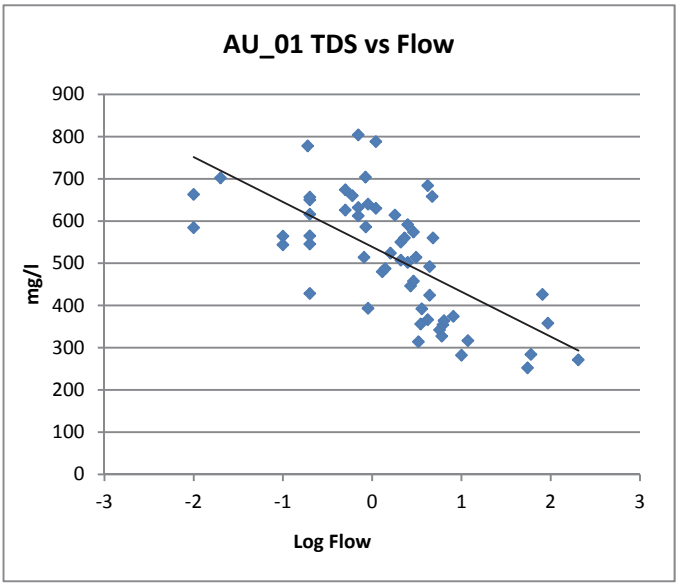


Trend analysis indicates a decreasing trend in chloride concentrations (t = -2.26, p = 0.027) with respect to flow. All of the values are below the standard.

Sulfate		Status	# samples	Min	Max	Average	ND	>100
AU_01	100 mg/l	FS	18	34.4	67	47.5	0	0

Trend analysis did not indicate any trends in sulfate concentrations over time or with respect to flow.

TDS		Status	# samples	Min	Max	Average	ND	>700
AU_01	700 mg/l	FS	19	356	702	541	0	1



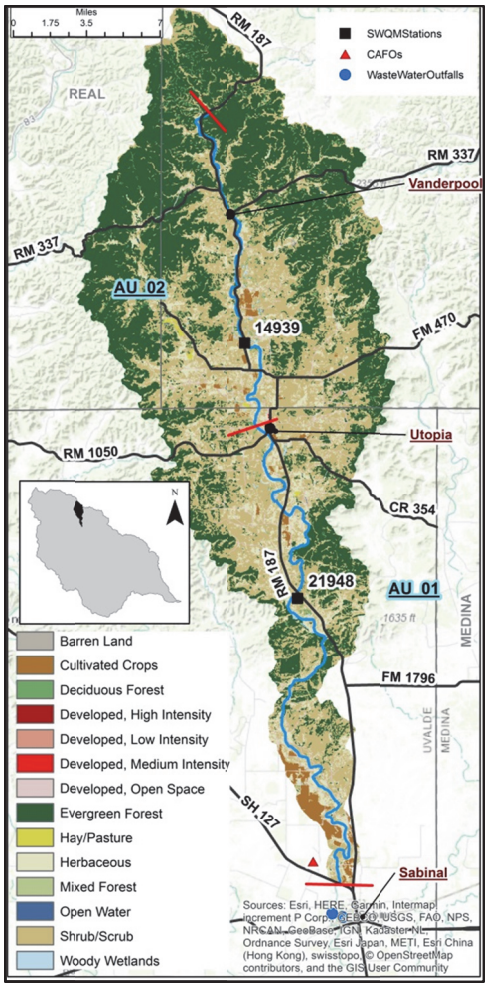
Trend analysis indicates a decreasing trend in TDS concentrations (t = -2.26, p = 0.027) with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	18	1	5	2

Trend analysis did not indicate any trends in TOC concentrations over time or with respect to flow.

UPPER SABINAL RIVER – SEGMENT 2111

Segment 2111, Upper Sabinal River, flows 48 miles from the most upstream crossing of FM 187 in Bandera County to a point 100m upstream of SH 127 in Uvalde County. It is divided into two AUs. **AU_01** is from the downstream end to the confluence with the West Sabinal River. **AU_02** is from the confluence with the West Sabinal River to the upstream end. Its watershed is 149,444 acres. The Cities of Utopia and Vanderpool are the only communities in the watershed. Lost Maples State Park is near the headwaters.



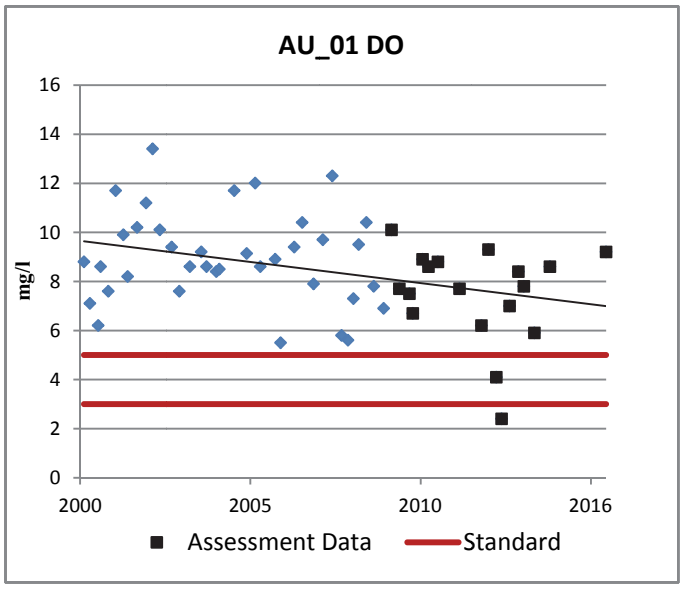
Bandera County River Authority and Groundwater District (BCRAGD) became a CRP sub-participant in FY 2016 to help NRA with sampling in AU_02 of the Upper Sabinal River and in AU_02 of Seco Creek (Segment 2115). They are contributing their resources for this sampling and providing the data to NRA for submittal to SWQMIS.

Water Quality Analysis

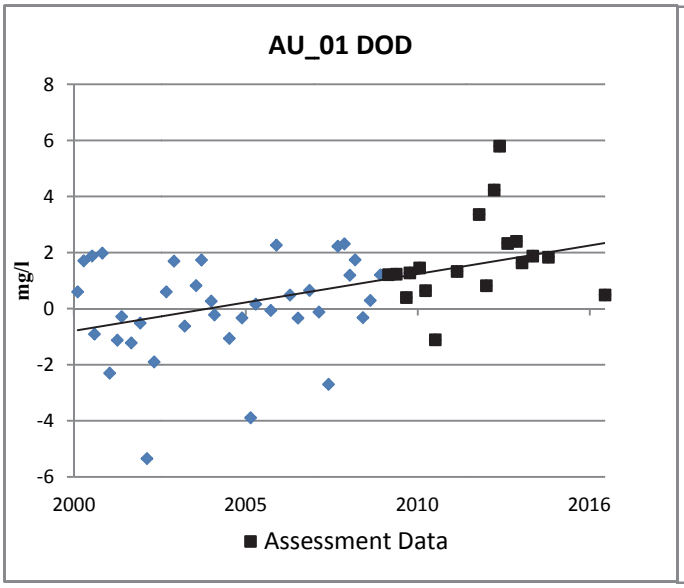
The analysis for AU_01 is based on data from **Station 21948** at Ranch Road 187. There is insufficient data in AU_02 for any analysis. There were only two sampling events at **Station 14939** at FM 187 in the analysis period.

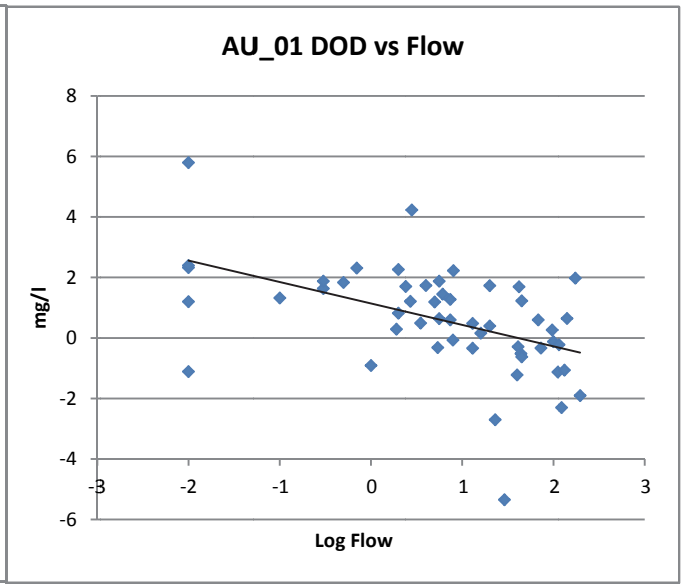
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	18	2.4	10.1	1.8	1	2
	Screening Level 5.0 mg/l	NC						



Trend analysis indicates a decreasing trend in DO levels (t = -2.84, p = 0.006) over time, an increasing trend in DOD (t = 3.88, p = 0.000) over time, and a decreasing trend in DOD (t = -4.04, p = 0.000) with respect to flow. 24-hour DO measurements may be needed if additional DO measurements fall below the grab screening level.





Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	18	<1	170	18.6	2	2

Trend analysis did not indicate any trends in *E. coli* concentrations over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	18	9.2	30.0	18.8	0

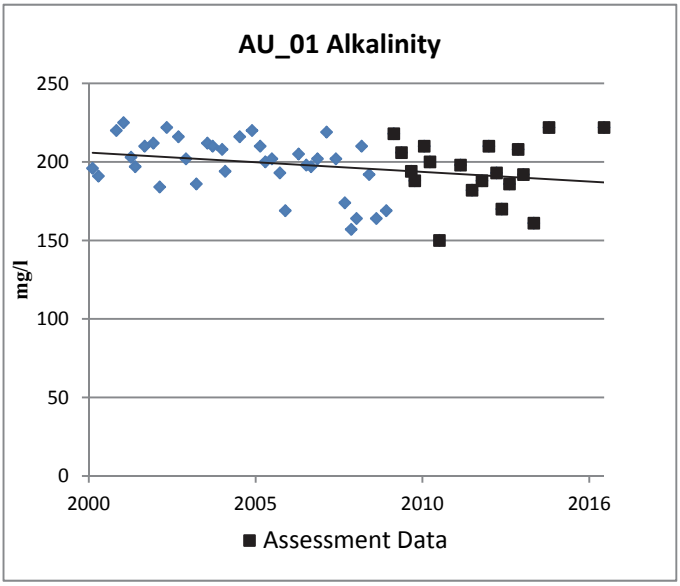
Trend analysis did not indicate any trends in water temperature over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	18	7.2	8.3	7.7	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Sampling location for Station 12948 at RR 187

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	150	222	194



Trend analysis indicates a decreasing trend in alkalinity (t = -2.09, 0.041) over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	18	<0.02	0.02	0.02	18	0

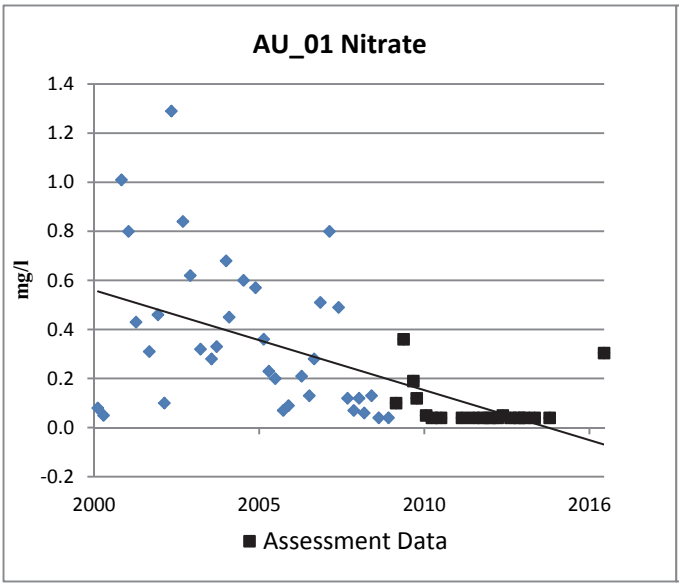
Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

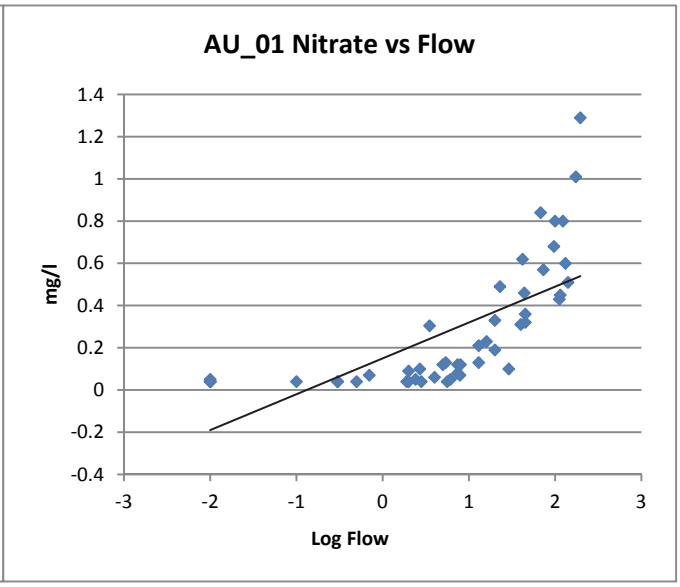
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	17	<0.2	2.36	0.2	10	0

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time or with respect to flow.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	19	<0.04	0.36	0.04	12	0

Trend analysis indicates a decreasing trend in nitrate concentrations (t = -5.00, p = 0.000) over time and an increasing trend (t = 5.72, 0.000) with respect to flow. All concentrations are currently below the screening level.





TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	16	<0.05	0.3	0.05

Trend analysis did not indicate any trends in TKN concentrations over time or with respect to flow.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	17	<0.02	0.02	0.02	16	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	1	4	1

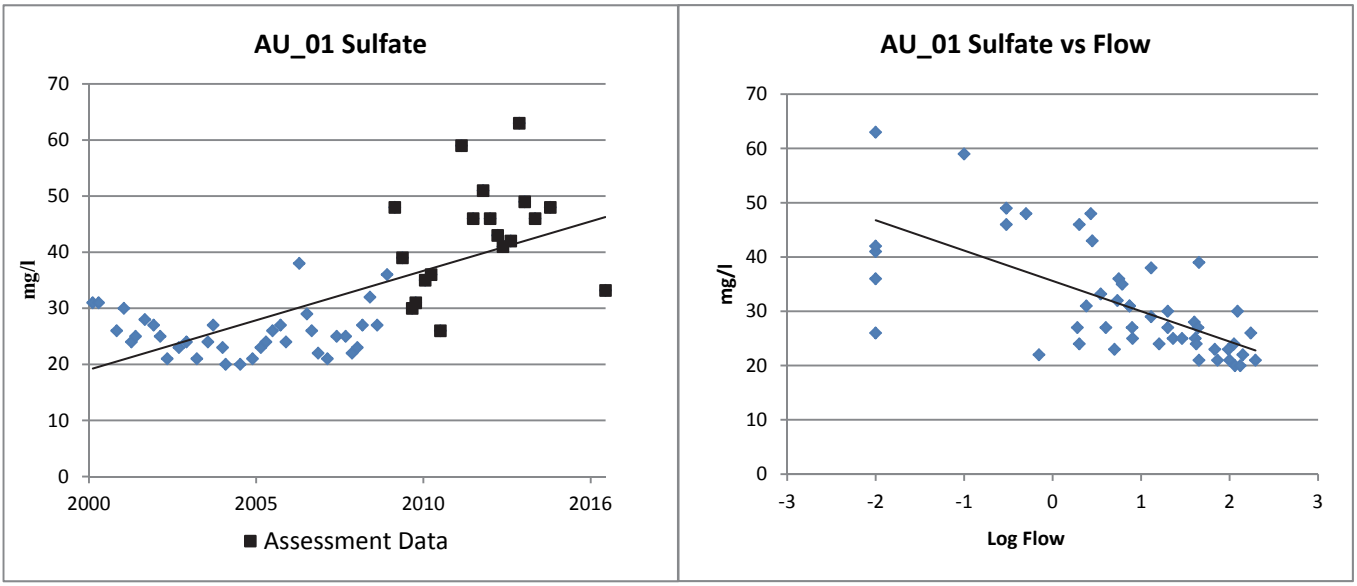
Trend analysis did not indicate any trends in TSS concentrations over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	FS	18	8	17	13.8	0	0

Trend analysis did not indicate any trends in chloride concentrations over time or with respect to flow.

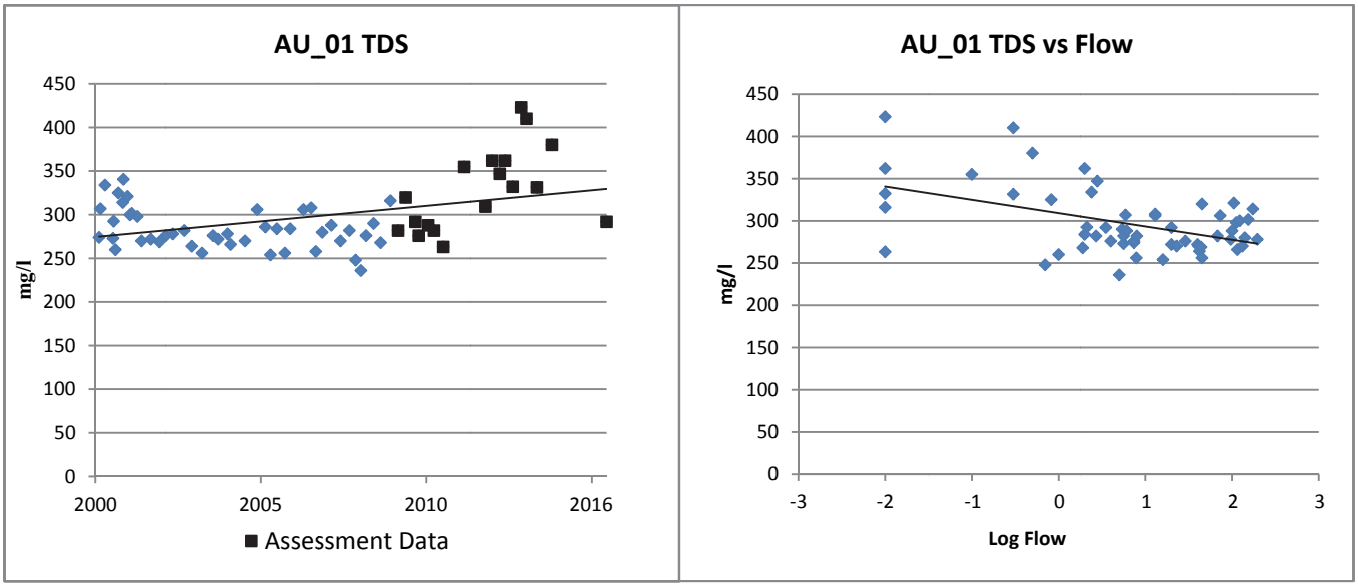
Sulfate		Status	# samples	Min	Max	Average	ND	>75
AU_01	75 mg/l	FS	19	26	63	42.7	0	0

Trend analysis indicates an increasing trend in sulfate concentrations (t = 6.98, p = 0.000) over time and a decreasing trend (t = -3.76, 0.000) with respect to flow. All concentrations are currently below the standard.



TDS		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	FS	18	263	423	328	0	0

Trend analysis indicates an increasing trend in TDS concentrations (t = 3.56, p = 0.001) over time and a decreasing trend (t = -4.10, 0.000) with respect to flow. All concentrations are currently below the standard.



TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	18	1	4	1

Trend analysis did not indicate any trends in TOC concentrations over time or with respect to flow.

Sampling location for Station 14939 at FM 187

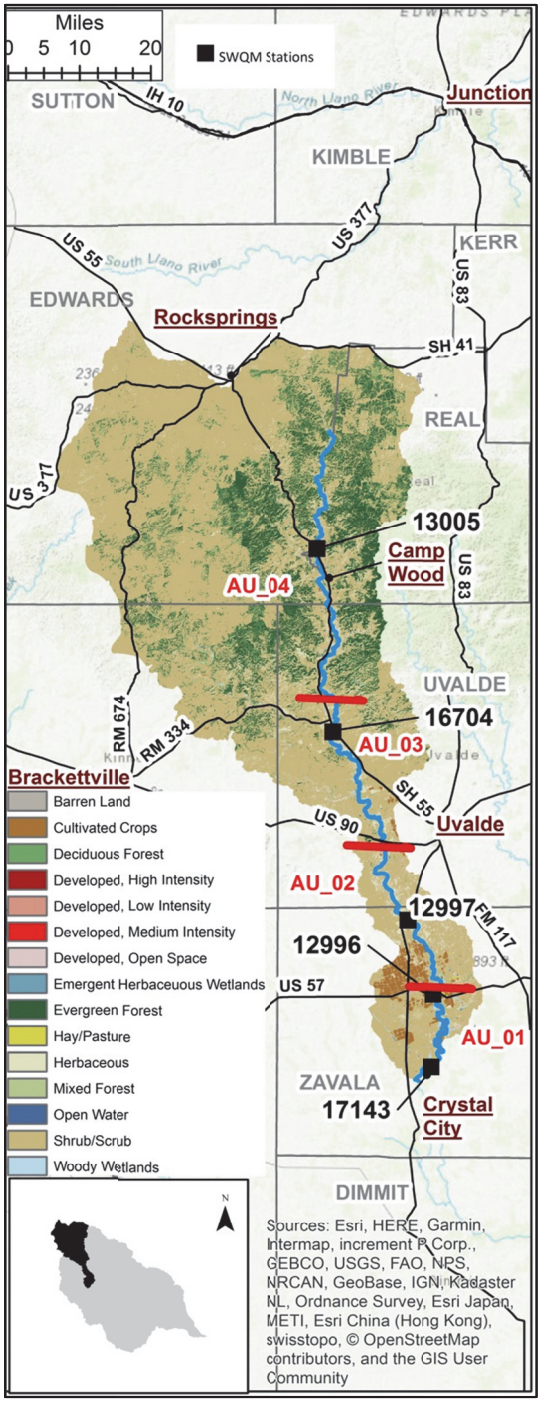
UPPER NUECES RIVER – SEGMENT 2112

Segment 2112, Upper Nueces River, flows 123 miles from the confluence of the East Prong Nueces River and Hackberry Creek in Edwards County to a point 100m (110 yards) upstream of FM 1025 in Zavala County. It is divided into four AUs. **AU_01** is from the downstream end to the confluence with Sand Ridge Creek. **AU_02** is from the confluence with Sand Ridge Creek to just downstream of US 90. **AU_03** is from just downstream of the US 90 to the confluence with Miller Creek. **AU_04** is from the confluence with Miller Creek to the upstream end. Its watershed is 1,336,006 acres. There are several small communities in the watershed.

Water Quality Analysis

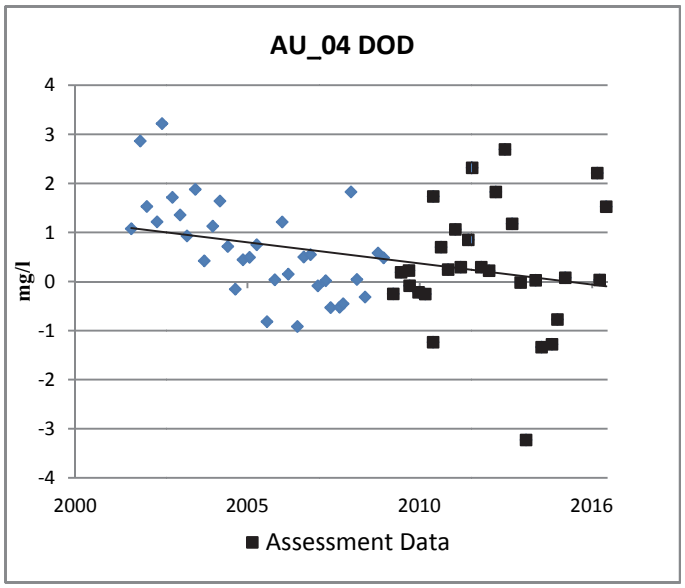
The analysis for AU_01 is based on data from **Station 12996** at US 57 and **Station 17143** at Lake Averhoff. There is insufficient flow data for trend analysis with respect to flow. There is insufficient data at **Station 12997** in AU_02 for either statistical or trend analysis. The analysis for AU_03 is based on data from **Station 16704** at SH 55 south of Laguna. The analysis for AU_04 is based on data from **Station 13005** at SH 55 south of Barksdale.

Sampling location for Station 16704 at SH 55.



Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	28	4.2	17.5	7.8	0	0
	Screening Level 5.0 mg/l	NC						
AU_03	Minimum 3.0 mg/l	FS	25	6.9	10.9	9.1	0	0
	Screening Level 5.0 mg/l	NC						
AU_04	Minimum 3.0 mg/l	FS	29	5.6	11.2	8.5	0	0
	Screening Level 5.0 mg/l	NC						

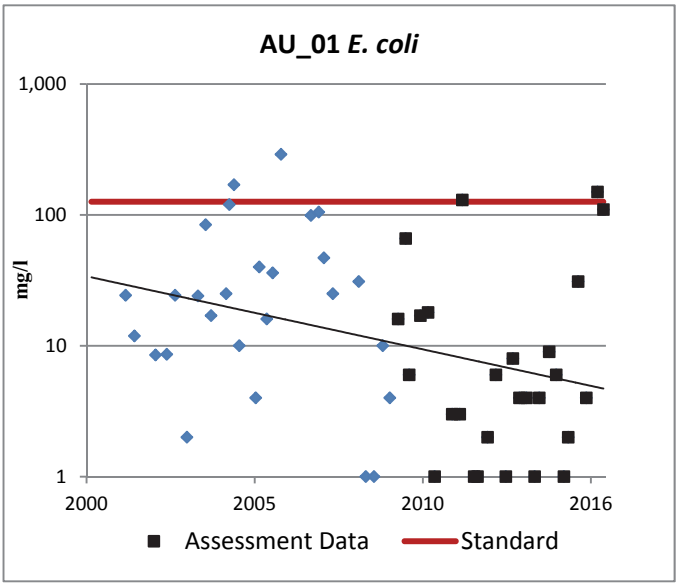


Trend analysis indicates a decreasing trend in DOD in AU_04 (t = -2.51, p = 0.015) over time.

Sampling location for Station 13005 at SH 55.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	27	<1	150	6.25	3	2
AU_03		FS	23	<1	190	12.6	4	1
AU_04		FS	25	3	61	16.5	0	0



Trend analysis indicates a decreasing trend in *E. coli* concentrations in AU_01 (t = -2.59, p = 0.012) over time.

General Use

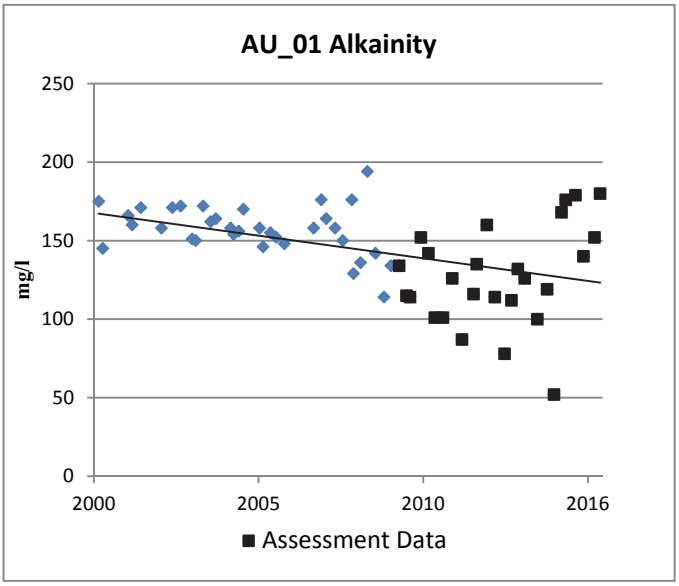
Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	28	11.2	32.3	25.2	1
AU_03		FS	25	12.7	33.5	22.1	1
AU_04		FS	29	13.8	30.2	21.9	0

Trend analysis did not indicate any trends in water temperature in any of the AUs over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	28	7.6	9.1	8.2	0	1
AU_03		FS	25	7.7	8.6	8.0	0	0
AU_04		FS	28	7.4	8.1	7.8	0	0

Trend analysis did not indicate any trends in pH levels in any of the AUs over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	52	180	126
AU_03		N/A	25	156	207	184
AU_04		N/A	26	154	202	177

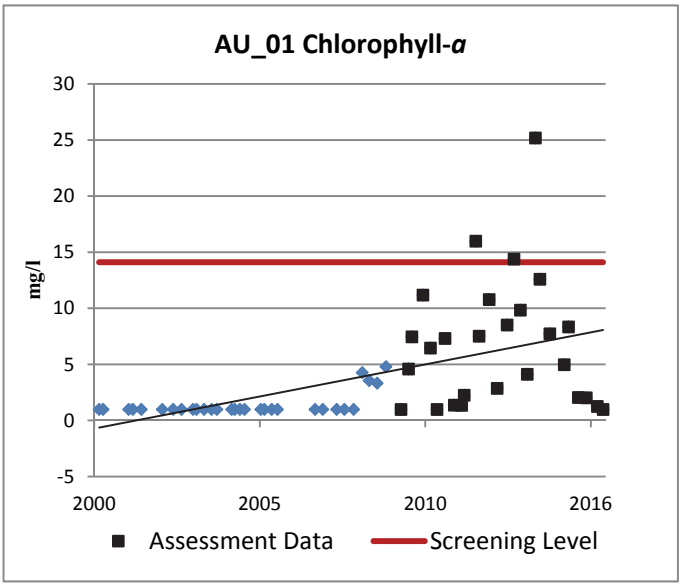


Trend analysis indicates a decreasing trend in alkalinity in AU_01 (t = -3.85, p = 0.000) over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	25	<0.02	0.06	0.02	23	0
AU_03		NC	25	<0.02	0.02	0.02	25	0
AU_04		NC	26	<0.02	0.03	0.02	23	0

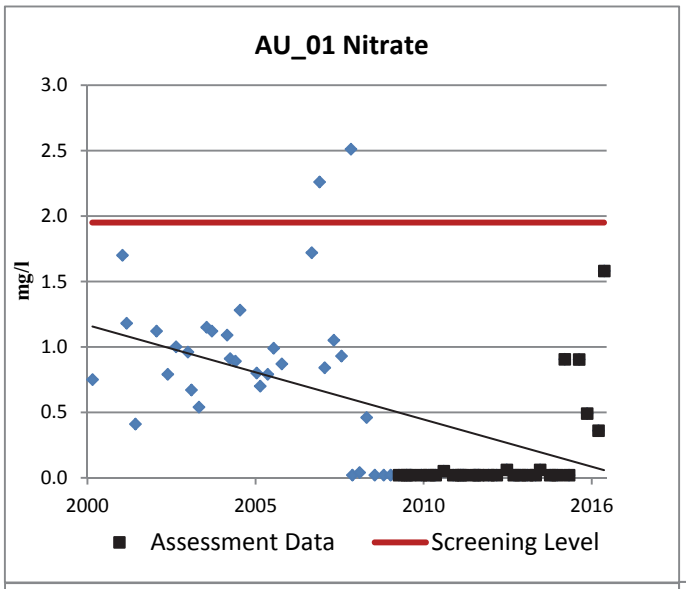
Trend analysis did not indicate any trends in ammonia concentrations in any of the AUs over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	27	<1	25.2	6.47	3	3
AU_03		NC	22	<0.02	0.34	0.2	15	0
AU_04		NC	25	<2	2.12	2	23	0

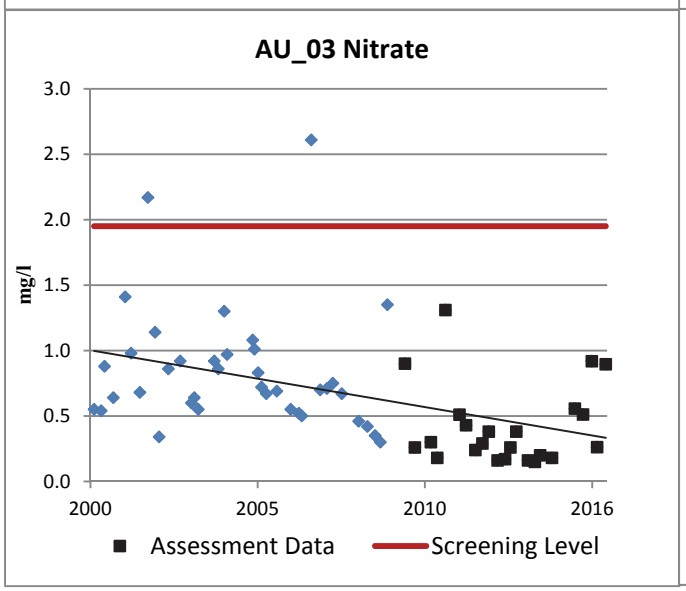


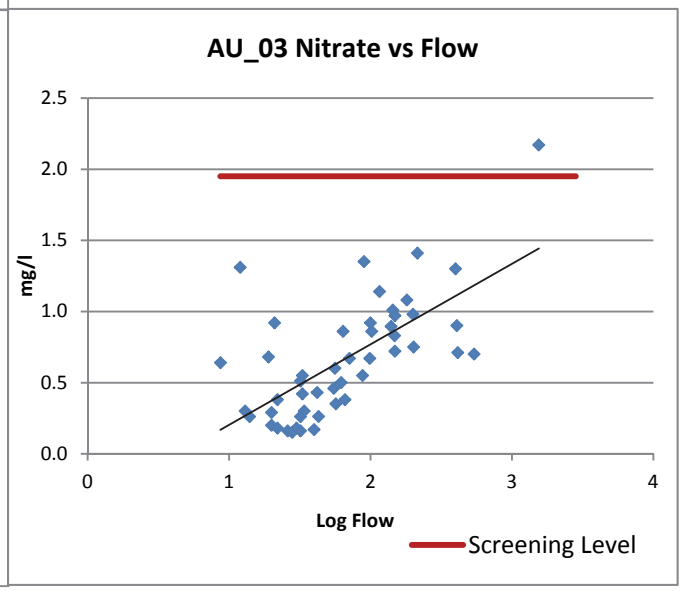
Trend analysis indicates an increasing trend in chlorophyll-*a* in AU_01 (t = 4.65, p = 0.000) over time.

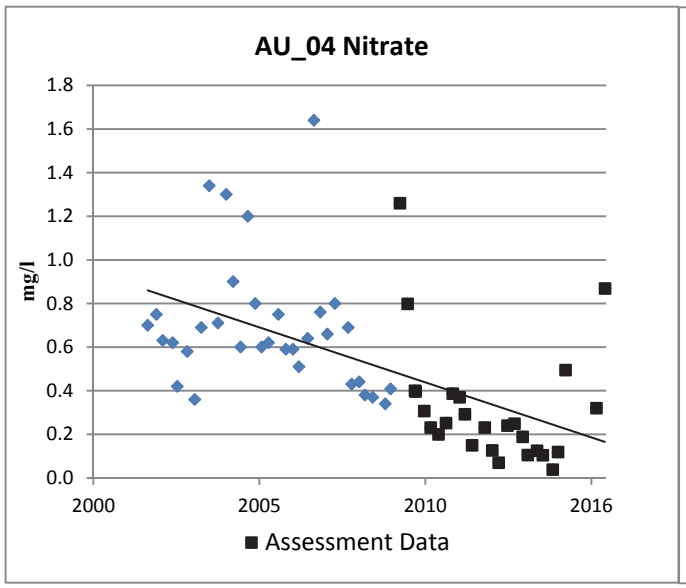
Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	28	<0.02	1.58	0.02	20	0
AU_03		NC	23	0.15	1.31	0.29	0	0
AU_04		NC	26	0.04	1.26	0.24	0	0

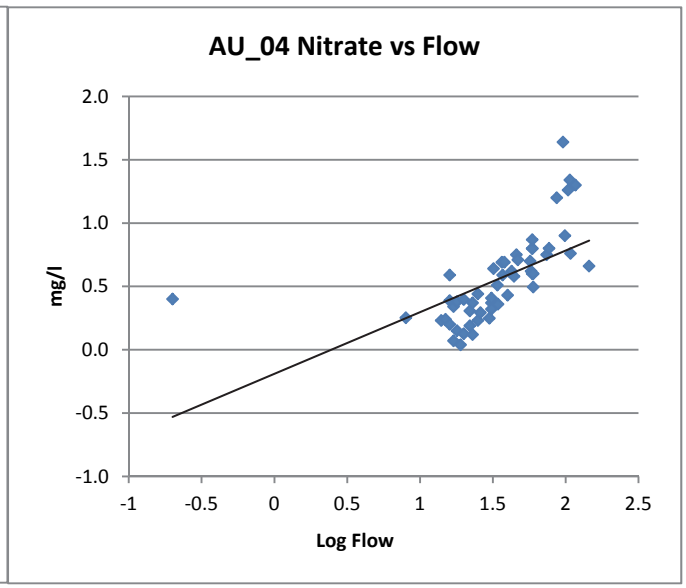


Trend analysis indicates decreasing trends in nitrate concentrations in AU_01 (t = -4.49, p = 0.000), in AU_03 (t = -3.74, p = 0.000), and in AU_04 (t = -5.45, p = 0.000) over time. Trend analysis also indicates decreasing trends in AU_03 (t = 7.43, p = 0.000) and in AU_04 (t = 5.34, p = 0.000) with respect to flow. All concentrations in AU_04 are currently below the screening level.



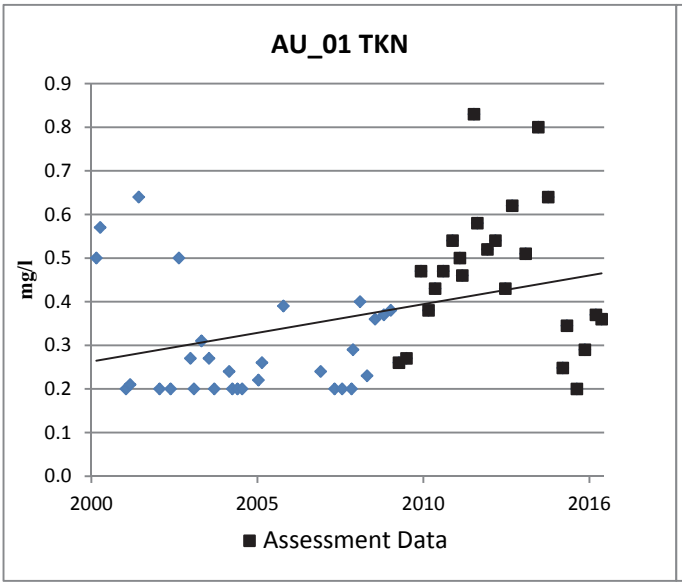


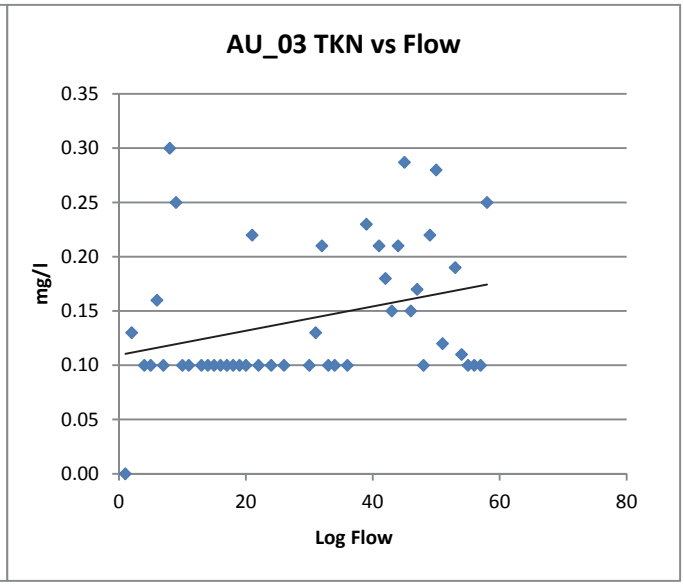




TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	<0.2	0.83	0.46
AU_03		N/A	18	<0.1	0.36	0.1

Trend analysis indicates increasing trends in TKN concentrations in AU_01 (t = 2.54, p = 0.014) over time and in AU_03 (t = 3.48, p = 0.001) with respect to flow. There is insufficient TKN data in AU_04 for either statistical or trend analysis.





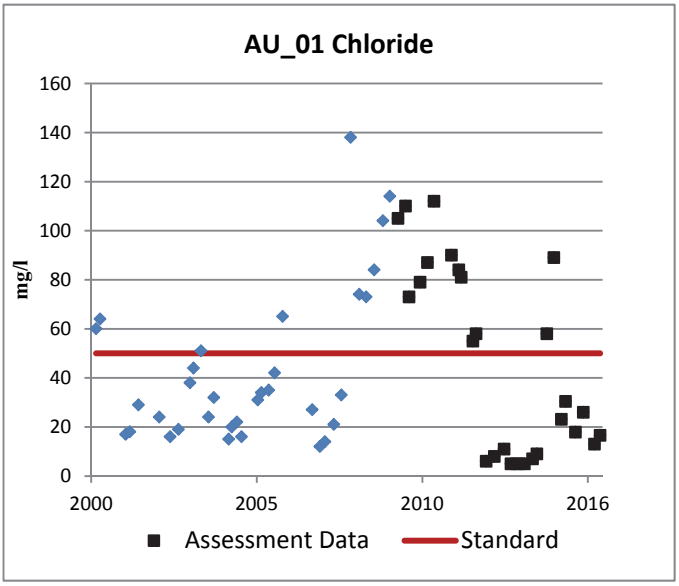
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	21	<0.02	0.05	0.02	14	0
AU_03		NC	21	<0.02	0.48	0.02	18	0
AU_04		NC	25	<0.002	0.002	0.002	25	0

Trend analysis did not indicate any trends in total phosphorus concentrations in any of the AUs over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	27	4	22	4
AU_03		N/A	22	<1	1.98	1
AU_04		N/A	26	1	208	1

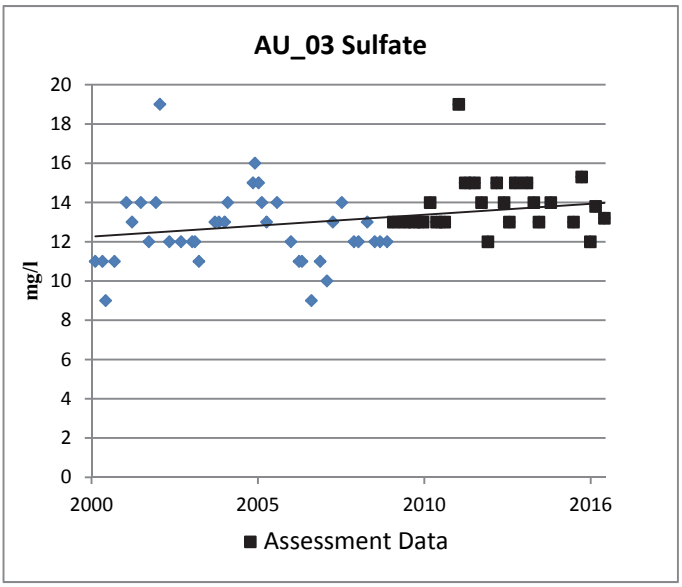
Trend analysis did not indicate any trends in TSS concentrations in any of the AUs over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	FS	27	5	112	46.8	1	13
AU_03		FS	25	9	15.6	12.1	0	0
AU_04		FS	26	<10	12.4	11.1	3	0



The average of the chloride concentrations is approaching the standard in AU_01, with nearly half of the measurements being above the standard. The majority of the high measurements were during the extreme drought around 2010 to 2011. No flow measurements were recorded during this time period. Trend analysis did not indicate any trends in chloride concentrations in any of the AUs over time or with respect to flow.

Sulfate		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	FS	28	6	61	29.5	0	7
AU_03		FS	25	12	19	13.9	0	0
AU_04		FS	26	<10	24.7	10.7	23	0



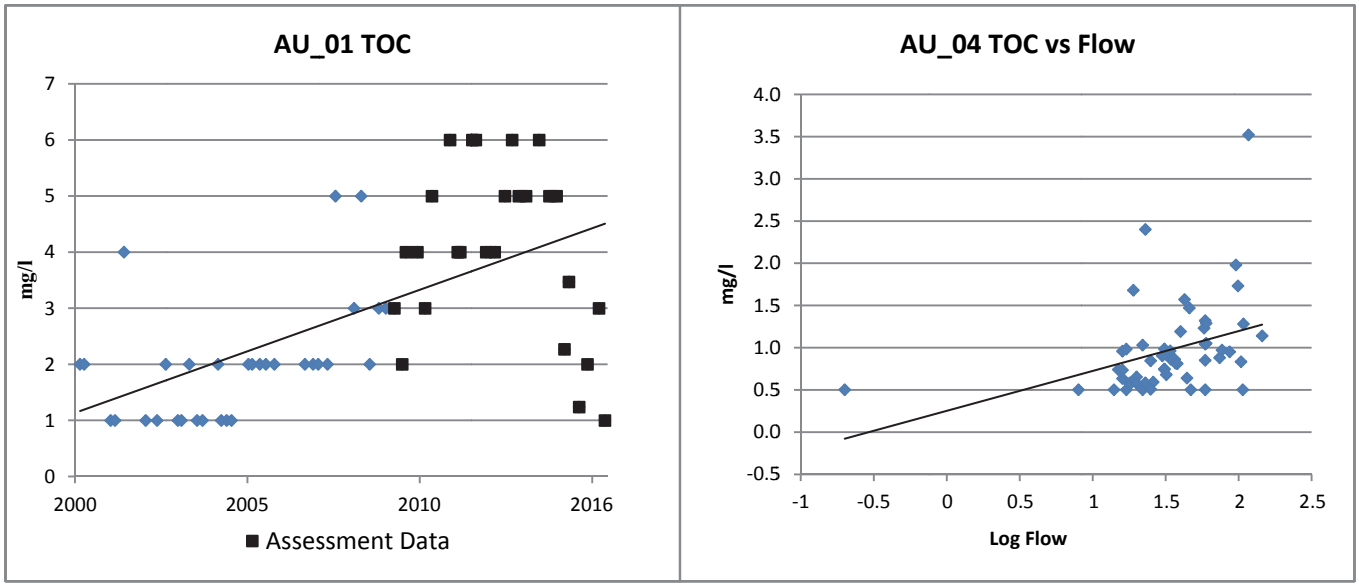
Trend analysis indicates an increasing trend in sulfate concentrations in AU_03 ($t = 2.25$, $p = 0.028$) over time. The measured values are still well below the standard.

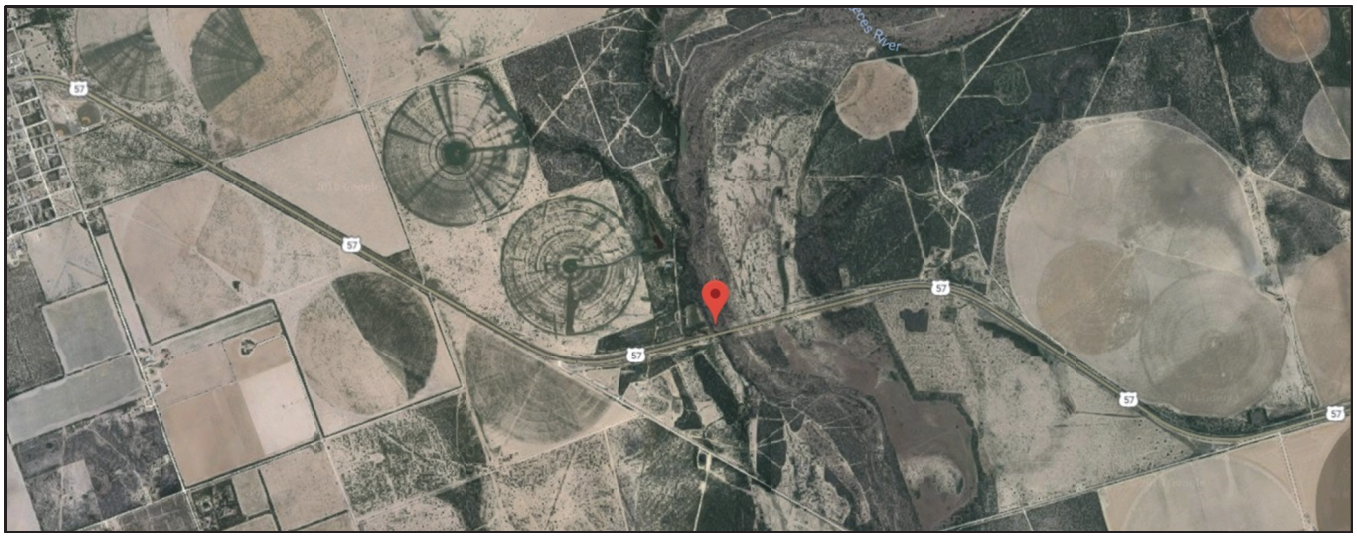
TDS		Status	# samples	Min	Max	Average	ND	>400
AU_01	400 mg/l	FS	27	134	490	299	0	6
AU_03		FS	25	23	308	243	0	0
AU_04		FS	29	109	277	223	0	0

Trend analysis did not indicate any trends in TDS concentrations in any of the AUs over time or with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	1	6	4
AU_03		N/A	22	1	2.66	1
AU_04		N/A	26	<5	2.4	0.74

Trend analysis indicates an increasing trend in TOC concentrations in AU_01 (t = 5.60, p = 0.000) over time and in AU_04 (t = 2.65, p = 0.010) with respect to flow.





Google Earth view of Station 12996 location.

UPPER FRIO RIVER – SEGMENT 2113

Segment 2113, Upper Frio River, flows 47 miles from the confluence with the West Frio River and the East Frio River in Real County to a point 100m upstream of US 90 in Uvalde County. It is divided into two AUs. **AU_01** is from the downstream end to the confluence with Bear Creek. **AU_02** is from the confluence with Bear Creek to the upstream end. Its watershed is 280,596 acres.

Special Studies

AU_01 has been assessed as having a concern for impaired habitat and non-supporting for impaired macrobenthic and fish communities. AU_02 has been assessed as having concerns for impaired habitat and fish community. TCEQ is conducting two aquatic life biological sampling events. The first one was held in April 2017. The second one was delayed due to Hurricane Harvey and is tentatively scheduled for September 2018. The results will be available to reassess these impairments and concerns in the 2020 assessment.

Water Quality Analysis

The analysis for AU_01 is based on data from **Station 13006** at SH 127. The analysis for AU_02 is based on data from **Station 13007** at Magers Crossing. Trend analysis was not run for AU_02 because of a five-year data gap between 2004 and 2009.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<6
AU_01	Minimum 4.0 mg/l	FS	19	6.4	11.1	8.4	0	0
	Screening Level 6.0 mg/l	NC						
AU_02	Minimum 4.0 mg/l	FS	20	6.4	11.3	8.4	0	0
	Screening Level 6.0 mg/l	NC						

Trend analysis did not indicate any trends in AU_01 for DO levels or DOD over time or with respect to flow.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	20	<1	100	10.3	6	0
AU_02		FS	21	<10	260	21.9	5	2

Trend analysis did not indicate any trends in AU_01 for *E. coli* concentrations over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	20	8.8	29.2	23.0	0
AU_02		FS	20	9.1	29.9	21.4	0

Trend analysis did not indicate any trends in AU_01 for water temperature over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	18	7.7	8.3	8.0	0	0
AU_02		FS	20	7.8	8.4	8.1	0	0

Trend analysis did not indicate any trends in AU_01 for pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	20	160	205	184
AU_02		N/A	21	160	205	188

Trend analysis did not indicate any trends in AU_01 for alkalinity over time or with respect to flow.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	20	<0.02	0.02	0.02	20	0
AU_02		NC	21	<0.03	0.1	0.03	17	0

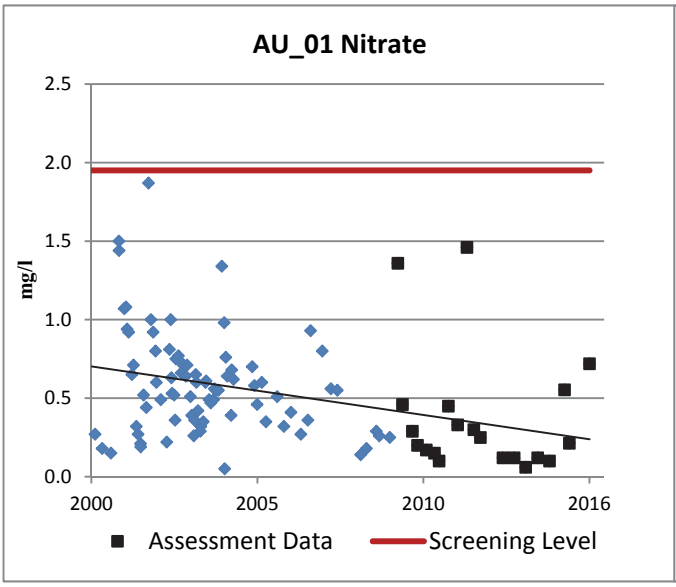
Trend analysis did not indicate any trends in AU_01 for ammonia concentrations over time or with respect to flow.

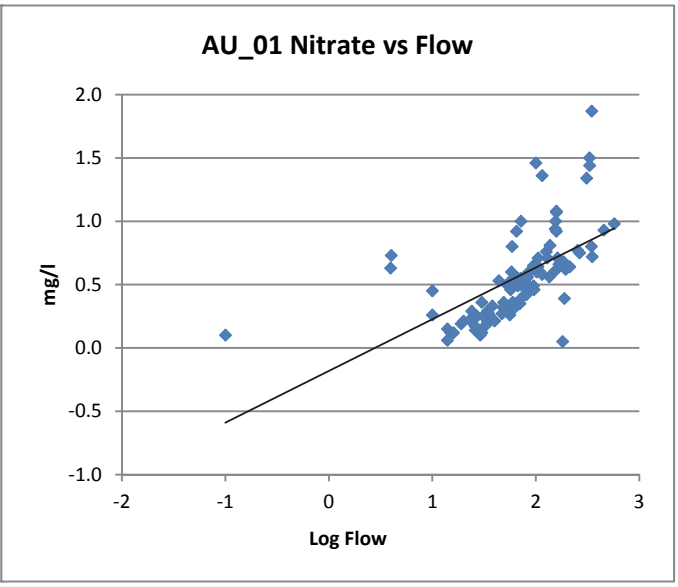
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	19	<0.2	1.26	0.2	11	0
AU_02		NC	20	<0.2	3.48	0.8	4	0

Trend analysis did not indicate any trends in chloride concentrations in AU_01 over time or with respect to flow.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	20	0.06	1.46	0.23	0	0
AU_02		NC	21	<0.04	1.51	0.12	5	0

Trend analysis indicates a decreasing trends in nitrate concentrations in AU_01 (t = -3.80, p = 0.000) over time and an increasing trend in AU_01 (t = 6.30, p = 0.000) with respect to flow.





TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	<0.05	0.34	0.05
AU_02		N/A	19	<0.05	0.5	0.05

Trend analysis did not indicate any trends in AU_01 for TKN concentrations over time or with respect to flow.

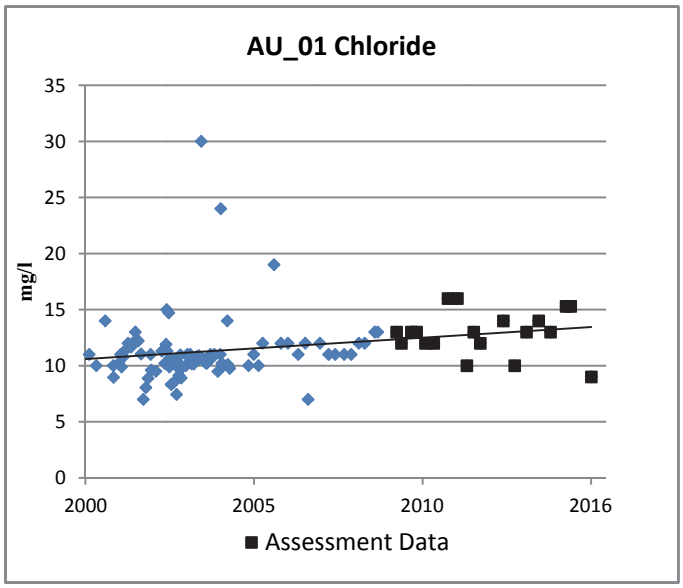
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	15	<0.004	0.004	0.004	15	0
AU_02		NC	15	<0.01	<0.01	0.01	15	0

Trend analysis did not indicate any trends in AU_01 for total phosphorus concentrations over time or with respect to flow.

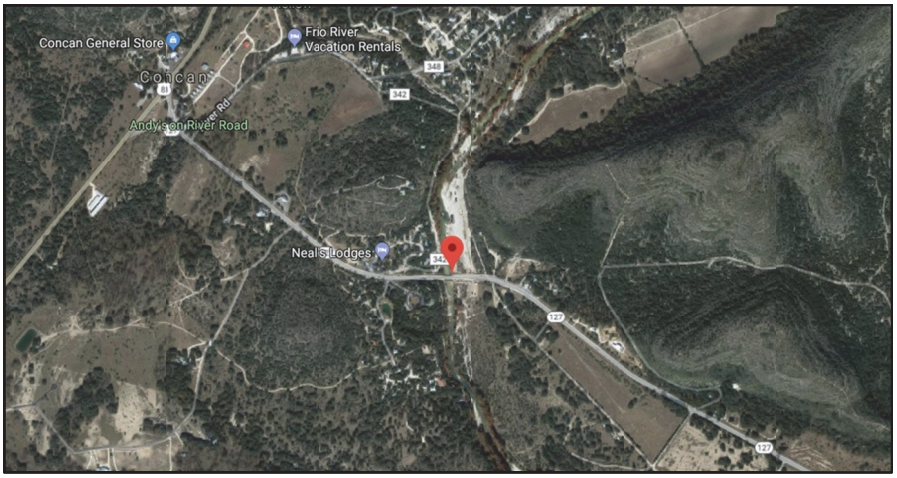
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	1	6	1
AU_02		N/A	20	<1	1	1

Trend analysis did not indicate any trends in AU_01 for TSS concentrations over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	FS	19	9	16	12.9	0	0
AU_02		FS	20	9	14	12.4	0	0



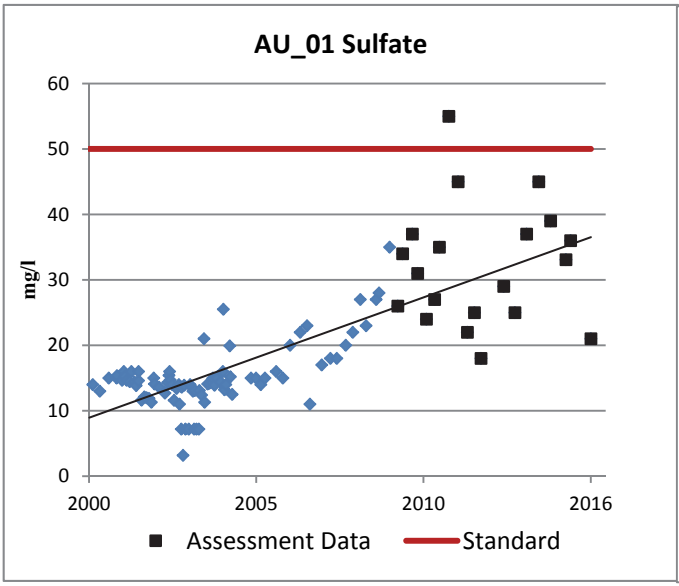
Trend analysis indicates an increasing trend in chloride concentrations in AU_01 (t = 2.60, p = 0.011) over time. However, the measurements are well below the standard. This trend, and the similarly increasing trends in sulfate and TDS, may be due to the increased sampling frequency in 2001 through 2005 and lower concentrations during that time period.

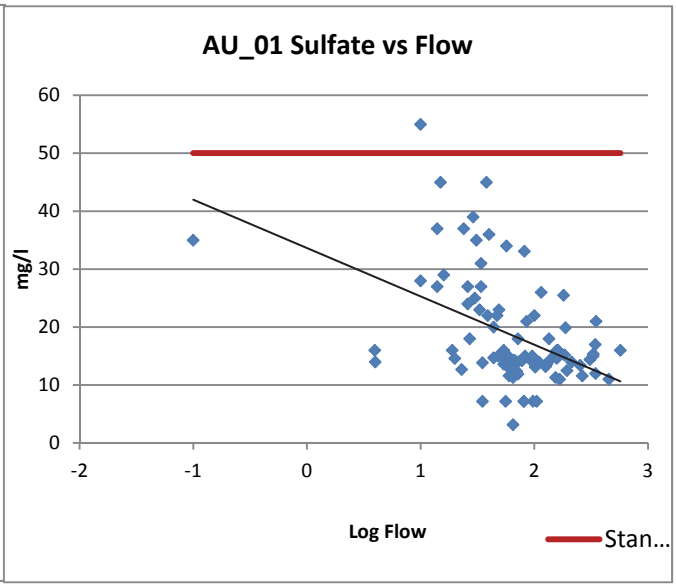


Google Earth view of Station 13006 location

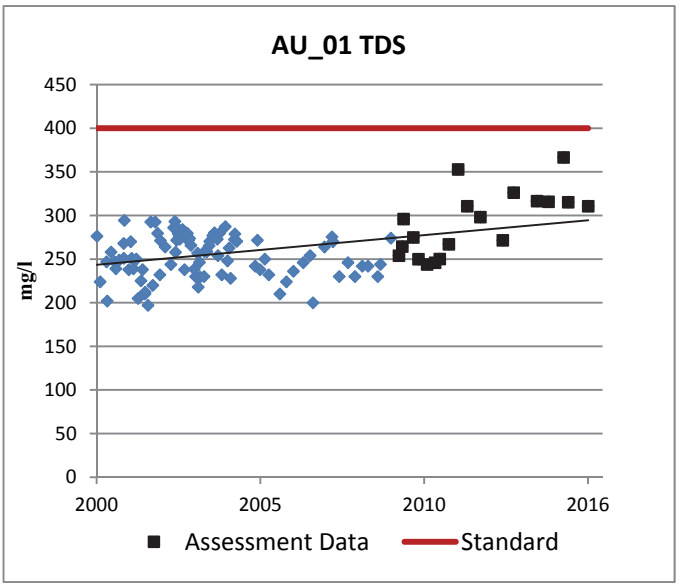
Sulfate		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	FS	20	18	55	32.2	0	1
AU_02		FS	21	12	40	15.5	0	0

Trend analysis indicates an increasing trend in sulfate concentrations in AU_01 (t = 12.80, p = 0.000 over time and a decreasing trend in (t = -3.91. p = 0.000) with respect to flow.





TDS		Status	# samples	Min	Max	Average	ND	>400
AU_01	400 mg/l	FS	19	244	367	291	0	0
AU_02		FS	20	210	312	263	0	0



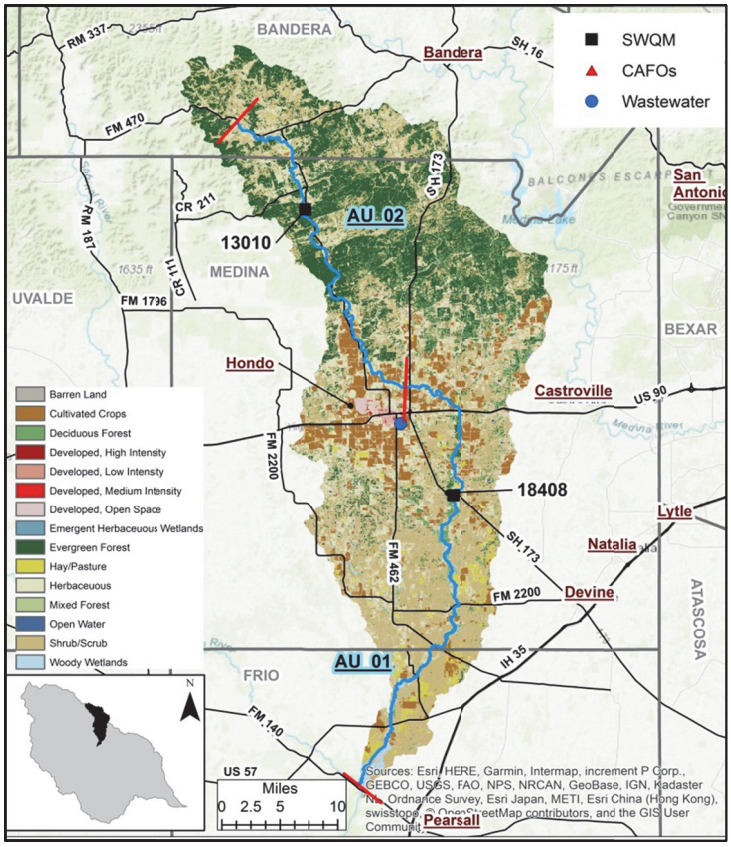
Trend analysis indicates an increasing trend in TDS concentrations in AU_01 (t = 4.93, p = 0.000) over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	17	1	2	1
AU_02		N/A	19	<1	2	1

Trend analysis did not indicate any trends in AU_01 for TOC concentrations over time or with respect to flow.

HONDO CREEK – SEGMENT 2114

Segment 2114, Hondo Creek, flows 78 miles from FM 470 in Bandera County to the confluence with the Frio River in Frio County. It is divided into two AUs. **AU_01** is from the downstream end to just upstream of FM 2676. **AU_02** is from just upstream of FM 2676 to the upstream end. Its watershed is 435,985 acres. The City of Hondo WWTP discharges to this segment. The two AUs are geographically very different and may be the reason for the large difference in chloride and TDS concentrations between the two sampling locations, as discussed below. The sampling location for AU_01 is below the City of Hondo WWTP discharge and the sampling location for AU_02 is located in the pristine hill county.



Water Quality Analysis

The analysis for AU_01 is based on data from **Station 18408** at SH 173 southeast of Hondo. The available flow data at this site is limited, but apparent trends with respect to flow are noted in the discussion. The analysis for AU_02 is based on data from **Station 13010,** downstream of RR 462.

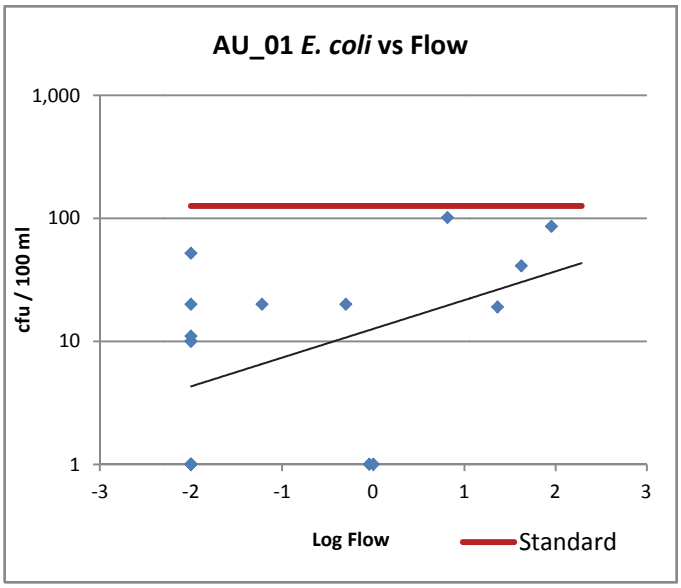
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	18	7.8	11.4	8.4	0	0
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	FS	14	7.9	11.6	8.8	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD in either AU over time or with respect to flow.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	FS	12	<1	75	6.18	4	0
AU_02		NC	14	<1	52	11.9	3	0



Trend analysis indicates an increasing trend in *E. coli* concentrations in AU_01 (t = 2.18, p = 0.040) with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	18	11.4	32.4	22.4	2
AU_02		FS	14	7.1	31.7	22.4	0

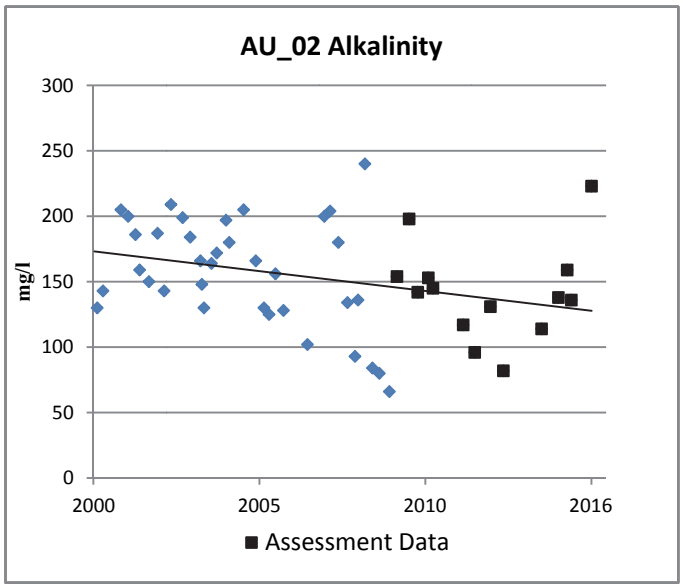
Trend analysis did not indicate any trends in water temperature in either AU over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	18	7.4	8.3	7.9	0	0
AU_02		FS	14	7.9	8.4	8.1	0	0

Trend analysis did not indicate any trends in pH levels in either AU over time or with respect to flow.

Sampling location for Station 18408 at SH 173.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	13	107	216	174
AU_02		N/A	14	82	223	140



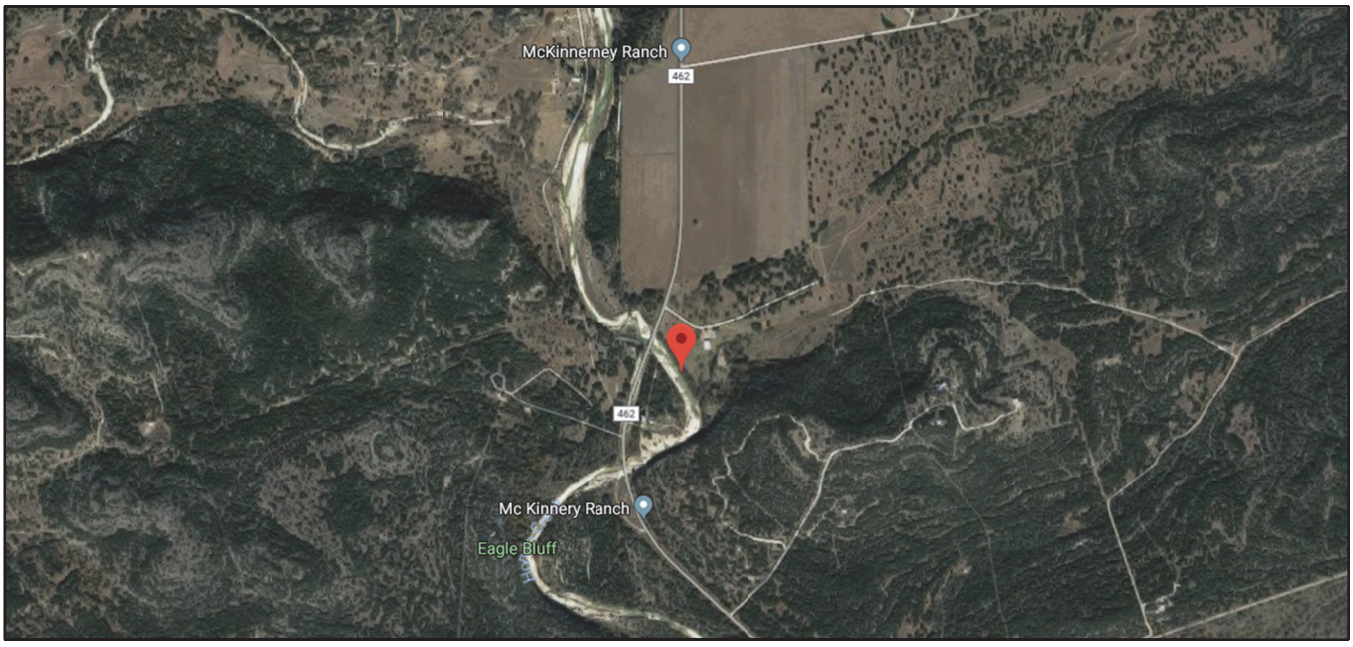
Trend analysis indicates a decreasing trend in alkalinity in AU_02 (t = -2.30, p = 0.026) over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	20	<0.02	1.0	0.02	18	0
AU_02		NC	15	<0.02	<0.02	0.02	15	0

Trend analysis did not indicate any trends ammonia concentrations in either AU over time or with respect to flow.

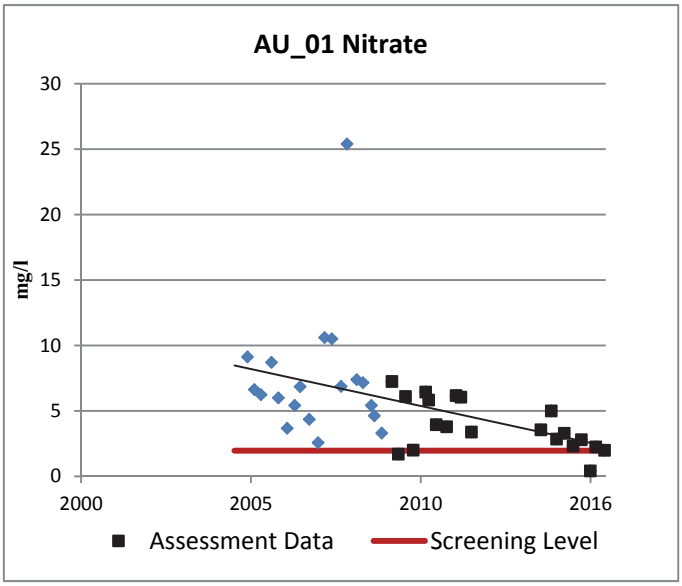
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	NC	12	<2	31.6	3.33	4	1
AU_02		NC	15	<1	4.82	1	12	0

Trend analysis did not indicate any trends chlorophyll-*a* concentrations in either AU over time or with respect to flow.



Google Earth view of Station 13010 location

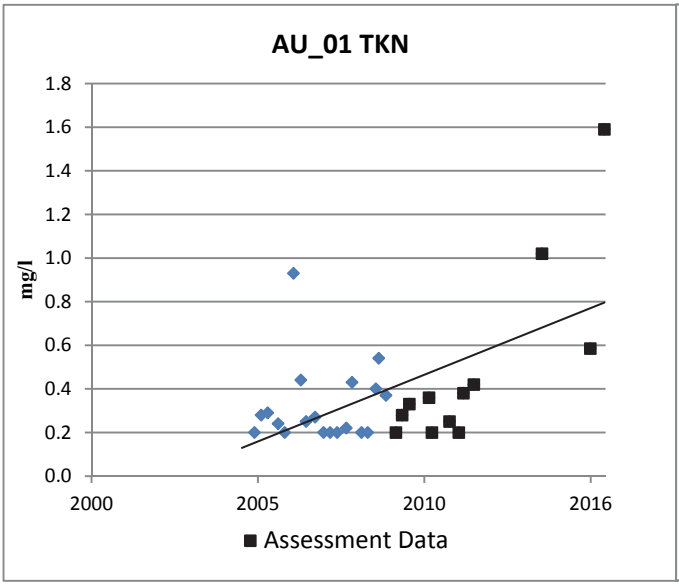
Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	CS	20	0.424	7.25	3.47	0	18
AU_02		NC	15	<0.04	0.78	0.04	7	0

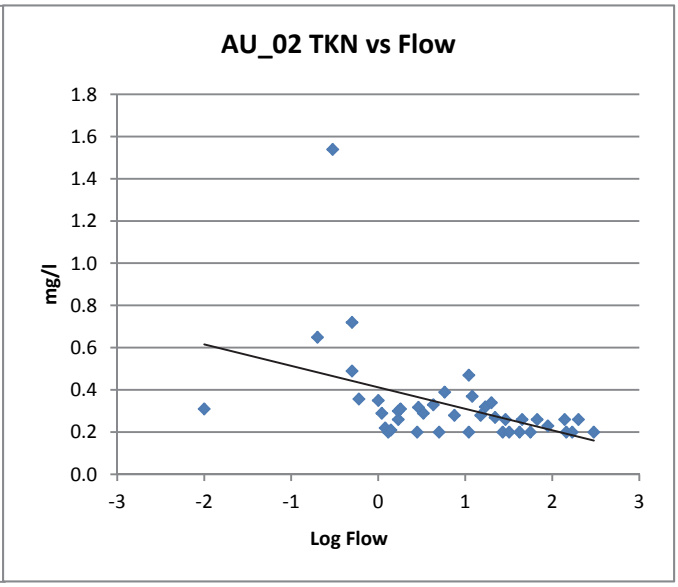


AU_01 is assessed as having a concern for nitrate. Trend analysis indicates a decreasing trend in AU_01 (t = -3.04, p = 0.004) over time, but the concentrations are still above the screening level.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	12	<0.2	1.59	0.34
AU_02		N/A	13	<0.2	0.72	0.31

Trend analysis indicates an increasing trend in TKN concentrations in AU_01 (t = 3.56, p = 0.001) over time and a decreasing trend in AU_02 (t = -2.33, p = 0.024) with respect to flow.





Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	19	<0.02	0.08	0.02	12	0
AU_02		NC	14	<0.02	0.08	0.02	11	0

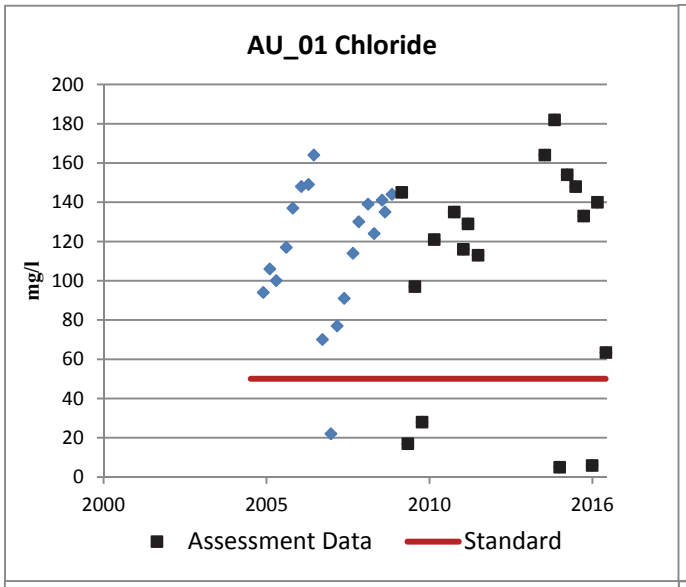
Trend analysis did not indicate any trends total phosphorus concentrations in either AU over time or with respect to flow.

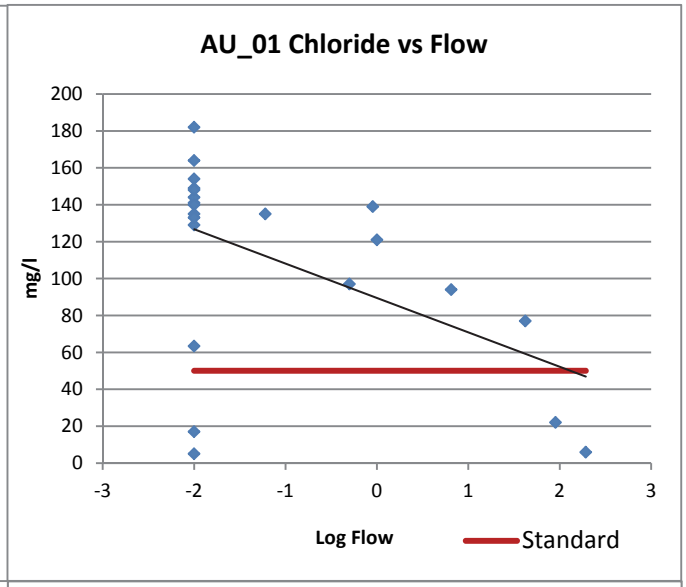
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	13	4	14	5
AU_02		N/A	14	<1	4	1

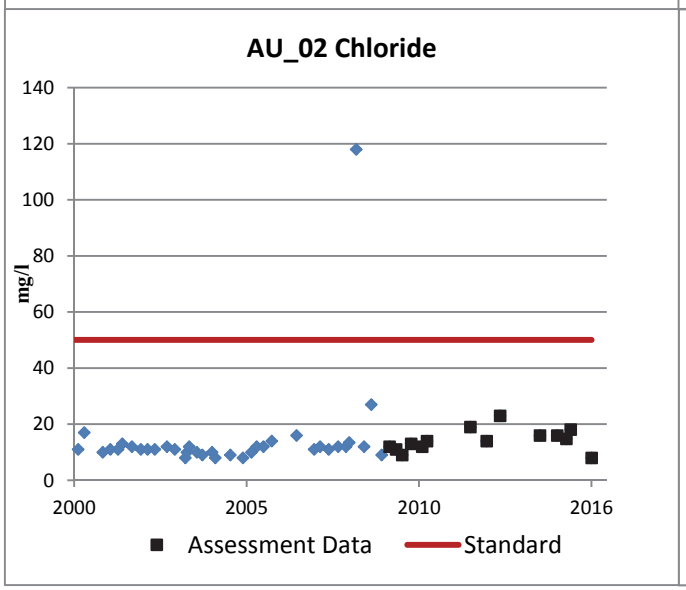
Trend analysis did not indicate any trends TSS concentrations in either AU over time or with respect to flow.

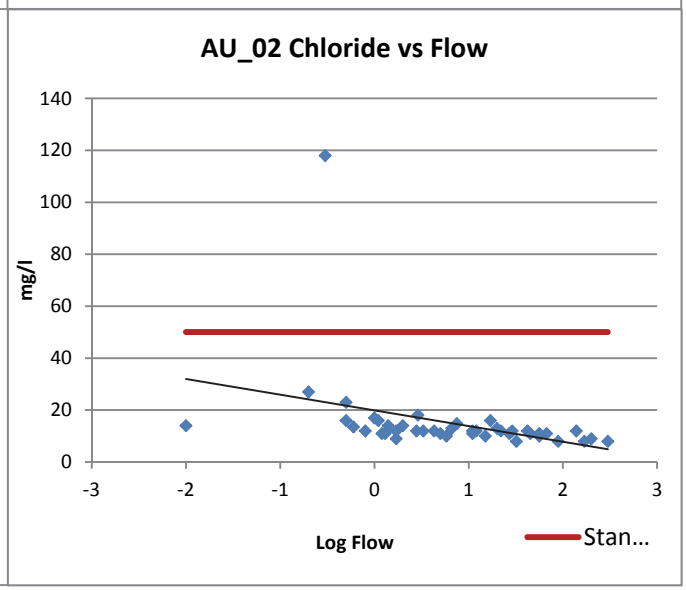
Chloride		Status	# samples	Min	Max	Average	ND	>50
AU_01	50 mg/l	NS	18	<5	182	105	1	14
AU_02		NS	14	8.0	23.0	14.3	0	0

Chloride is assessed on the entire segment causing both AUs to be listed as being impaired for this parameter. The data supports that assessment for AU_01, but high chloride concentrations are not an issue in AU_02. Trend analysis indicates decreasing trends in choride concentrations in AU_01 (t = -2.13, p= 0.043) and in AU_02 (t = -2.28, p = 0.027) with respect to flow.



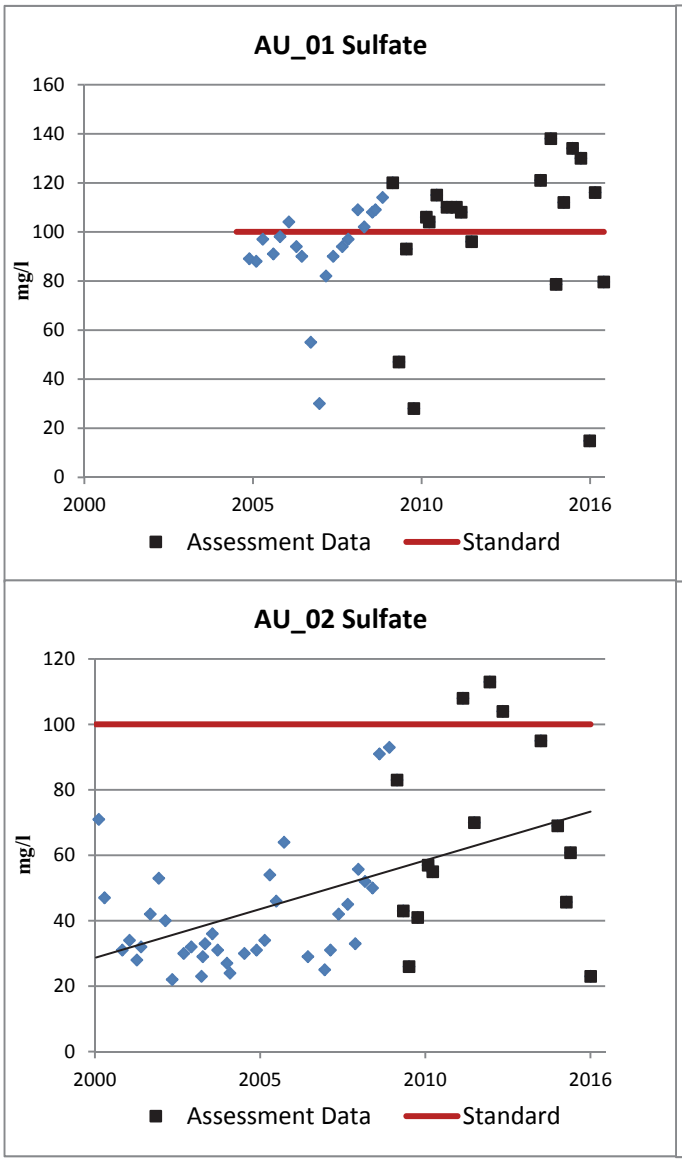


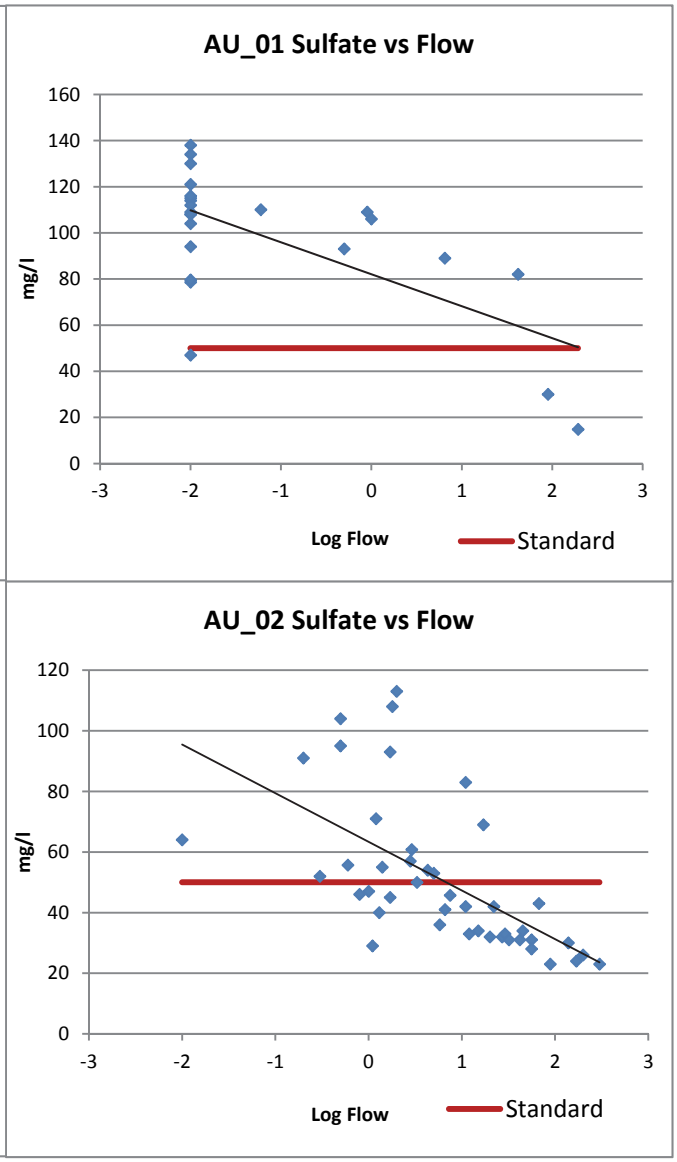




Sulfate		Status	# samples	Min	Max	Average	ND	>100
AU_01	100 mg/l	FS	20	14.8	138	98	0	13
AU_02		FS	15	23	113	66.2	0	3

Although both AUs are listed as fully supporting for sulfate, the data analysis shows that the average concentration in AU_01 is just barely below the standard and trend analysis indicates an increasing trend in AU_02 (t = 4.21, p = 0.000) over time, with some values exceeding the standard. Trend analysis also indicates decreasing trends in AU_01 (t = -4.67, p = 0.000) and in AU_02 (t = -3.69, p = 0.001) with respect to flow.





TDS		Status	# samples	Min	Max	Average	ND	>400
AU_01	400 mg/l	FS	19	195	706	549	0	16
AU_02		FS	14	246	349	296	0	0

TDS is assessed on the entire segment. The concentrations in AU_02 are low enough to offset the concentrations in AU_01 so that the segment meets the standard. Trend analysis did not indicate any trends TDS concentrations in either AU over time or with respect to flow.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	20	1	8	1.04
AU_02		N/A	13	<1	5	2

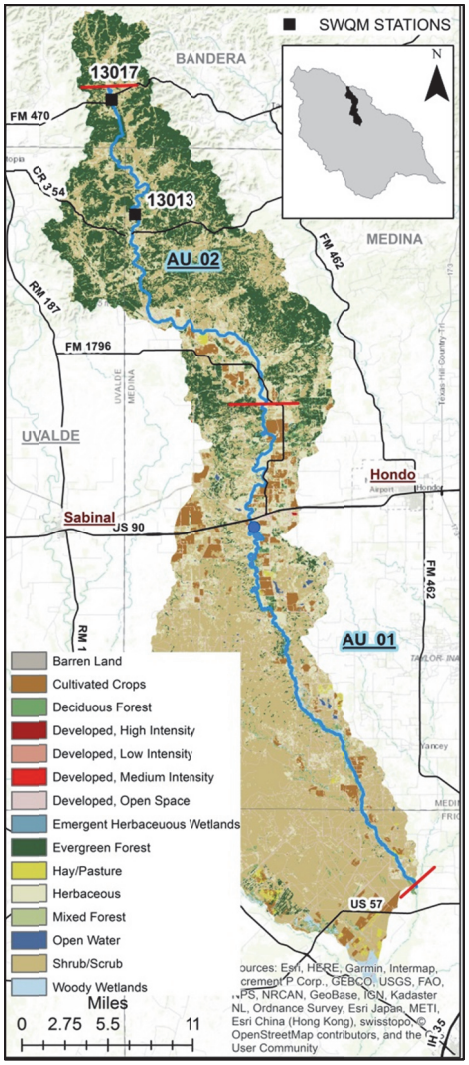
Trend analysis did not indicate any trends TOC concentrations in either AU over time or with respect to flow.

Another view of the sampling location for Station 18408.

SECO CREEK – SEGMENT 2115

Segment 2115, Seco Creek, flows 70 miles from the confluence with West Seco Creek in Bandera County to the confluence with Hondo Creek in Frio County. It is divided into two AUs. **AU_01** is from the downstream end to the confluence with an unnamed tributary near FM 1796. **AU_02** is from the confluence with an unnamed tributary near FM 1796 to the upstream end. Its watershed is 266,833 acres.

BCRAGD began sampling in AU-02 in FY 2016. They are contributing their resources for this sampling and providing the data to NRA for submittal to SWQMIS.



Water Quality Analysis

There are no sampling stations in AU_01. The analysis for AU_02 is based on limited data from **Station 13013** at Miller Ranch and **Station 13017** at SH 470. Drought conditions have limited the number of sampling events in the segment. This station has a maximum of 8 samples during the assessment period, with 5 samples in 2010, 1 sample in 2014, and 2 samples in 2016. But the statistics are being shown since this is the only station in the segment. There is enough data back to 2000 for trend analysis.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_02	Minimum 3.0 mg/l	NC	7	8.1	10.6	9.4	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time or with respect to flow.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_02	Geomean 126 cfu/100 ml	NC	7	<1	99	8.02	2	0

Trend analysis did not indicate any trends in *E. coli* levels over time or with respect to flow.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_02	32.2 °C	NC	7	8.4	31.5	22.7	0

Trend analysis did not indicate any trends in water temperature over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_02	6.5 – 9.0 su	NC	7	8.0	8.7	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	7	109	188	149

Trend analysis did not indicate any trends in alkalinity over time or with respect to flow.

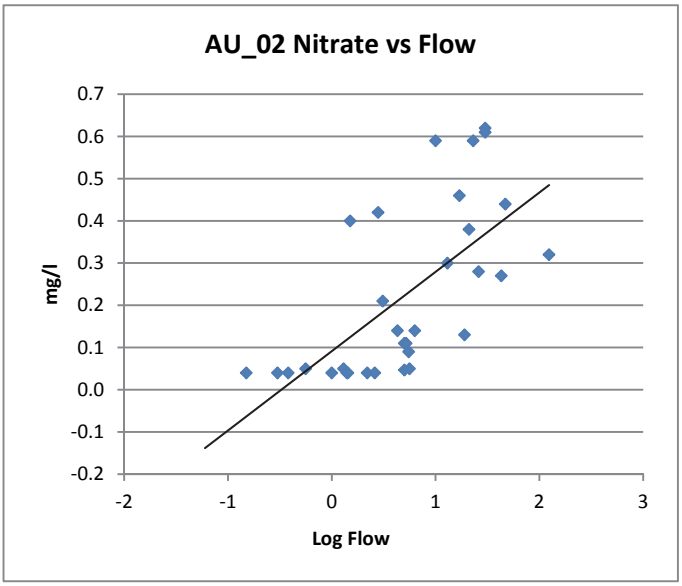
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_02	0.33 mg/l	NC	8	<0.02	<0.02	0.02	8	0

Trend analysis did not indicate any trends in ammonia concentrations over time or with respect to flow.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_02	14.1 µg/l	NC	7	<1	<1	1	7	0

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time or with respect to flow.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_02	1.95 mg/l	NC	7	<0.04	0.59	0.11	2	0



Trend analysis indicates an increasing trend in nitrate (t = 3.81, p = 0.000) with respect to flow. The measured values are well below the screening level.

TKN		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	5	<0.2	0.41	0.22

Trend analysis did not indicate any trends in TKN concentrations over time or with respect to flow.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_02	0.69 mg/l	NC	7	<0.02	<0.02	0.02	7	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time or with respect to flow.

TSS		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	7	<1	1.3	1

Trend analysis did not indicate any trends in TSS concentrations over time or with respect to flow.

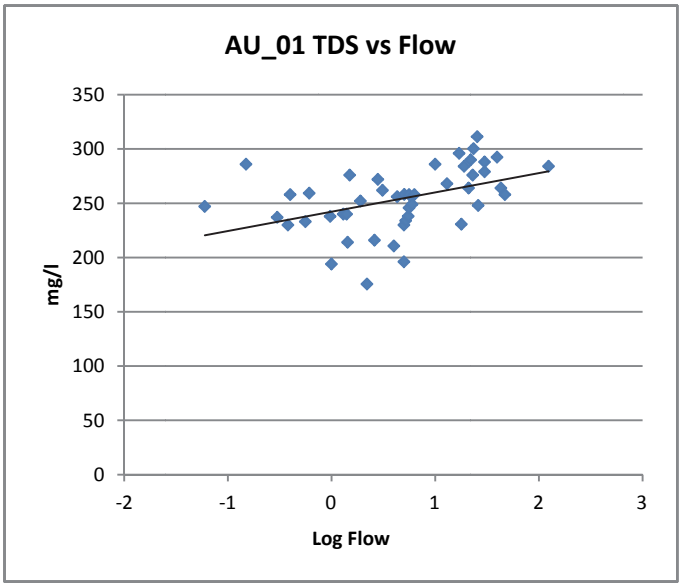
Chloride		Status	# samples	Min	Max	Average	ND	>50
AU_02	50 mg/l	NC	8	9.84	16.0	12.2	0	0

Trend analysis did not indicate any trends in chloride concentrations over time or with respect to flow.

Sulfate		Status	# samples	Min	Max	Average	ND	>70
AU_02	70 mg/l	NC	7	28.0	60.0	47.8	0	0

Trend analysis did not indicate any trends in sulfate concentrations over time or with respect to flow.

TDS		Status	# samples	Min	Max	Average	ND	>400
AU_02	400 mg/l	NC	8	176	296	243	0	0



Trend analysis indicates an increasing trend in TDS ($t = 3.21$, $p = 0.002$) with respect to flow. The concentrations are all below the standard.

TOC		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	8	1	2	1.04

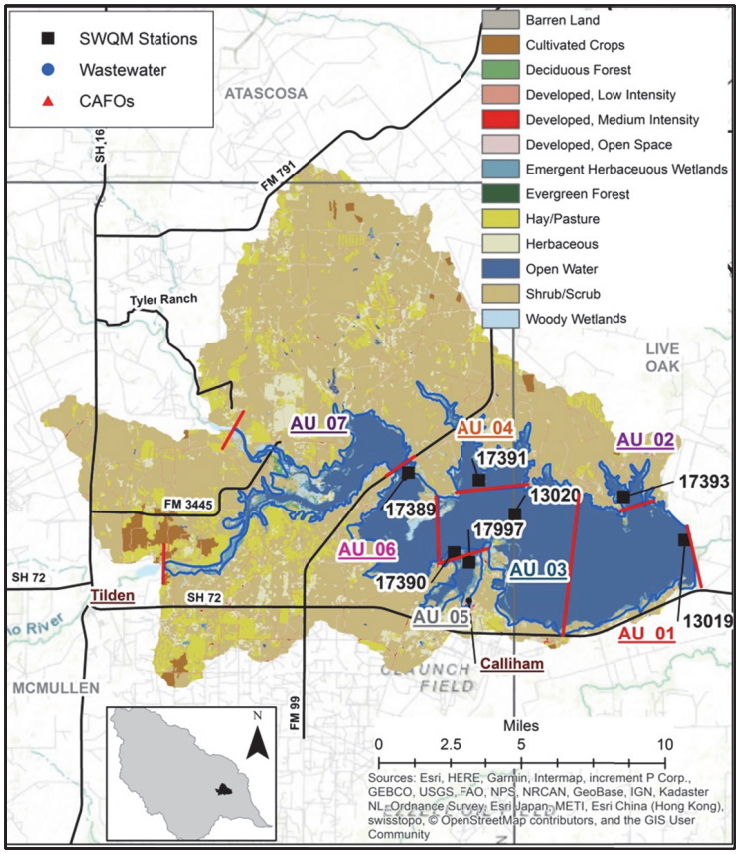
Trend analysis did not indicate any trends in TOC concentrations over time or with respect to flow.

Sampling location for Station 13017 at SH 470.

CHOKE CANYON RESERVOIR – SEGMENT 2116

Segment 2116, Choke Canyon Reservoir, impounds the Frio River and is defined by the 220.5‘ MSL elevation. The reservoir covers portions of McMullen and Live Oak Counties. When near capacity, the water levels at the Frio River at Tilden are affected. The reservoir is divided into seven AUs. **AU_01** is the 5120 acres near the dam. **AU_02** is the small north arm near the dam and Willow Hollow Tank. **AU_03** is the 5120 acres in the middle of the reservoir. **AU_04** is the large north arm near mid-reservoir and Jacob Oil Field. **AU_05** is the southern arm near mid-reservoir and Recreation Road 7 west of Calliham. **AU_06** is the western end of the reservoir up to RR 99. **AU_07** is from RR 99 to the upper end (AU_07). Its watershed is 11,304 acres.

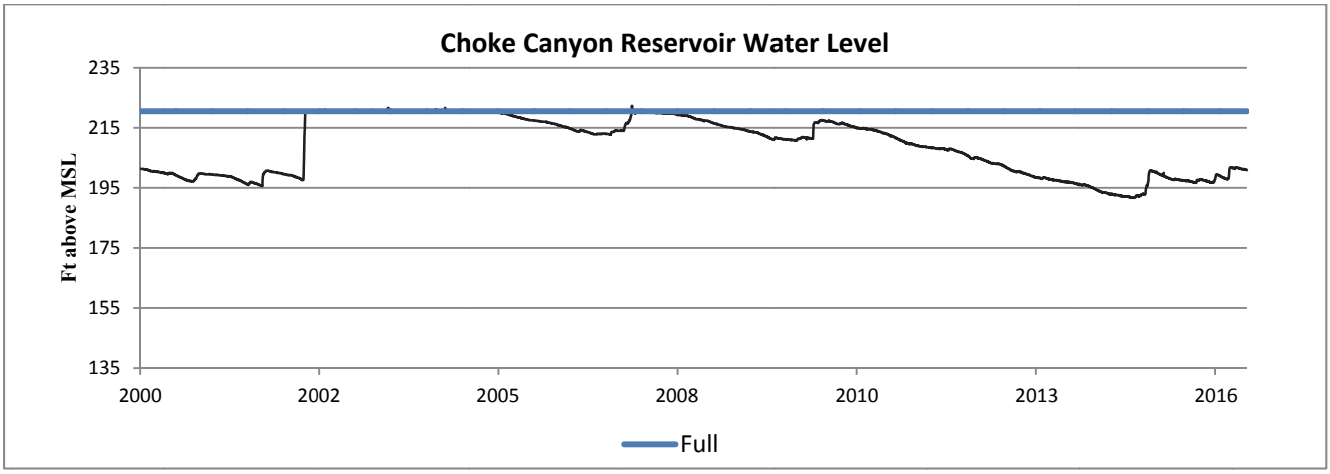
The last time the reservoir was full was in 2007. A graph of the water level from 2000 through 2016 is shown below.



Additional information about the reservoir is available at http://www.twdb.texas.gov/surfacewater/rivers/reservoirs/choke_canyon/index.asp.

Water Quality Analysis

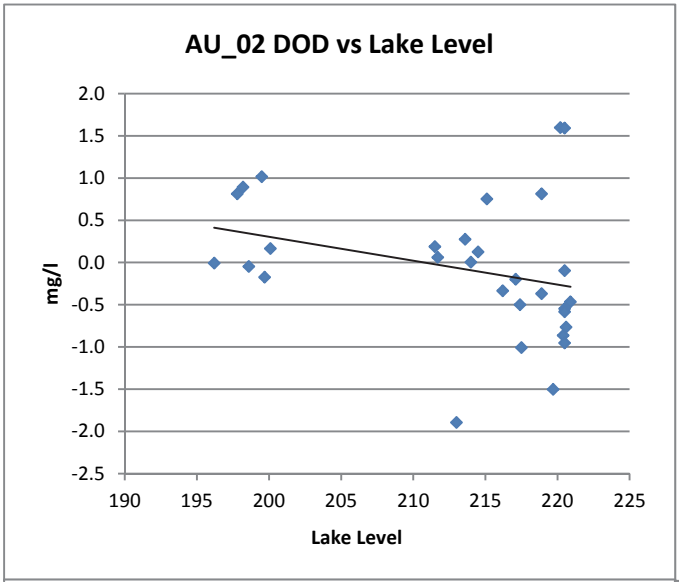
The analysis for AU_01 is based on data from **Station 13019** near the dam. The analysis for AU_02 is based on data from **Station 17393** in the northeast arm west of the intersection of US 281 and HI 37. The analysis for AU_03 is based on data from **Station 13020** at the Live Oak / McMullen county line. The analysis for AU_04 is based on data from **Station 17391** at the mouth of Opossum Creek arm. The analysis for AU_05 is based on data from **Station 17390** in the Salt Creek arm north of SH 72 crossing and **Station 17997** in the Salt Creek arm near the end of McMullen CR 303. The analysis for AU_06 is based on data from **Station 17389** at FM 99 in the Frio River arm. There are no stations in AU_07. For AU_01, AU_02, AU_04, and AU_05, there was insufficient data for statistical analysis and only water temperature, DO, DOD, and pH had enough data for trend analysis**.** Statistical and trend analysis was conducted for all parameters in AU_03 and AU_06.



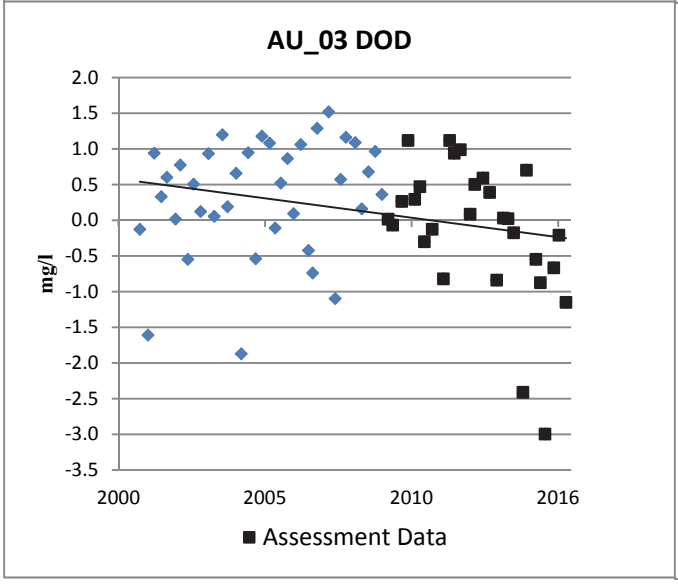
New for the Draft 2016 Integrated Report are Reservoir Nutrient Assessment Data for chlorophyll-a, total nitrogen, and total phosphorus. These new criteria/threshold values will be discussed in the water quality discussions below.

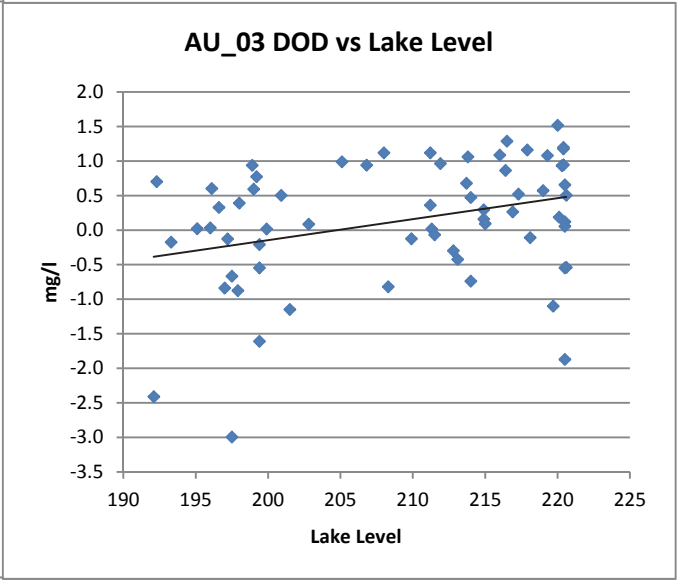
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<5
AU_03	Minimum 3.0 mg/l	FS	28	6.8	12.5	8.3	0	0
	Screening Level 5.0 mg/l	NC						
AU_06	Minimum 3.0 mg/l	FS	30	3.3	11.0	7.4	0	0
	Screening Level 5.0 mg/l	NC						



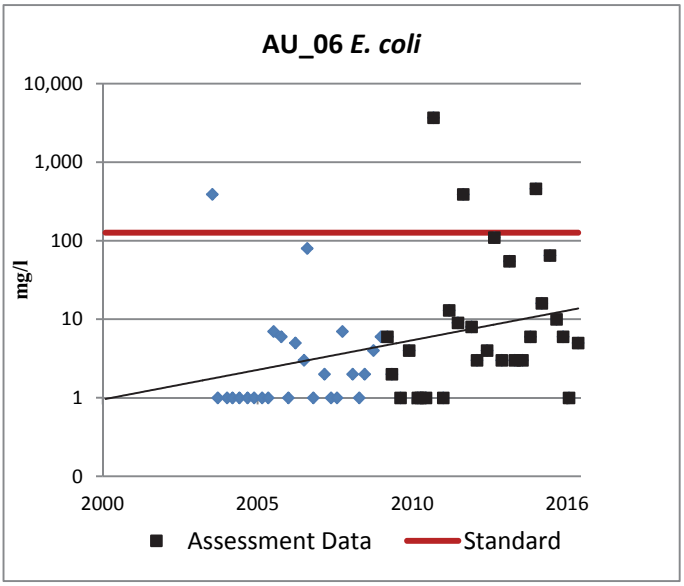
Trend analysis indicates a decreasing trend in DOD in AU_02 (t = -2.12, p = 0.043) with respect to the lake level. In AU_03, trend analysis indicates a decreasing trend (t = -2.21, p = 0.031) over time and an increasing trend (t = 2.72, p = 0.008) with respect to the lake level





Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_03	Geomean 126 cfu/100 ml	FS	28	<1	3	1.12	16	0
AU_06		FS	28	<1	3700	8.51	3	3



Trend analysis indicates an increasing trend in *E. coli* concentrations in AU_06 (t = 2.43, p = 0.019) over time.

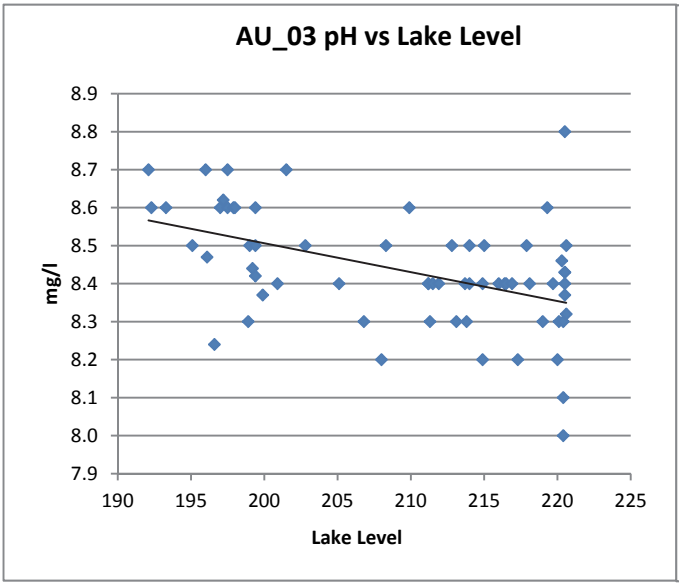
General Use

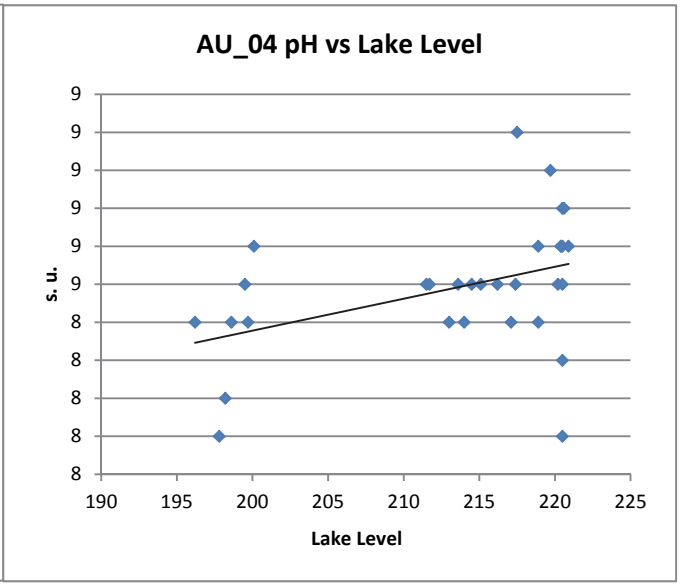
Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_03	32.2 °C	FS	28	12.2	32.1	23.8	0
AU_06		FS	30	9.3	32.9	24.0	1

Trend analysis did not indicate any trends in water temperature in any of the AUs over time or with respect to the lake level.

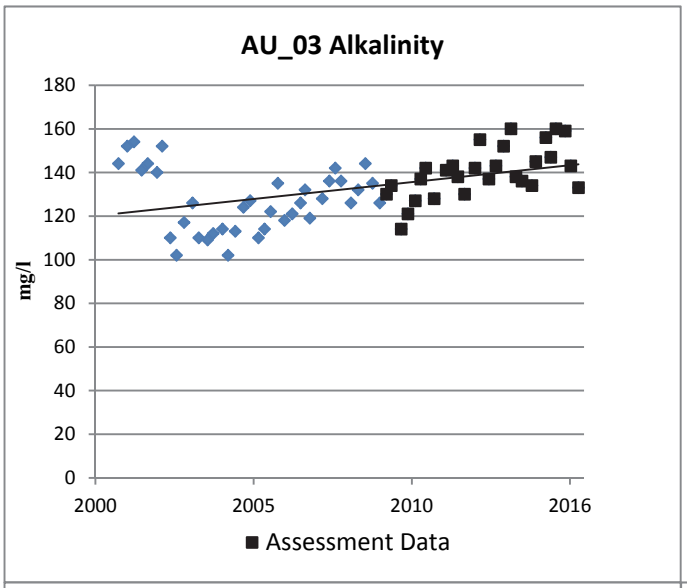
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_03	6.5 – 9.0 su	FS	28	8.2	8.7	8.5	0	0
AU_06		FS	30	7.4	8.7	8.2	0	0

Trend indicates a decreasing trend in pH levels in AU_03 (t = -4.31, p = 0.000) and an increasing trend in AU_04 (t = 2.46, p = 0.020) with respect to the lake level.

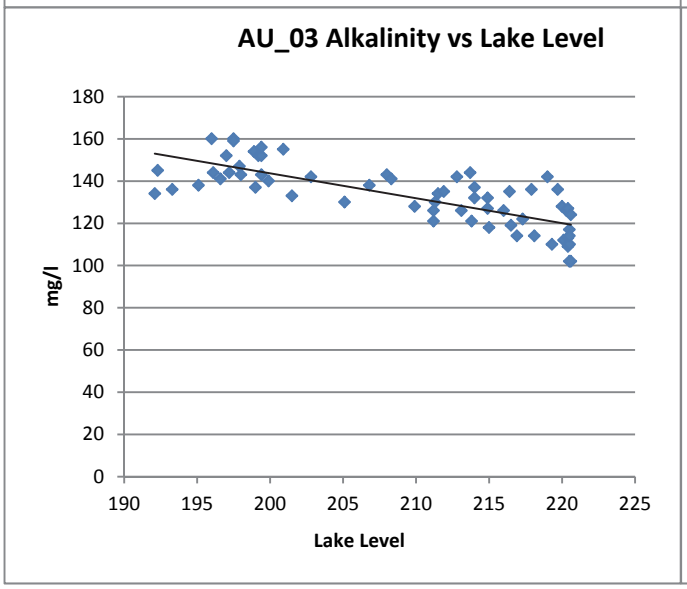


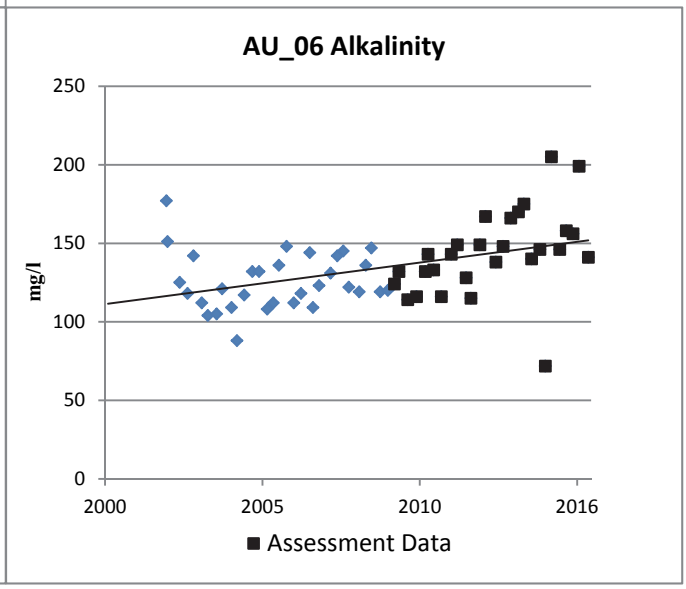


Alkalinity		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	28	114	160	140
AU_06		N/A	28	71.8	205	143



Trend analysis indicates increasing trends in alkalinity in AU_03 (t = 4.06, p = 0.000) and in AU_06 (t = 3.70, p = 0.000) over time. Trend analysis also indicates a decreasing trend in AU_03 (t = -9.57, p = 0.000) with respect to the lake level.

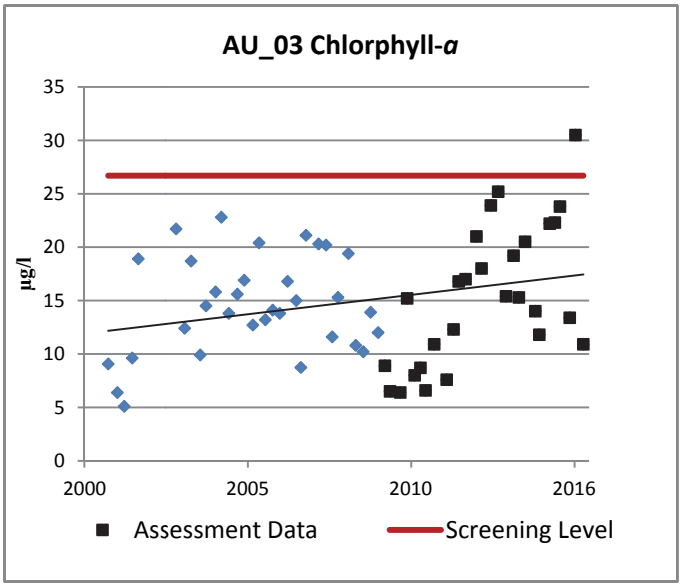




Ammonia		Status	# samples	Min	Max	Median	ND	>0.11
AU_03	0.11 mg/l	NC	28	<0.02	0.038	0.02	26	0
AU_06		NC	28	<0.02	0.277	0.02	19	2

Trend analysis did not indicate any trends in ammonia concentrations in either AU over time or with respect to the lake level.

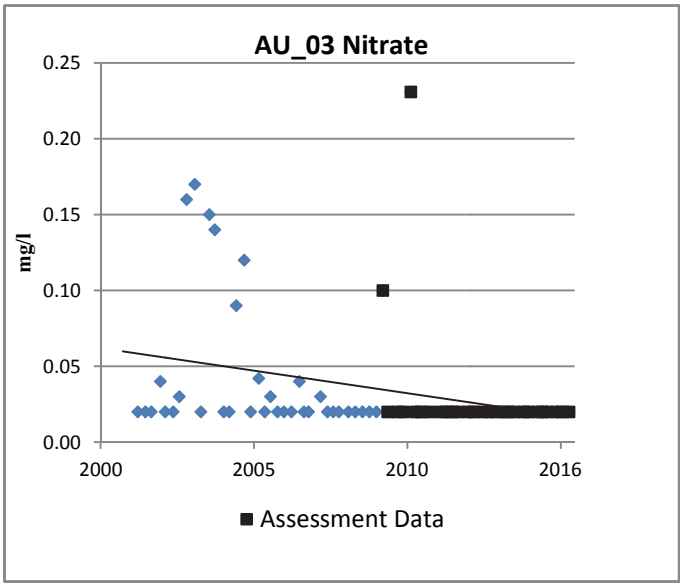
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>26.7
AU_03	26.7 µg/l	NC	28	6.4	30.5	15.2	0	1
AU_06		CS	28	<10	57	21.2	5	11



Trend analysis indicates increasing trends in chlorophyll-*a* concentrations in AU_03 (t = 2.17, p = 0.034) over time.

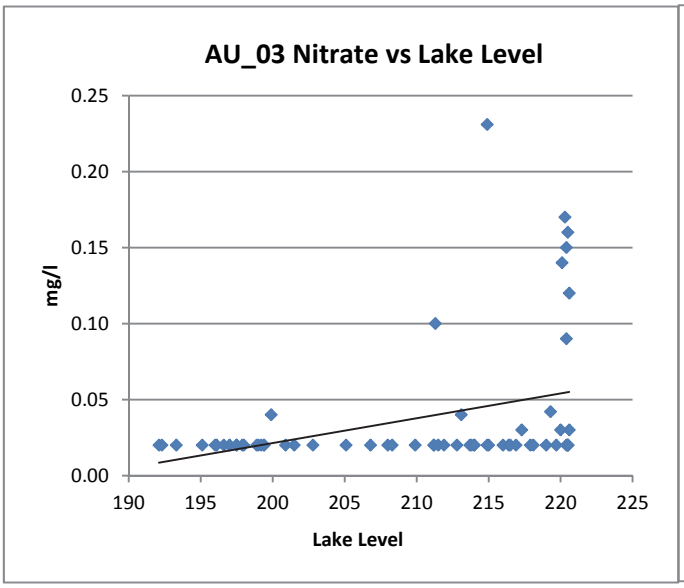
The criteria/threshold for chlorophyll-a in Choke Canyon Reservoir based on Reservoir Nutrient Assessment Data is 12.05 µg/l. Fifteen samples were assessed from AU_03 with a median of 10.80 µg/l.

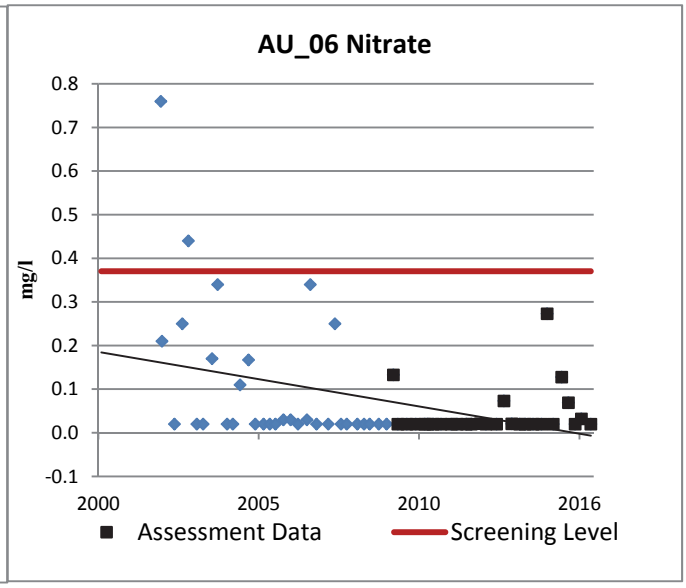
Nitrate		Status	# samples	Min	Max	Median	ND	>0.37
AU_03	0.37 mg/l	FS	28	<0.02	0.231	0.02	27	0
AU_06		FS	28	<0.02	0.273	0.02	20	0



Trend analysis indicates decreasing trends in nitrate concentrations in AU_03 (t = -3.06, p = 0.003) and in AU_06 (t = -2.99, p = 0.004) over time. Trend analysis also indicates a increasing trend in AU_03 (t = -3.14, p = 0.003) with respect to the lake level. The concentrations in AU_03 are well below the screening level.

Sampling location for Station 17389 at FM 99





TKN		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	21	1.01	1.79	1.39
AU_06		N/A	21	0.53	2.57	1.48

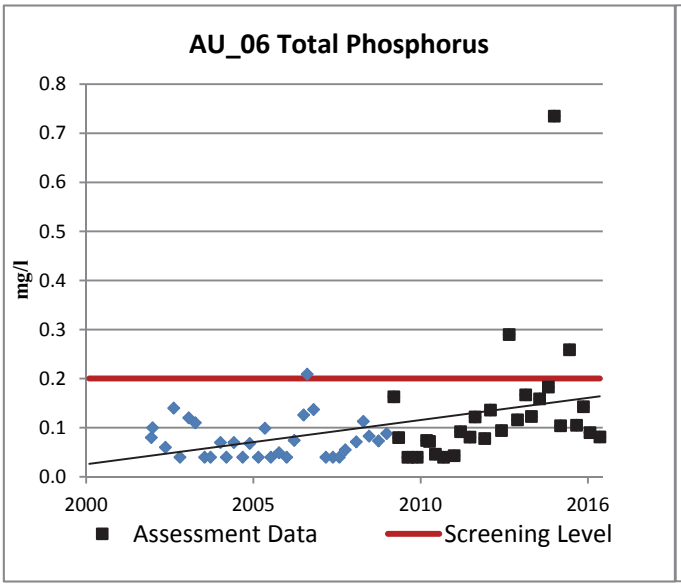
There was insufficient data in either AU for trend analysis for TKN.

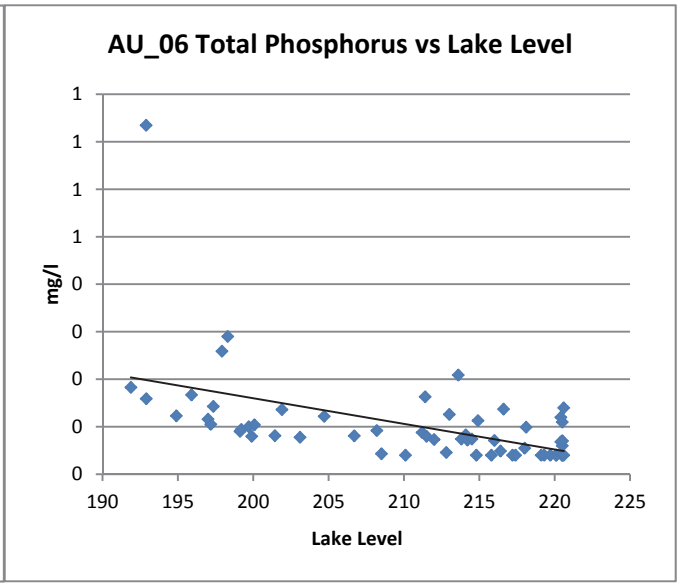
The criteria/threshold for total nitrogen in Choke Canyon Reservoir based on Reservoir Nutrient Assessment Data is 0.80 mg/l. Zero samples were assessed.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.20
AU_03	0.20 mg/l	NC	28	<0.02	0.099	0.046	7	0
AU_06		NC	28	<0.04	0.735	0.099	3	3

Trend analysis indicates an increasing trend in total phosphorus concentrations in AU_06 (t = 2.63, p = 0.011) over time and a decreasing trend (t = -3.44, p = 0.001) with respect to the lake level.

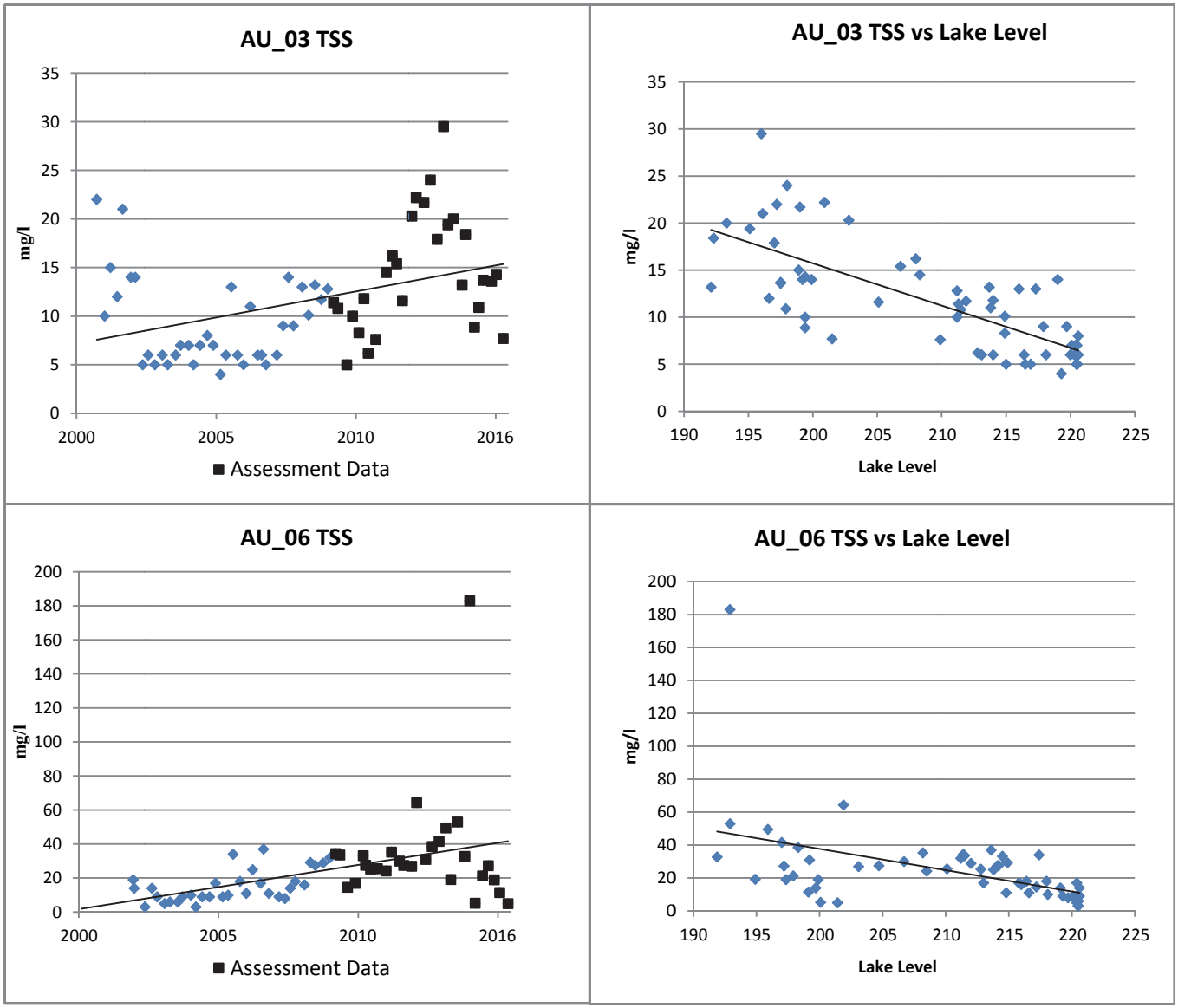
The criteria/threshold for total phosphorus in Choke Canyon Reservoir based on Reservoir Nutrient Assessment Data is 0.05 mg/l. Eight samples were assessed from AU_03 with a median of 0.03 mg/l.





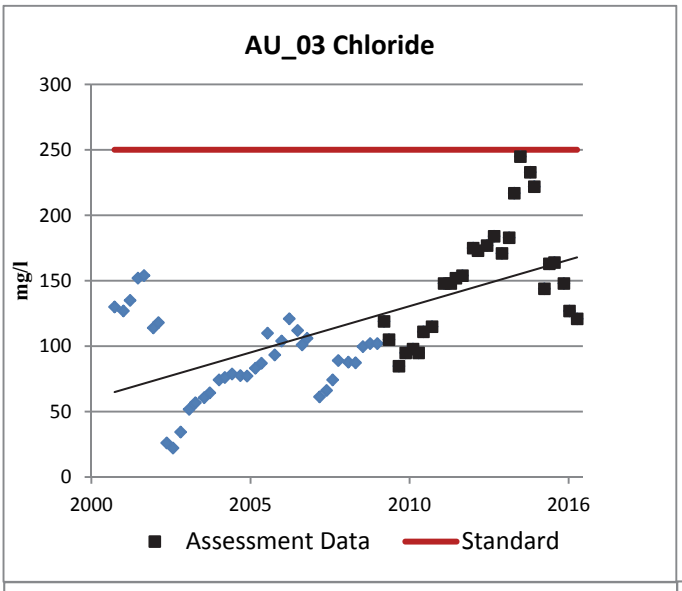
TSS		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	28	5	29.5	13.6
AU_06		N/A	28	5.01	183	27.6

Trend analysis indicates increasing trends in TSS concentrations in AU_03 (t = 3.50, p = 0.001) and in AU_06 (t = 3.52, p = 0.001) over time and decreasing trends in AU_03 (t = -9.06, p = 0.000) and in AU_06 (t = -3.34, p = 0.001) with respect to the lake level.

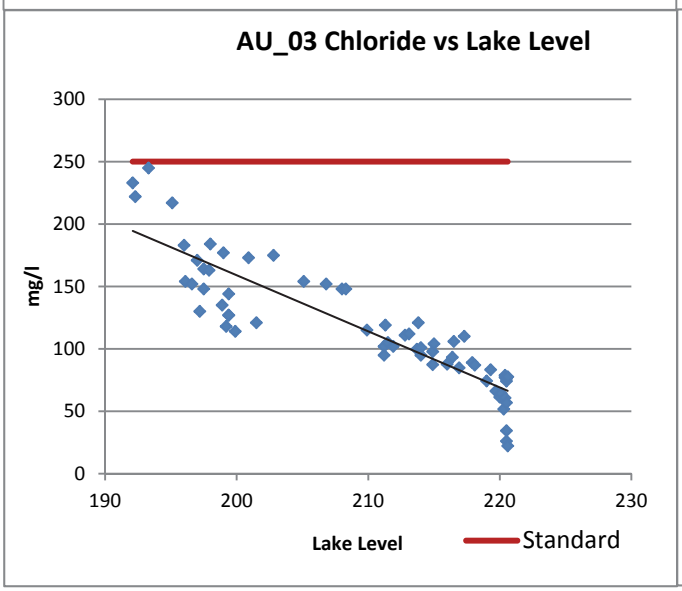


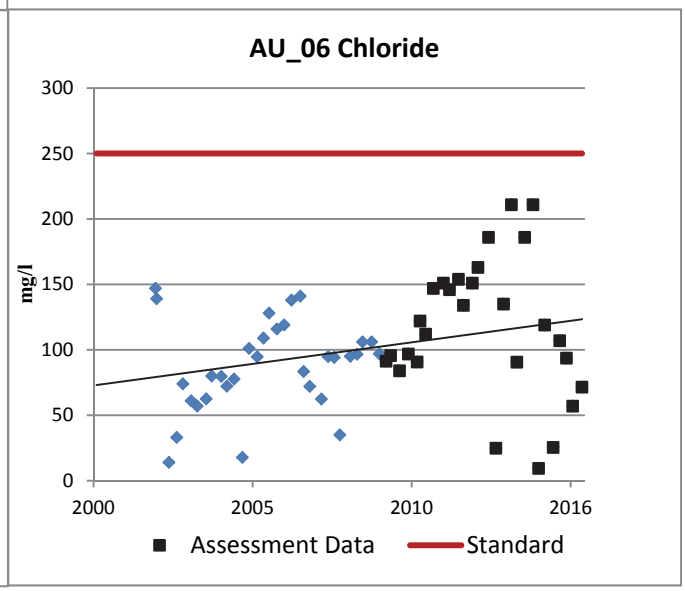
Sampling location for Station 13020 at the Live Oak / McMullen County Line

Chloride		Status	# samples	Min	Max	Average	ND	>250
AU_03	250 mg/l	FS	28	84.8	245	152	0	0
AU_06		FS	28	9.41	211	117	0	0



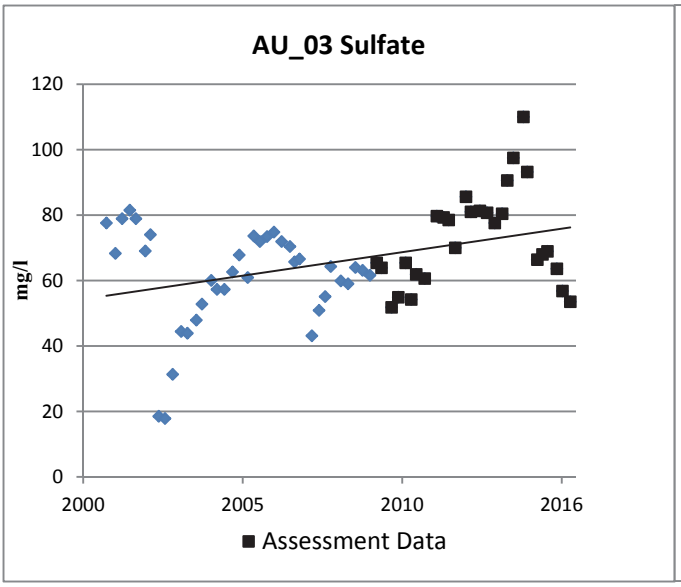
Trend analysis indicates increasing trends in chloride concentrations in AU_03 (t = 6.44, p = 0.000) and in AU_06 (t = 2.28, p = 0.026) over time and a decreasing trend in AU_03 (t = -15.45, p = 0.000) with respect to the lake level.

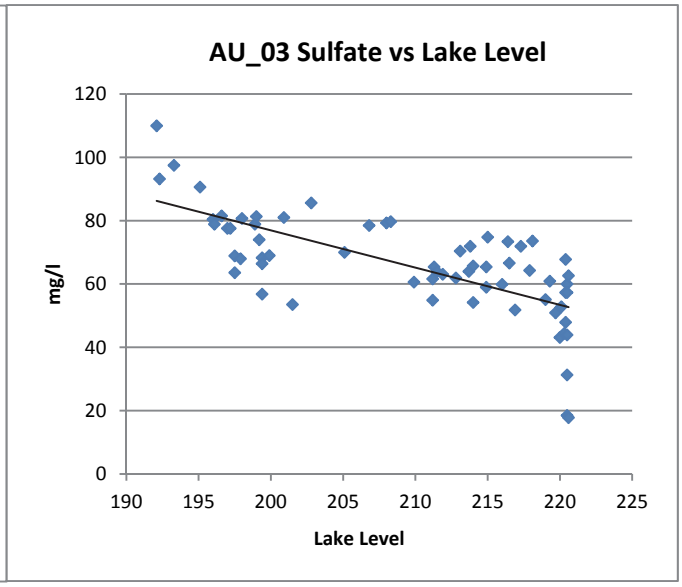




Sulfate		Status	# samples	Min	Max	Average	ND	>250
AU_03	250 mg/l	FS	28	51.8	110	72.9	0	0
AU_06		FS	28	26.5	111	66.7	0	0

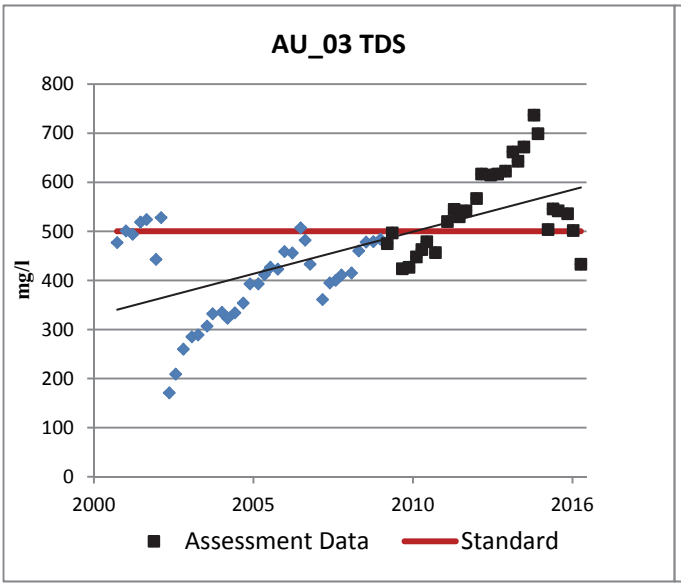
Trend analysis indicates an increasing trend in sulfate concentrations in AU_03 (t = 3.30, p = 0.002) and a decreasing trend in (t = -7.79, p = 0.000) with respect to the lake level. The concentrations are well below the standard.

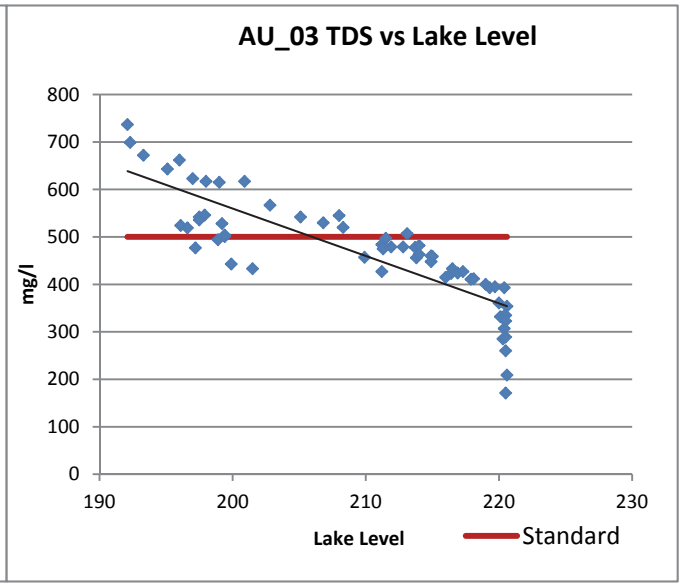




TDS		Status	# samples	Min	Max	Average	ND	>500
AU_03	500 mg/l	NS	28	424	737	547	0	19
AU_06		NS	30	179	819	496	0	12

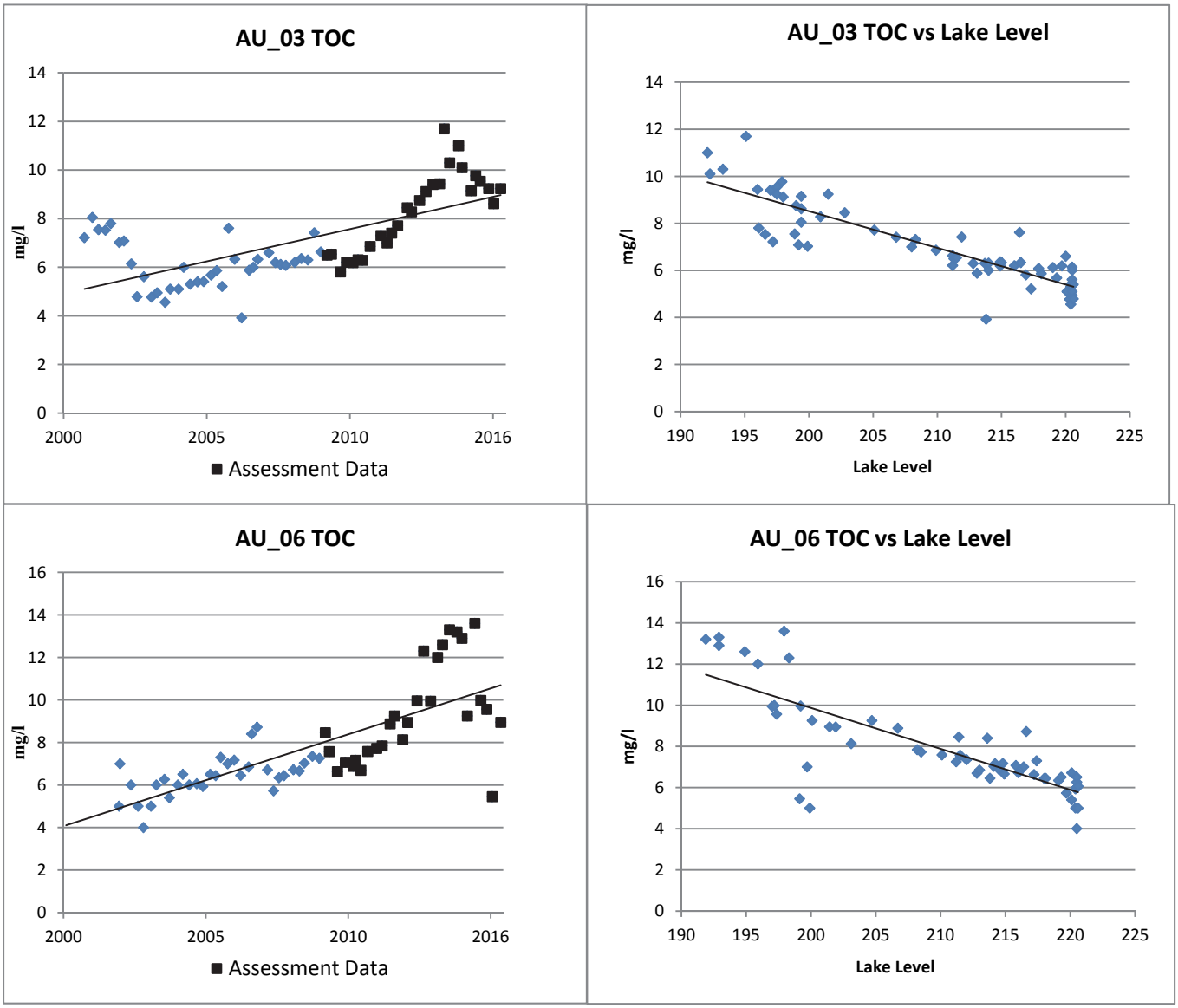
Trend analysis indicates an increasing trend in TDS concentrations in AU_03 (t = 6.83, p = 0.000) and a decreasing trend in (t = -12.50, p = 0.000) with respect to the lake level. The combined average is currently exceeding the standard, and will likely continue to do so until the reservoir receives significant inflow.





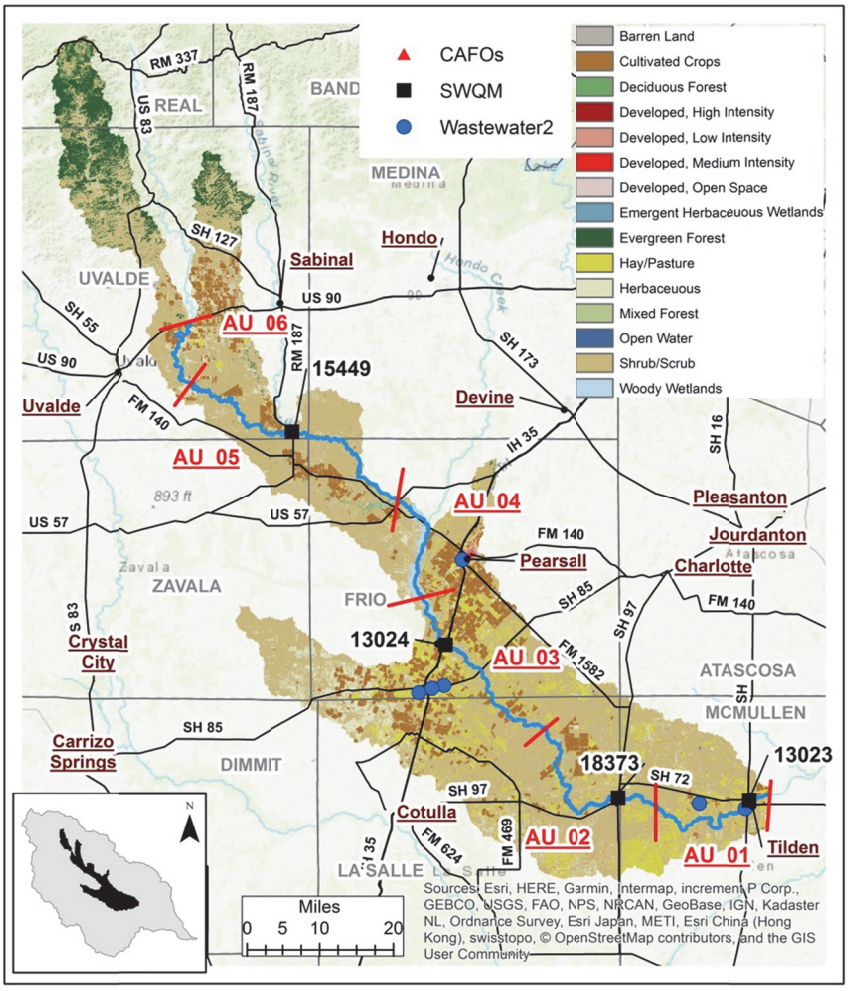
TOC		Status	# samples	Min	Max	Median
AU_03	mg/l	N/A	28	5.81	11.7	8.54
AU_06		N/A	28	5.45	13.6	8.94

Trend analysis indicates increasing trends in TOC concentrations in AU_03 (t = 7.23, p = 0.000) and in AU_06 (t = 8.76, p = 0.000) over time and decreasing trends in AU_03 (t = -14.81, p = 0.000) and in AU_06 (t = -2.98, p = 0.004) with respect to the lake level.



FRIO RIVER ABOVE CHOKE CANYON RESERVOIR – SEGMENT 2117

Segment 2117, Frio River above Choke Canyon Reservoir, flows 158 miles from 100m upstream of US 90 in Uvalde County to the confluence with Choke Canyon Reservoir in McMullen County. The segment is divided into six AUs. **AU_01** is from Choke Canyon Reservoir to the confluence with Esperanza Creek. **AU_02** is from the confluence with Esperanza Creek to the confluence with Ruiz Creek. **AU_03** is from the confluence with Ruiz Creek to the confluence with Live Oak Creek. **AU_04** is from the confluence with Live Oak Creek to the confluence with Elm Creek. **AU_05** is from the confluence with Elm Creek to the confluence with Spring Branch. **AU_06** is from the confluence with Spring Branch to the upper end of the segment. Its watershed is 1,161,405 acres.

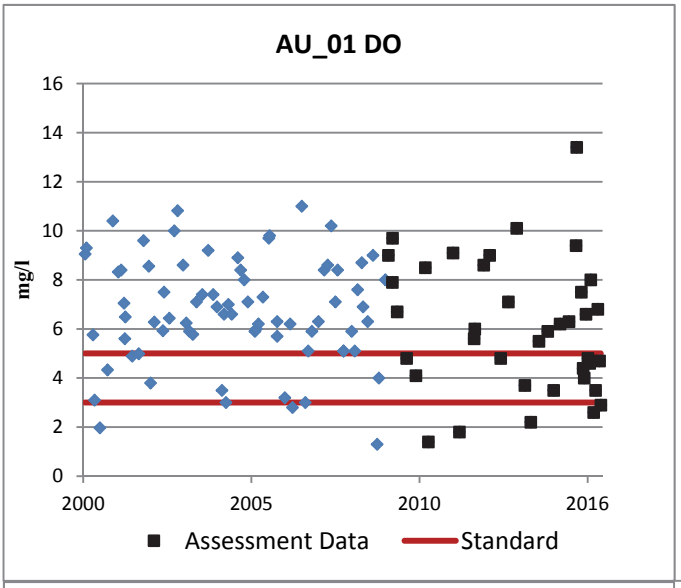


Water Quality Analysis

The analysis for AU_01 is based on data from **Station 13023** at SH 16. The analysis for AU_02 is based on data from **Station 18373** at SH 97. The analysis for AU_03 is based on data from **Station 13024** at IH 35. There is a maximum of six samples during the assessment period in this AU. This is an insufficient number for a statistically valid analysis, but the data are shown below for informational purposes. The analysis for AU_05 is based on data from **Station 15449** at FM 87 eight miles south of Sabinal. There are no sampling stations in AU_04 or AU_06.

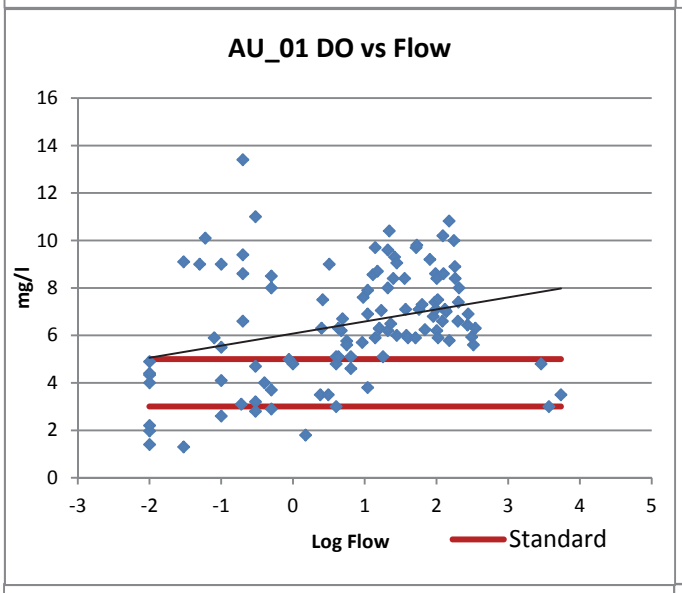
Aquatic Life Use Assessment

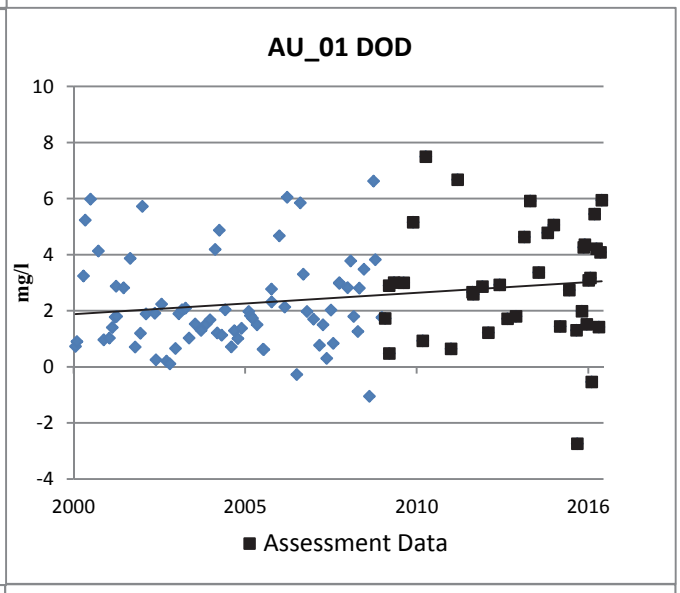
DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	38	1.4	13.4	6.0	5	16
	Screening Level 5.0 mg/l	CS						
AU_02	Minimum 3.0 mg/l	FS	22	3.1	15.0	5.6	0	0
	Screening Level 5.0 mg/l	CS						
AU_03	Minimum 3.0 mg/l	FS	6	1.1	6.8	4.0	2	5
	Screening Level 5.0 mg/l	CS						
AU_05	Minimum 3.0 mg/l	FS	10	8.1	11.6	9.8	0	0
	Screening Level 5.0 mg/l	NC						

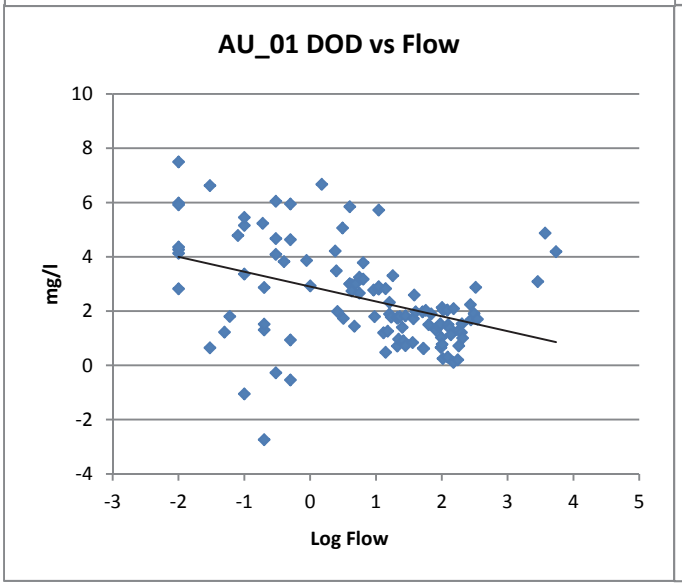


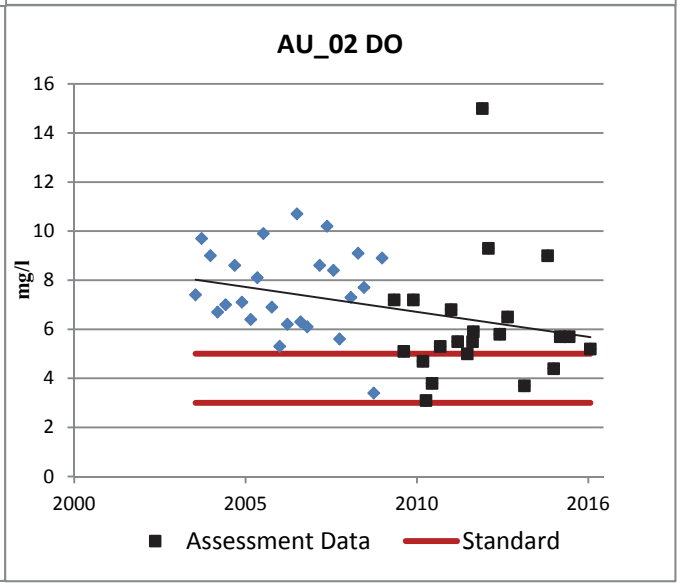
AU_01, AU_02, and AU_03 have been assessed as having concerns for low DO at the grab screening level. Trend analysis indicates decreasing trends in the DO levels in AU_02 (t = -2.12, p = 0.039) and in AU_03 (t = -4.57, p = 0.000) over time. There is also an increasing trend in AU_01 (t = 2.44, p = 0.016) with respect to flow. When enough flow exists in the river, 24-Hr DO measurements will be taken to more fully evaluate this concern.

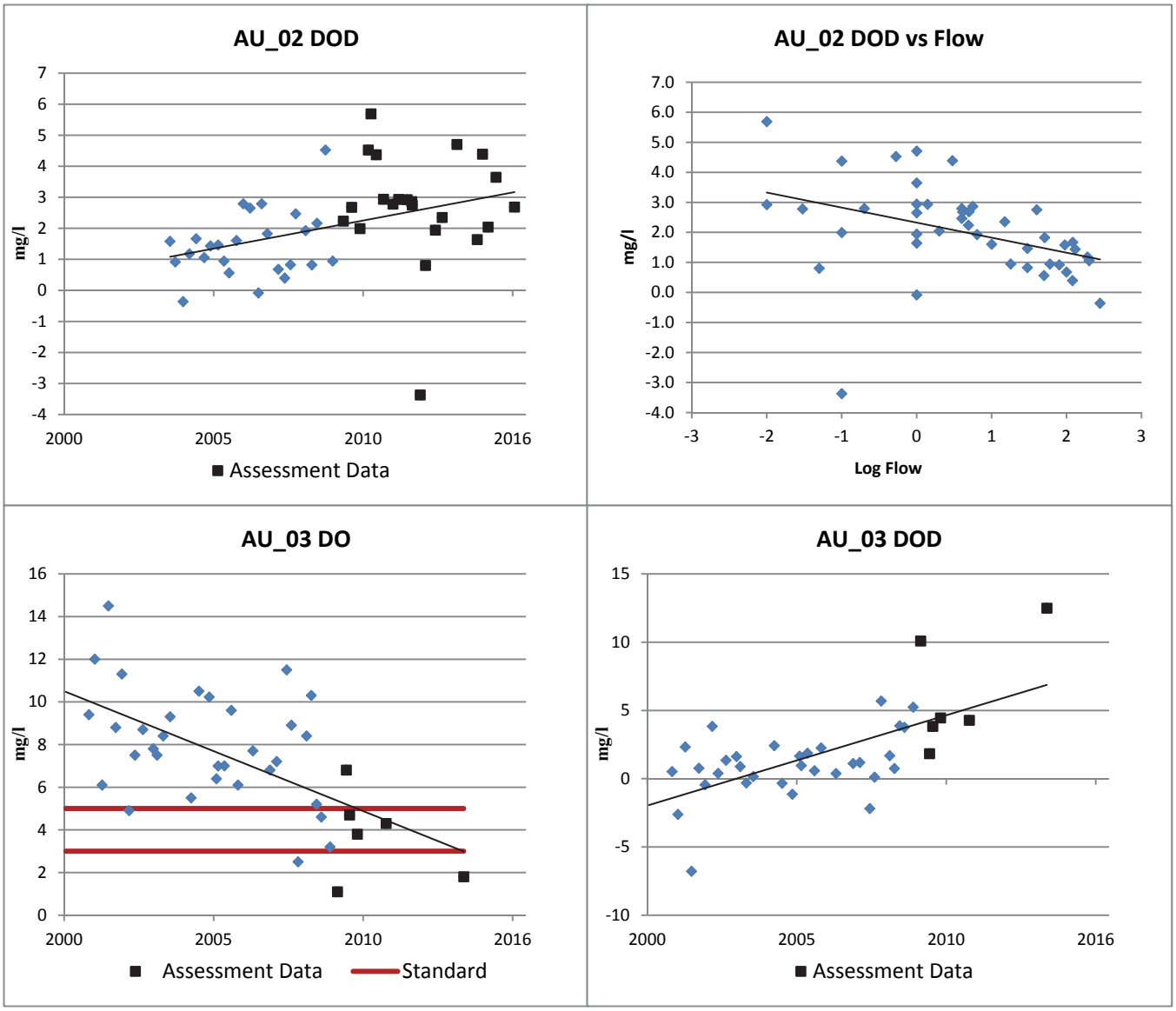
Trend analysis indicates increasing trends in DOD in AU_01 (t = 2.11, p = 0.037), in AU_02 (t = 2.77, p = 0.008), and in AU_03 (t = 5.09, p = 0.000) over time. Decreasing trends are indicated in AU_01 (t = -4.54, p = 0.000) and in AU_02 (t = -2.43, p = 0.019) with respect to flow.







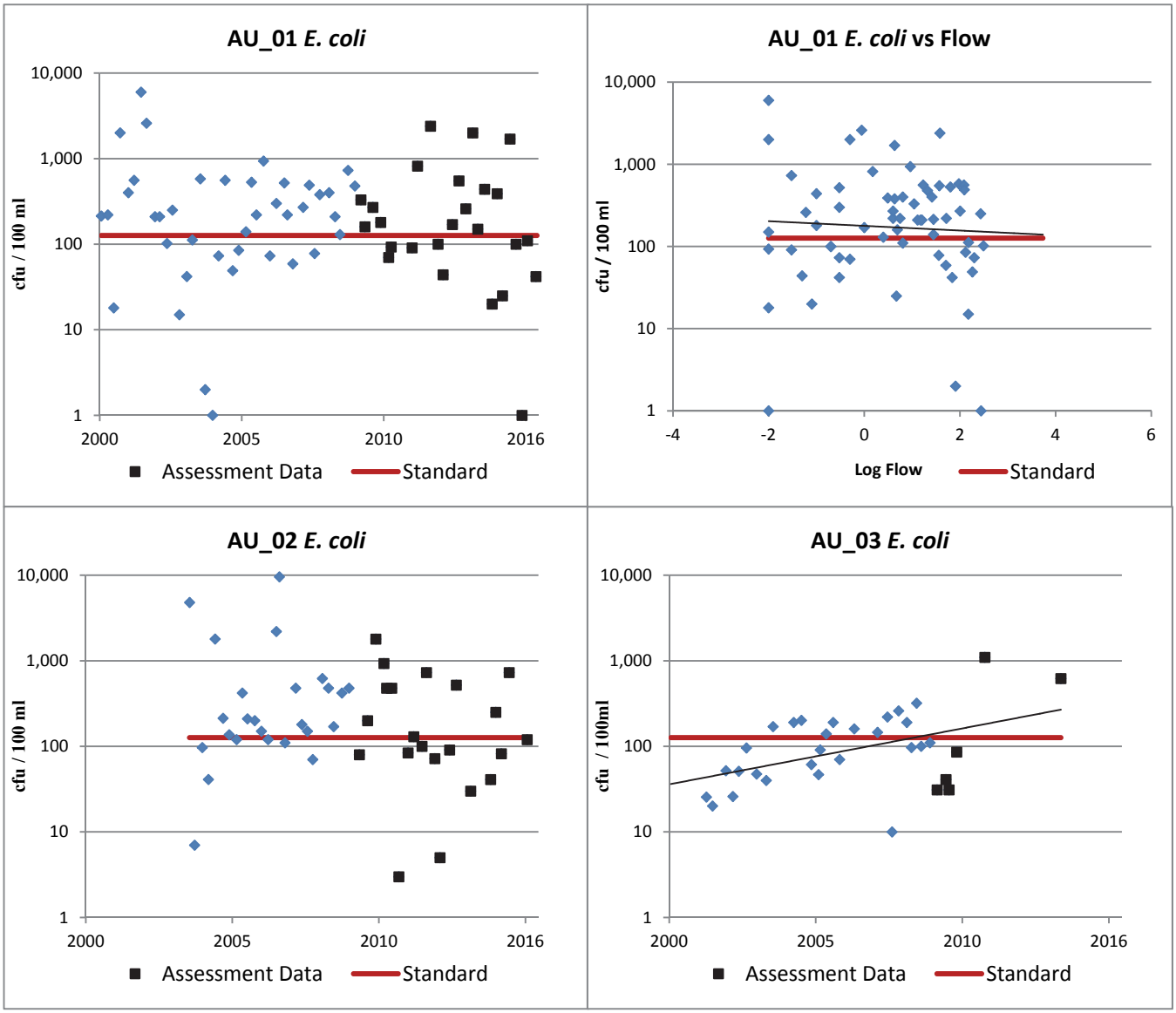




Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	25	<1	2400	155.8	1	14
AU_02		NS	21	3	1800	135.1	0	10
AU_03		NC	6	31	1100	115.0	0	2
AU_05		NC	10	<1	150	4.69	6	1

AU_01 and AU_02 are listed as being impaired for bacteria for contact recreation. Trend analysis indicates an increasing trend in AU_03 (t = 2.77, p = 0.009) over time and may exceed the standard if the trend continues. Trend analysis also indicates a decreasing trend in AU_01 (t = -2.59, p = 0.011) with respect to flow.



General Use

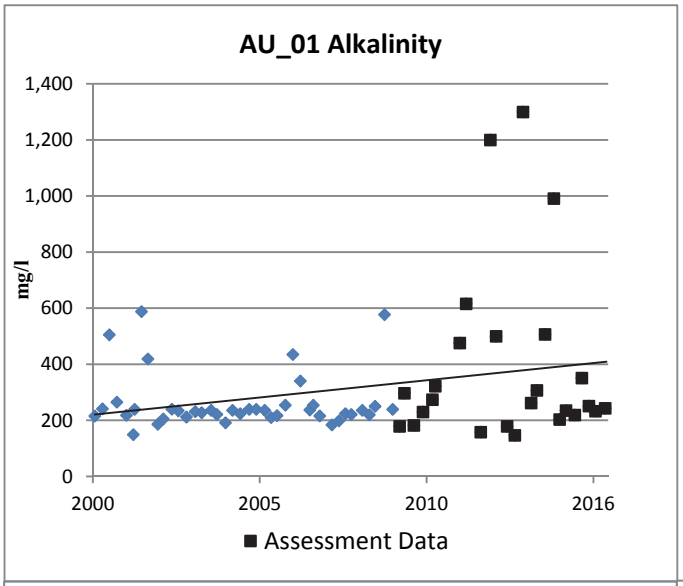
Water Temperature		Status	# samples	Min	Max	Median	>32.2
AU_01	32.2 °C	FS	39	7.0	32.0	21.7	0
AU_02		FS	22	8.0	29.6	22.4	0
AU_03		FS	5	9.7	25.6	23.3	0
AU_05		FS	10	12.8	31.6	21.0	0

Trend analysis did not indicate any trends in water temperature any of the AUs over time or with respect to flow.

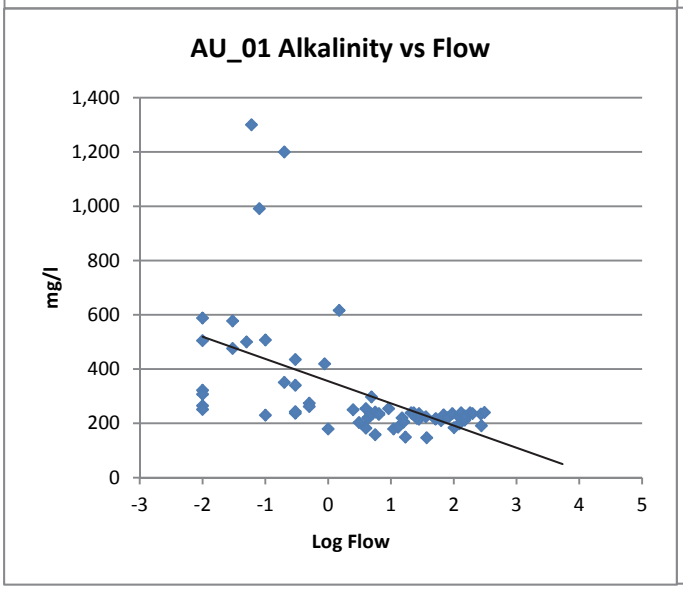
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	39	7.5	9.0	7.9	0	0
AU_02		FS	22	7.1	9.2	5.6	0	1
AU_03		FS	6	7.4	9.1	7.8	0	0
AU_05		FS	10	7.3	7.9	7.6	0	0

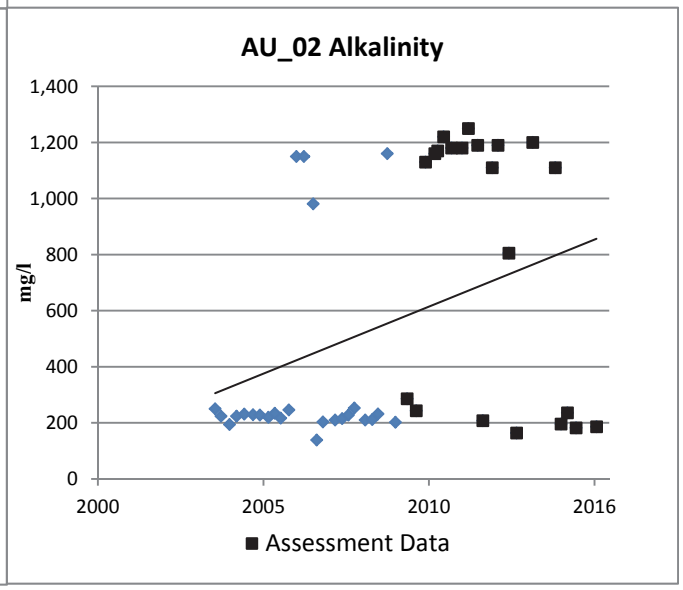
Trend analysis did not indicate any trends in pH levels any of the AUs over time or with respect to flow.

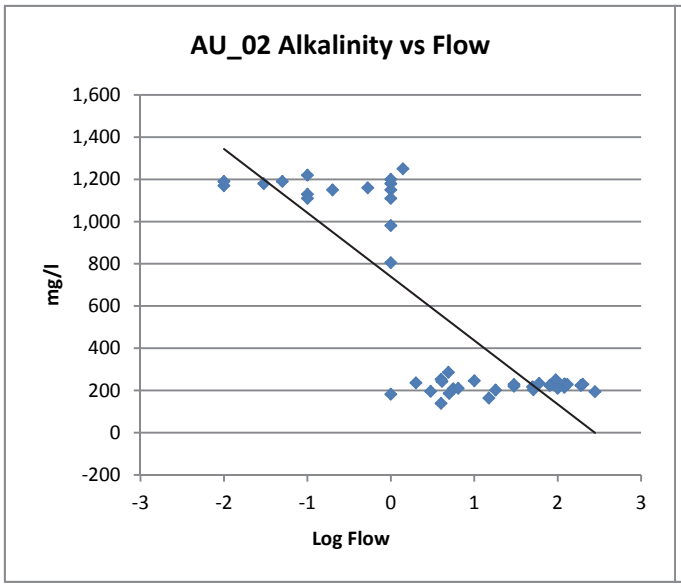
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	147	1300	262
AU_02		N/A	21	164	1250	1110
AU_03		N/A	6	125	238	172
AU_05		N/A	10	163	254	210

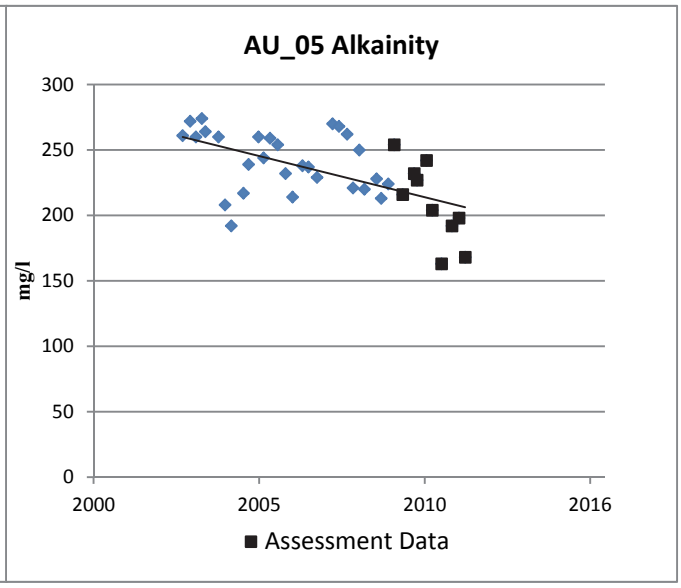


Trend analysis indicates increasing trends in alkalinity in AU_01 (t = 2.14, p = 0.036) and in AU_02 (t = 2.46, p = 0.018) over time. These two AUs are the lower reaches of the segment below several WWTP discharges. There is a decreasing trend in AU_05 (t = -4.26, p = 0.000) over time. This AU is above any WWTP discharges. Trend analysis also indicates decreasing trends in AU_01 (t = -5.41, p = 0.000) and in AU_02 (t = -6.11, p = 0.000) with respect to flow.



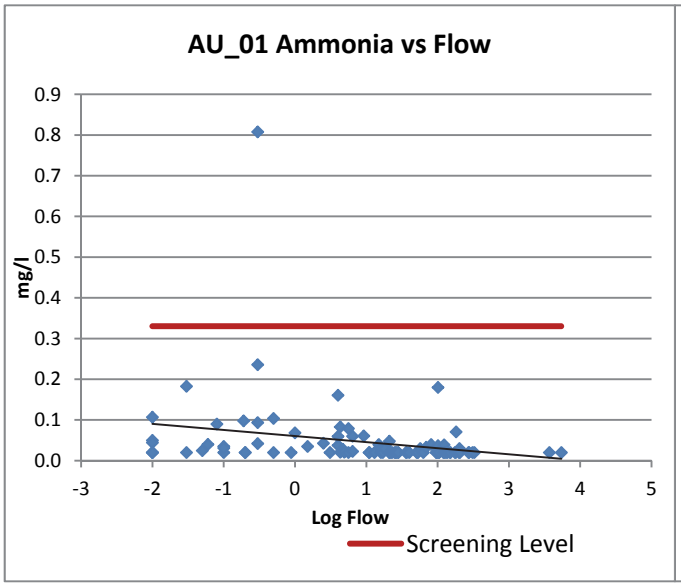


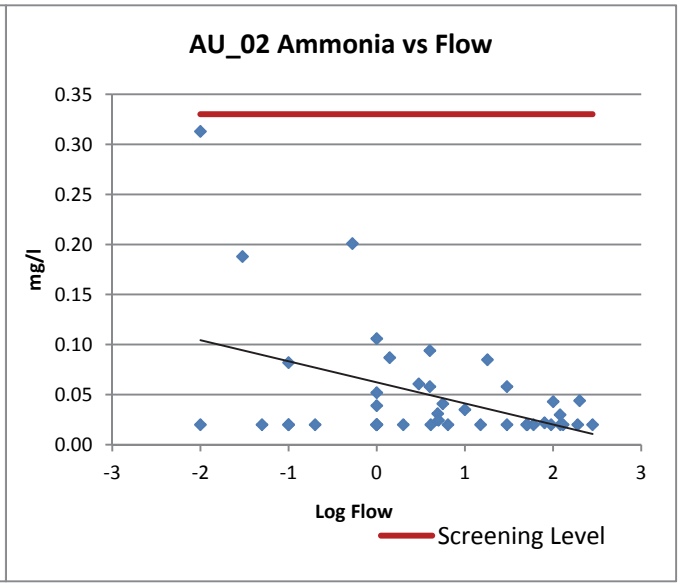




Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	25	<0.02	0.107	0.031	8	0
AU_02		NC	21	<0.02	0.419	0.02	11	3
AU_03		NC	6	<0.05	0.29	0.06	2	0
AU_05		NC	10	<0.05	<0.05	0.05	10	0

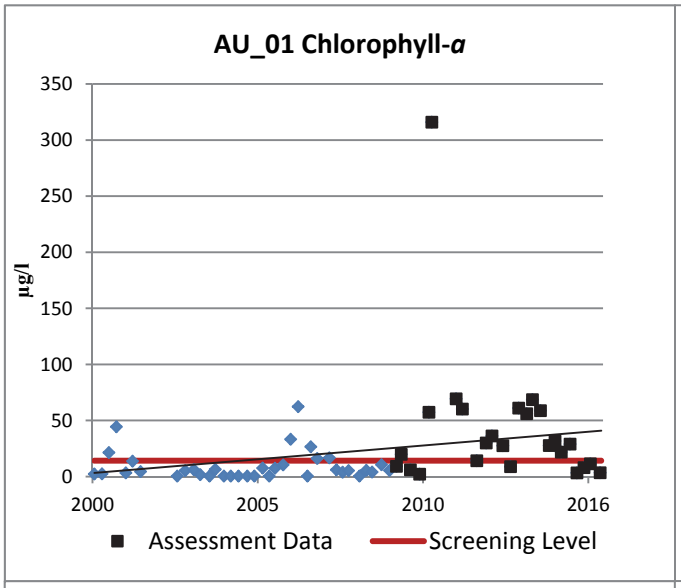
Trend analysis indicates decreasing trends in AU_01 (t = -2.03, p = 0.045) and in AU_02 (t = -2.93, p = 0.005) with respect to flow.

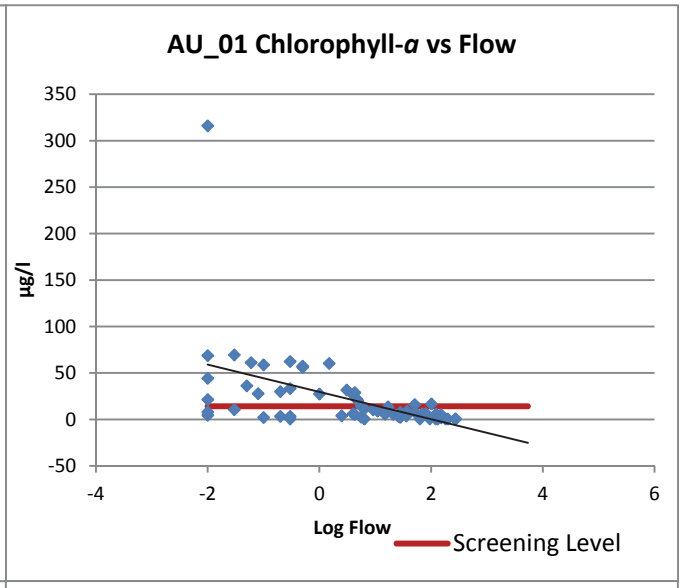


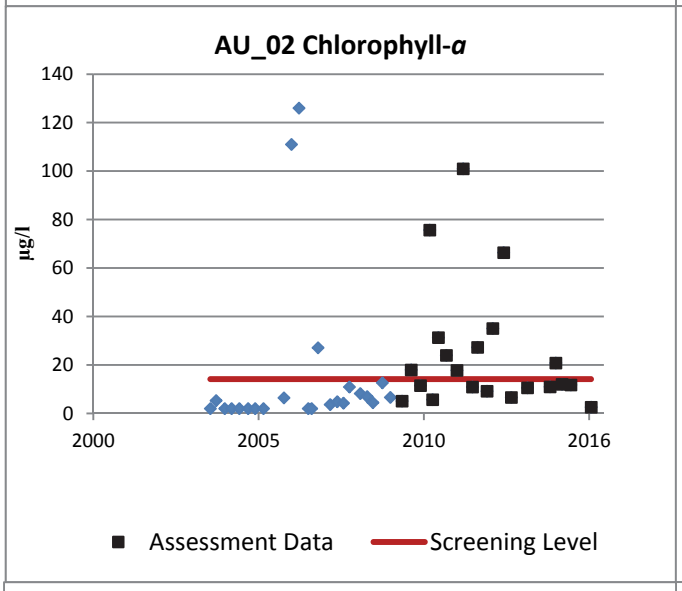


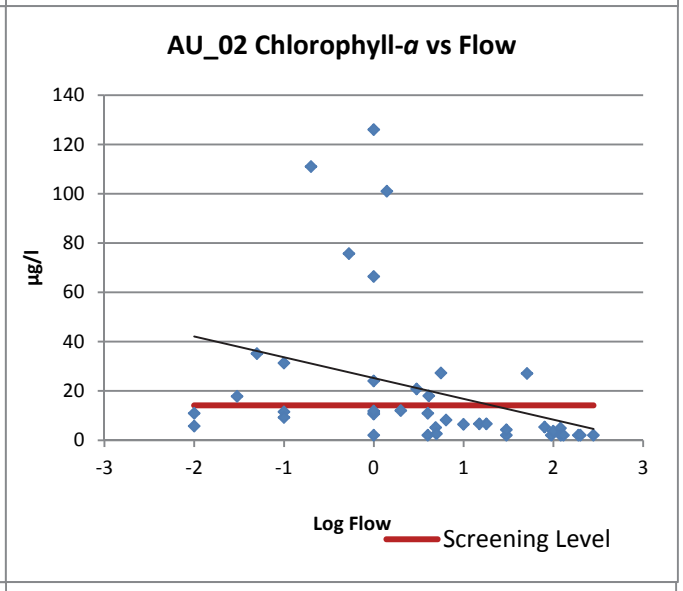
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	25	2.2	316	27.7	0	17
AU_02		CS	21	2.61	101	12	0	10
AU_03		CS	6	1.26	33.7	18.3	0	4
AU_05		NC	4	<10	<10	10	0	0

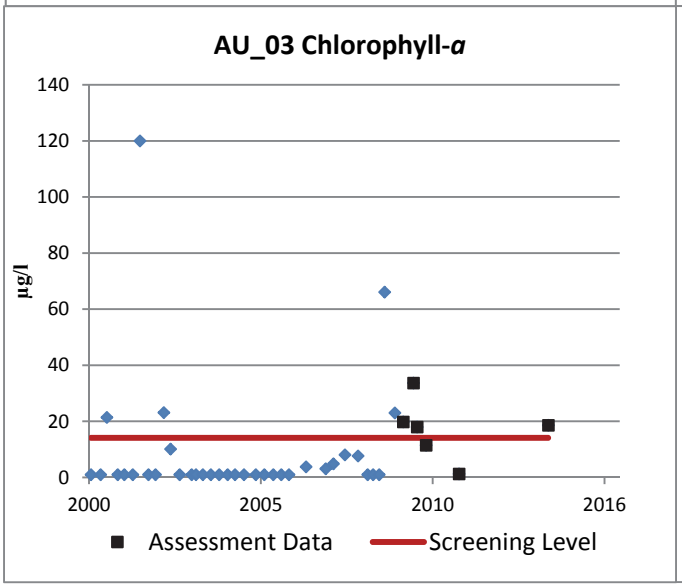
AU_01, AU_02, and AU_03 have been assessed as having concerns for chlorophyll-*a*. Trend analysis indicates decreasing trends in AU_01 (t = -4.99, p = 0.000), in AU_02 (t = -2.35, p = 0.023), and in AU_03 (t = -2.95, p = 0.005) with respect to flow.

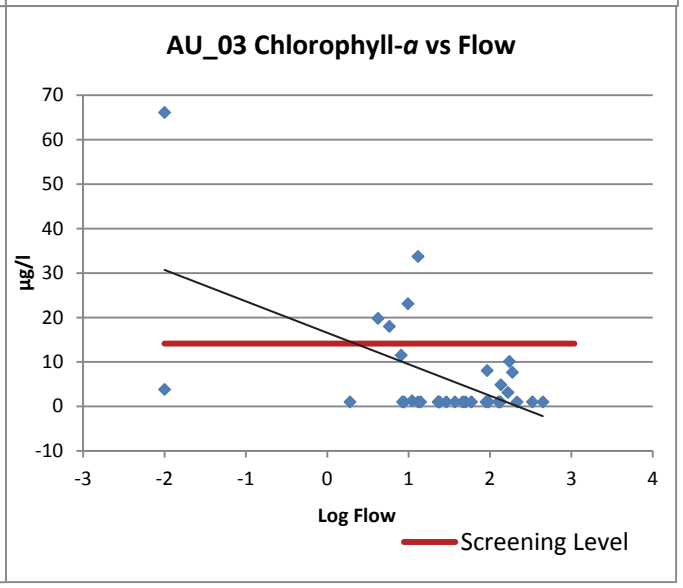

AU_01 Chlorophyll-a
µg/l
350
300
250
200
150
100
50
0
2000
2005
2010
2016
Assessment Data
Screening Level


AU_01 Chlorophyll-a vs Flow
µg/l
350
300
250
200
150
100
50
0
-50
-4
-2
0
2
4
6
Log Flow
Screening Level

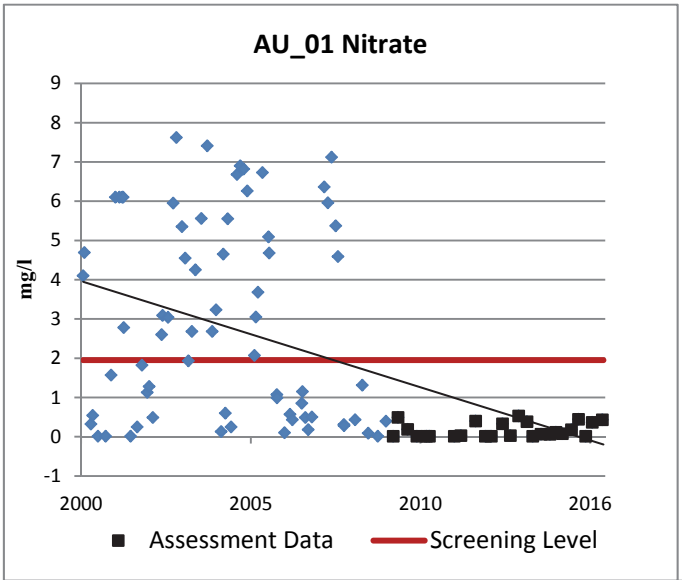

AU_02 Chlorophyll-a
µg/l
140
120
100
80
60
40
20
0
2000
2005
2010
2016
Assessment Data
Screening Level


AU_02 Chlorophyll-a vs Flow
µg/l
140
120
100
80
60
40
20
0
-3
-2
-1
0
1
2
3
Log Flow
Screening Level

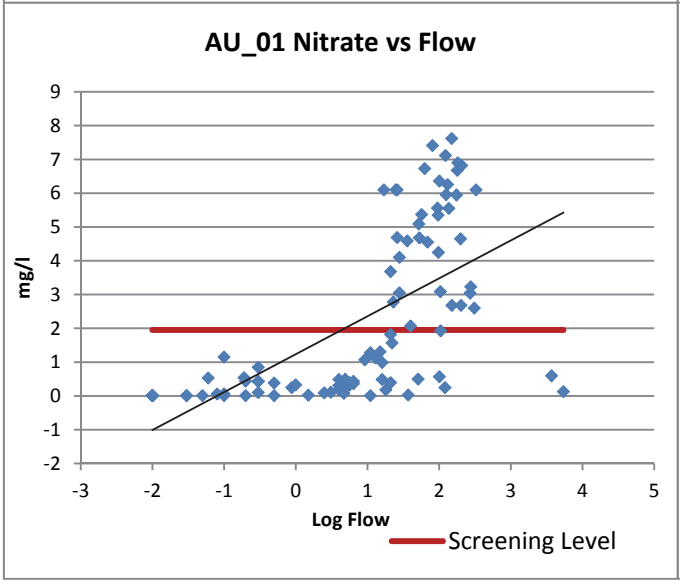

AU_03 Chlorophyll-a
µg/l
140
120
100
80
60
40
20
0
2000
2005
2010
2016
Assessment Data
Screening Level

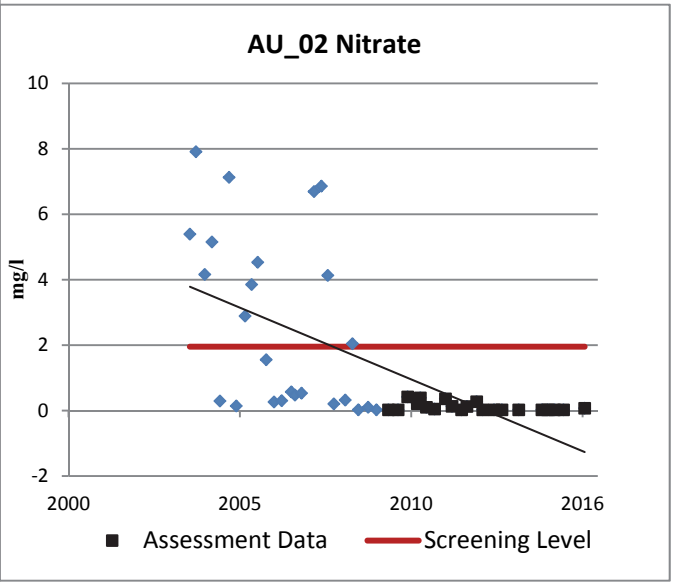

AU_03 Chlorophyll-a vs Flow
µg/l
70
60
50
40
30
20
10
0
-10
-3
-2
-1
0
1
2
3
4
Log Flow
Screening Level

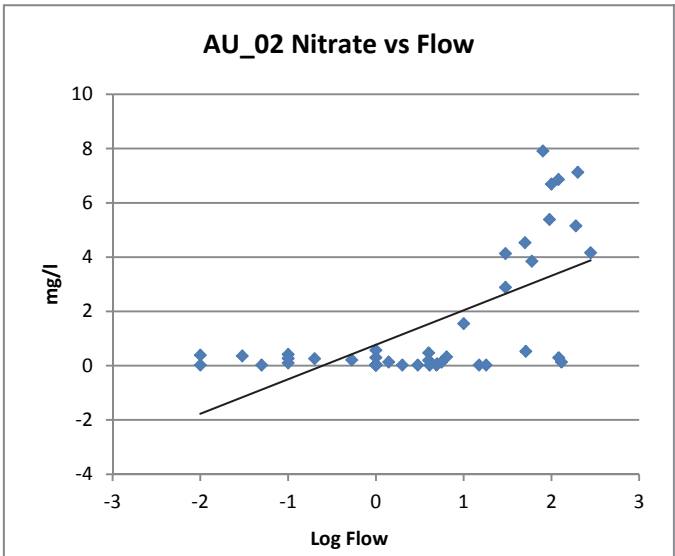
Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	25	<0.02	0.107	0.031	8	0
AU_02		NC	21	<0.02	0.419	0.02	11	3
AU_03		CS	6	<0.04	1.89	0.295	2	0
AU_05		CS	10	<0.05	<0.05	0.05	10	0

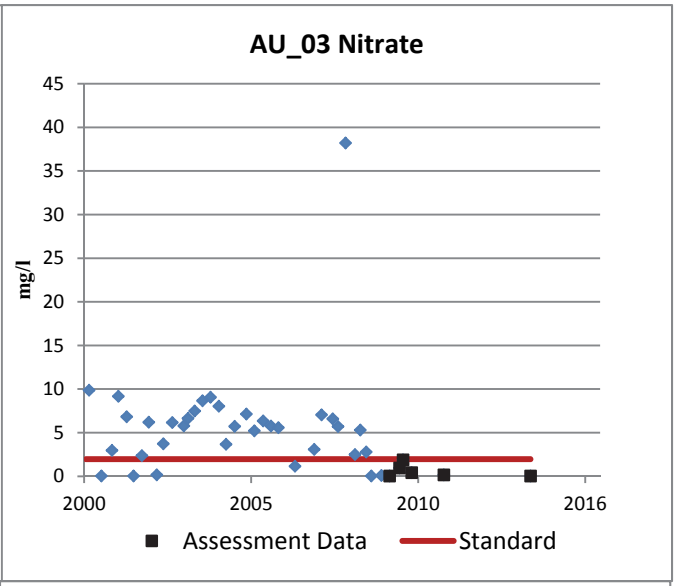


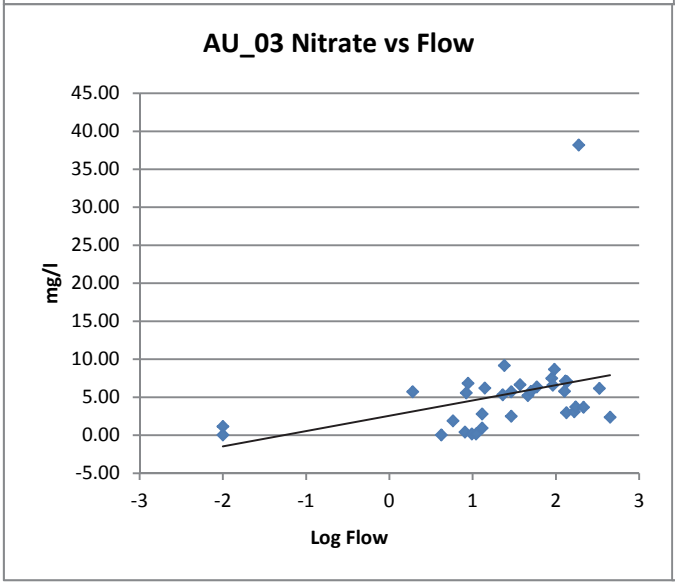
AU_03, AU_04, and AU_05 have been assessed as having concerns for nitrate. Even though there is no data in AU_04, it is included in the concern because of the AUs on either side. It is apparent in the AU_01 and AU_02 graphs that a significant change occurred in 2008 to reduce nitrate levels in the lower reaches of the river, most likely associated with changes in WWTP discharges. Because of this, the trend analysis indicates decreasing trends in AU_01 (t = -5.13, p = 0.000) and in AU_02 (t = -5.21, p = 0.000) over time. Trend analysis also indicates increasing trends in AU_01 (t = 7.02, p = 0.000), in AU_02 (t = 4.16, p = 0.000) and in AU_03 (t = 2.14, p = 0.037) with respect to flow.

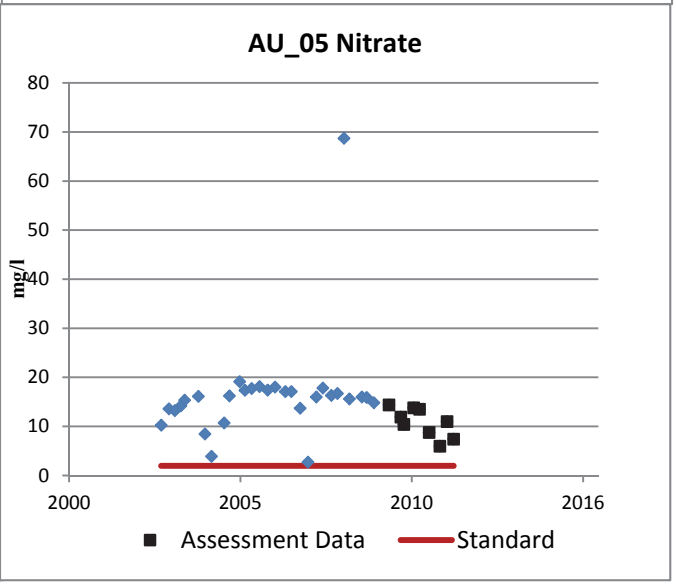










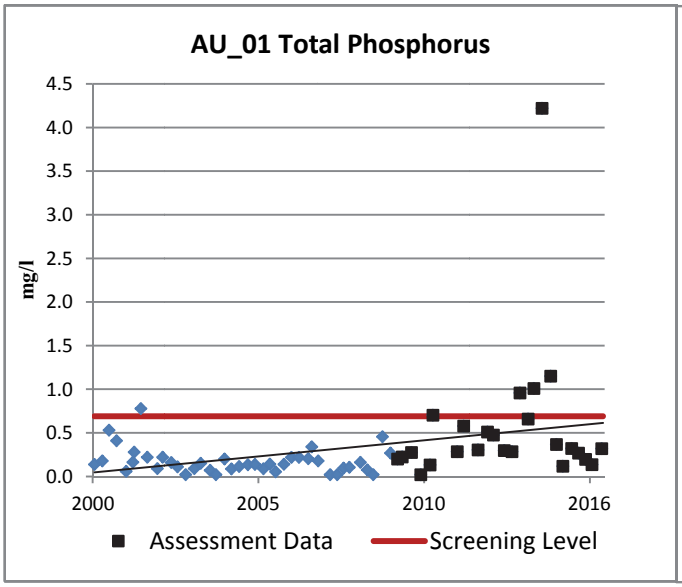


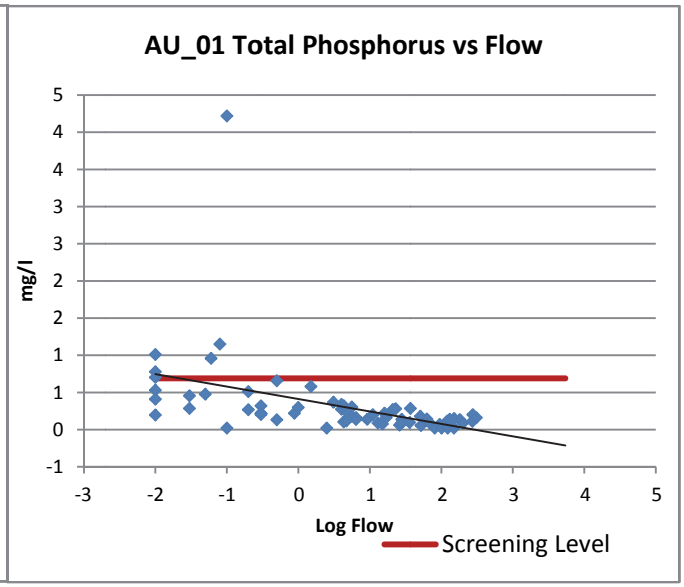
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	0.85	3.11	1.89
AU_02		N/A	15	0.46	4.2	1.42
AU_03		N/A	5	0.56	0.9	0.75
AU_05		N/A	9	<0.05	0.38	0.25

Trend analysis did not indicate any trends in TKN concentrations in AU_03 or AU_05 over time or with respect to flow. There was insufficient data for trend analysis in AU_01 and AU_02.

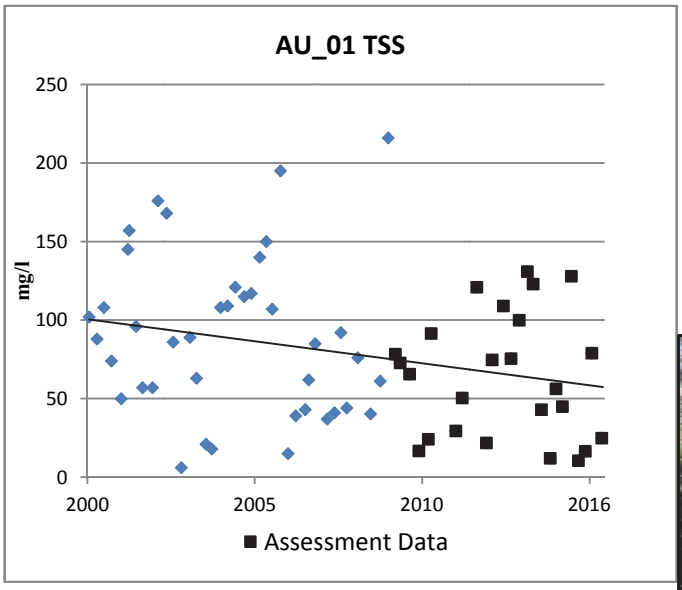
Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	25	<0.02	4.22	0.30	1	5
AU_02		NC	21	<0.04	0.49	0.17	1	0
AU-03		NC	4	<0.05	0.15	0.06	1	0
AU_05		NC	10	<0.02	0.03	0.02	8	0

There are currently no concerns for total phosphorus assessed on this segment. However, 20% of the more recent measurements exceed the standard in AU_01. Trend analysis also indicates an increasing trend in AU_01 ($t = 2.56$, $p = 0.013$) over time and decreasing trend ($t = -4.53$, $p = 0.000$) with respect to flow.



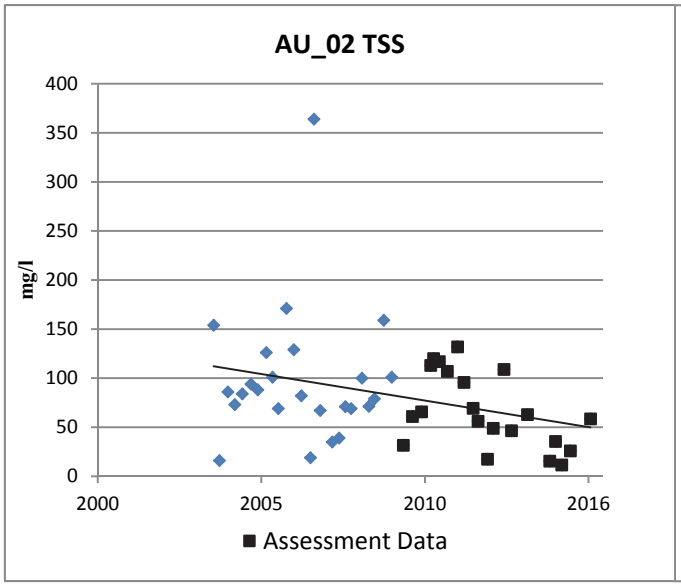


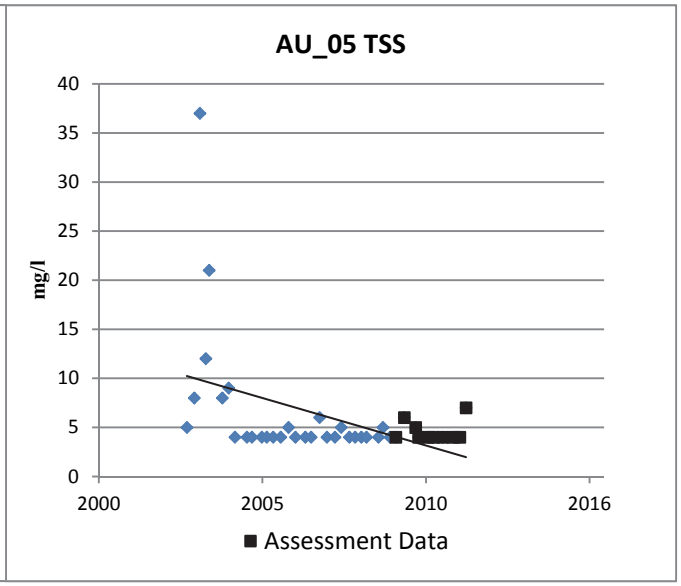
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	10.5	131	65.6
AU_02		N/A	21	11.6	132	61
AU_03		N/A	6	5	27	12
AU_05		N/A	10	4	7	4



Trend analysis indicates decreasing trends in TSS concentrations in AU_01 (t = -2.22, p = 0.030), in AU_02 (t = -2.14, p = 0.037), and in AU_05 (t = -2.80, p = 0.008) over time.

Sampling location for Station 13023 at SH 16

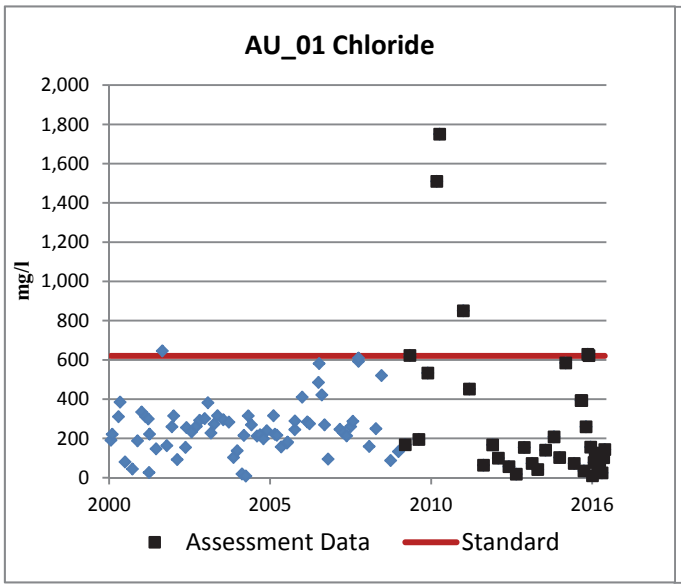


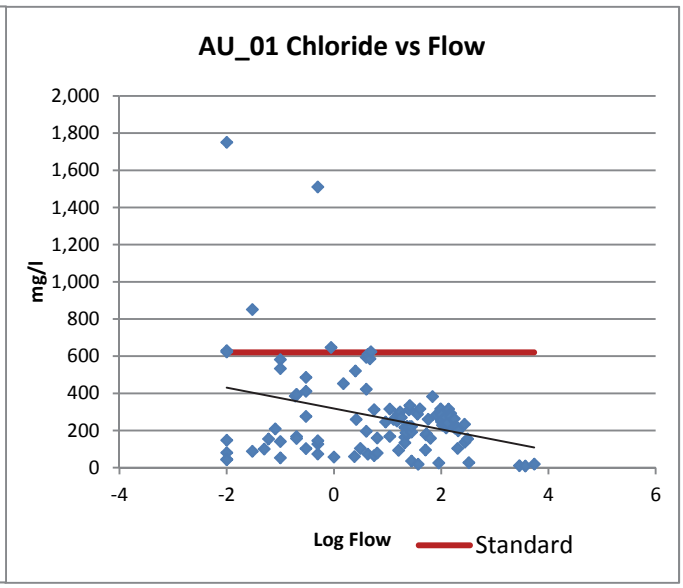


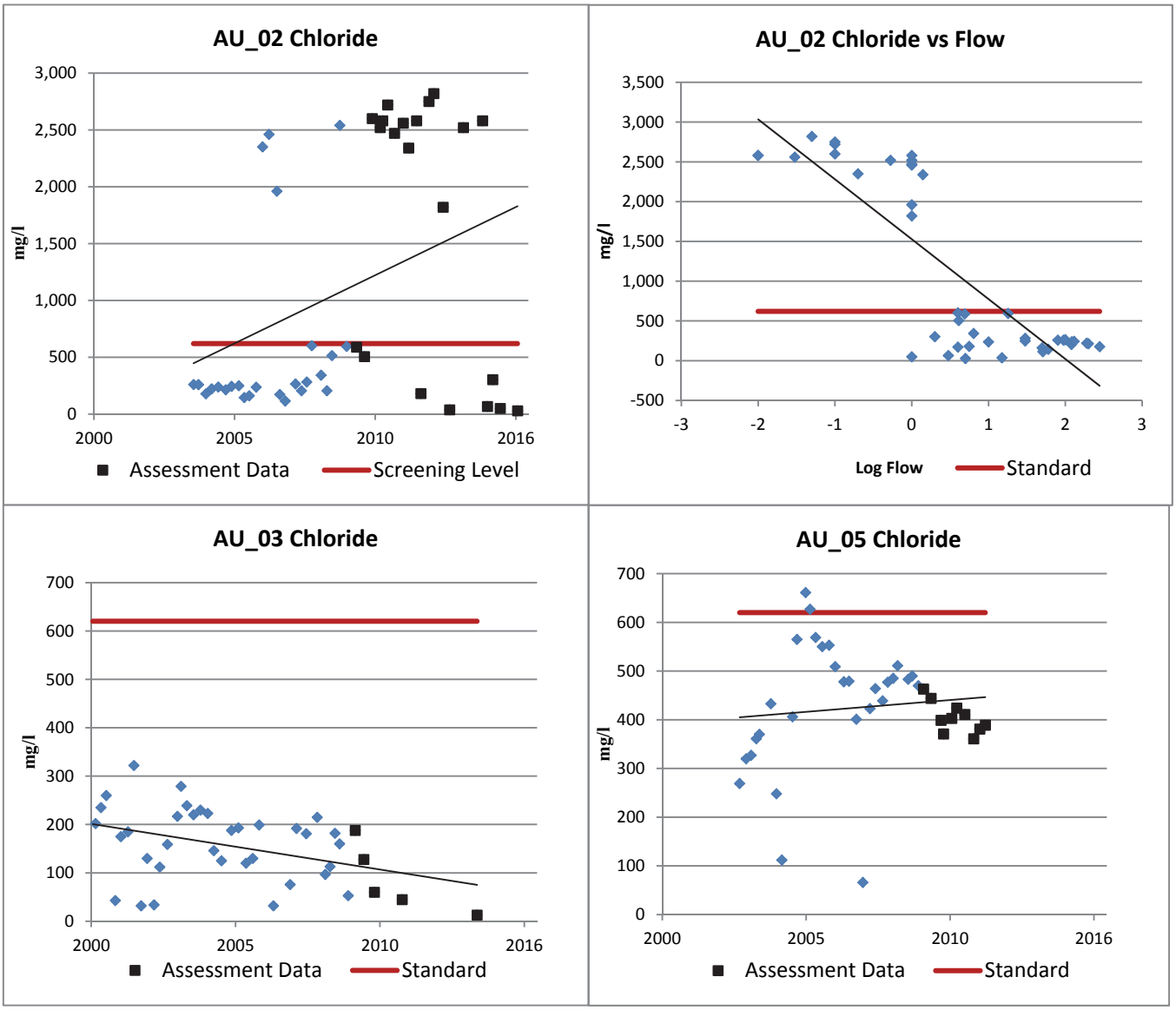
Chloride		Status	# samples	Min			Max	Average	ND	>620
AU_01	620 mg/l	NS	36	9.62			1750	304	0	6
AU_02		NS	21	28.6			2820	1648	0	13
AU_03		NS	5	13	188		86.8	0	0	
AU_05		NS	10	361	463		405	0	0	

Since chloride is assessed over the entire segment, all AUs are listed as being impaired for this parameter. Individually, AU_02 is the only AU currently exceeding the standard. The highest values were recorded during low flow and the more active period of the Eagle Ford Shale oil and gas operations. They appear to have returned to normal levels.

Trend analysis indicates decreasing trends in chloride concentrations in AU_01 (t = -3.28, p = 0.001) and in AU_02 (t = -6.68, p = 0.000) with respect to flow. Trend analysis also indicates increasing trends in AU_02 (t = 2.55, p = 0.014) and in AU_03 (t = 2.76, p = 0.009) over time.

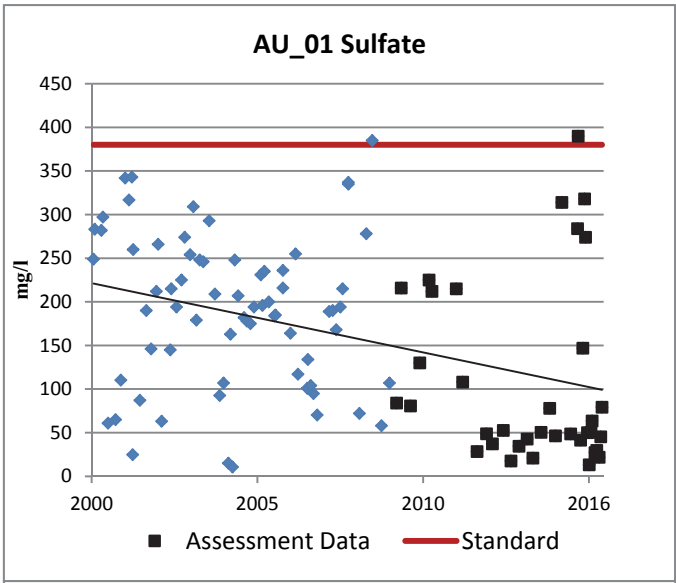


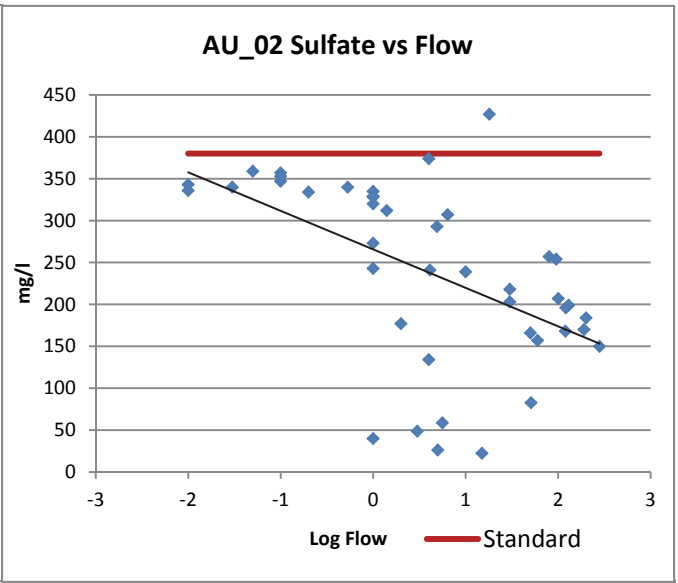


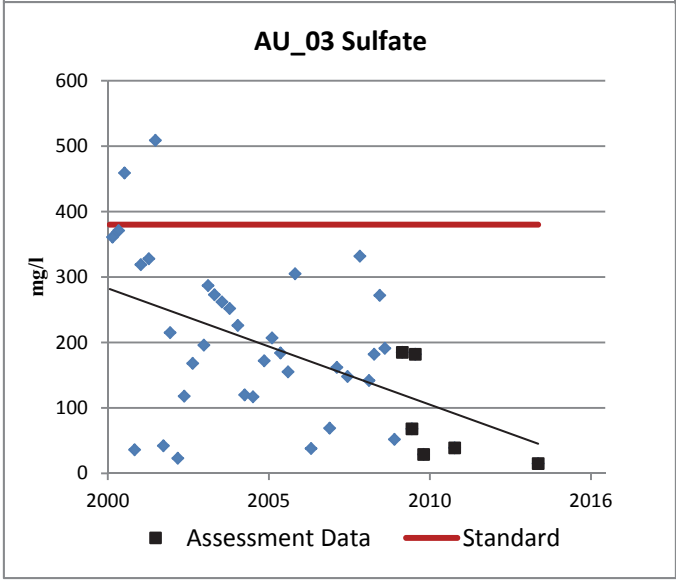


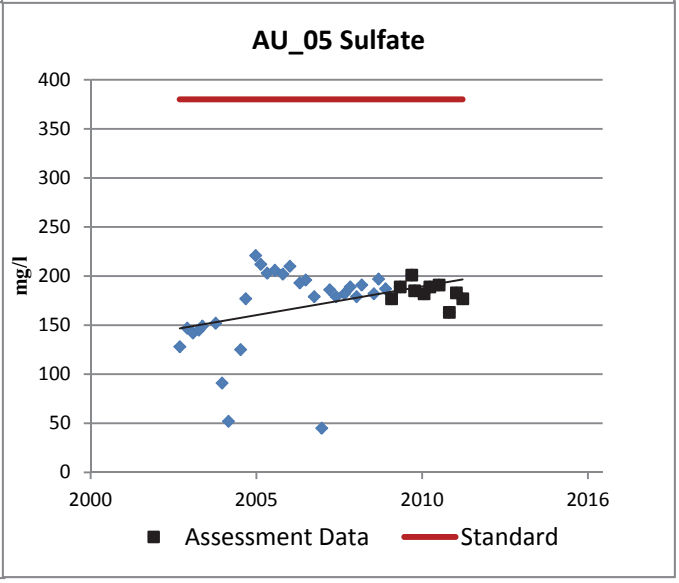
Sulfate		Status	# samples	Min	Max	Average	ND	>380
AU_01	380 mg/l	FS	36	13.3	390	109	0	1
AU_02		FS	21	22.4	359	248	0	0
AU_03		FS	6	15	185	86.3	0	0
AU_05		FS	10	163	201	184	0	0

Trend analysis indicates decreasing trends in sulfate concentrations in AU_01 (t = -4.22, p = 0.000) and in AU_03 (t = -3.53, p = 0.001), and an increasing trend in AU_05 (t = 2.52, p = 0.016) over time. The measurements in AU_05 are well below the standard. Trend analysis also indicates a decreasing trend in AU_02 (t = -2.96, p = 0.005) with respect to flow.





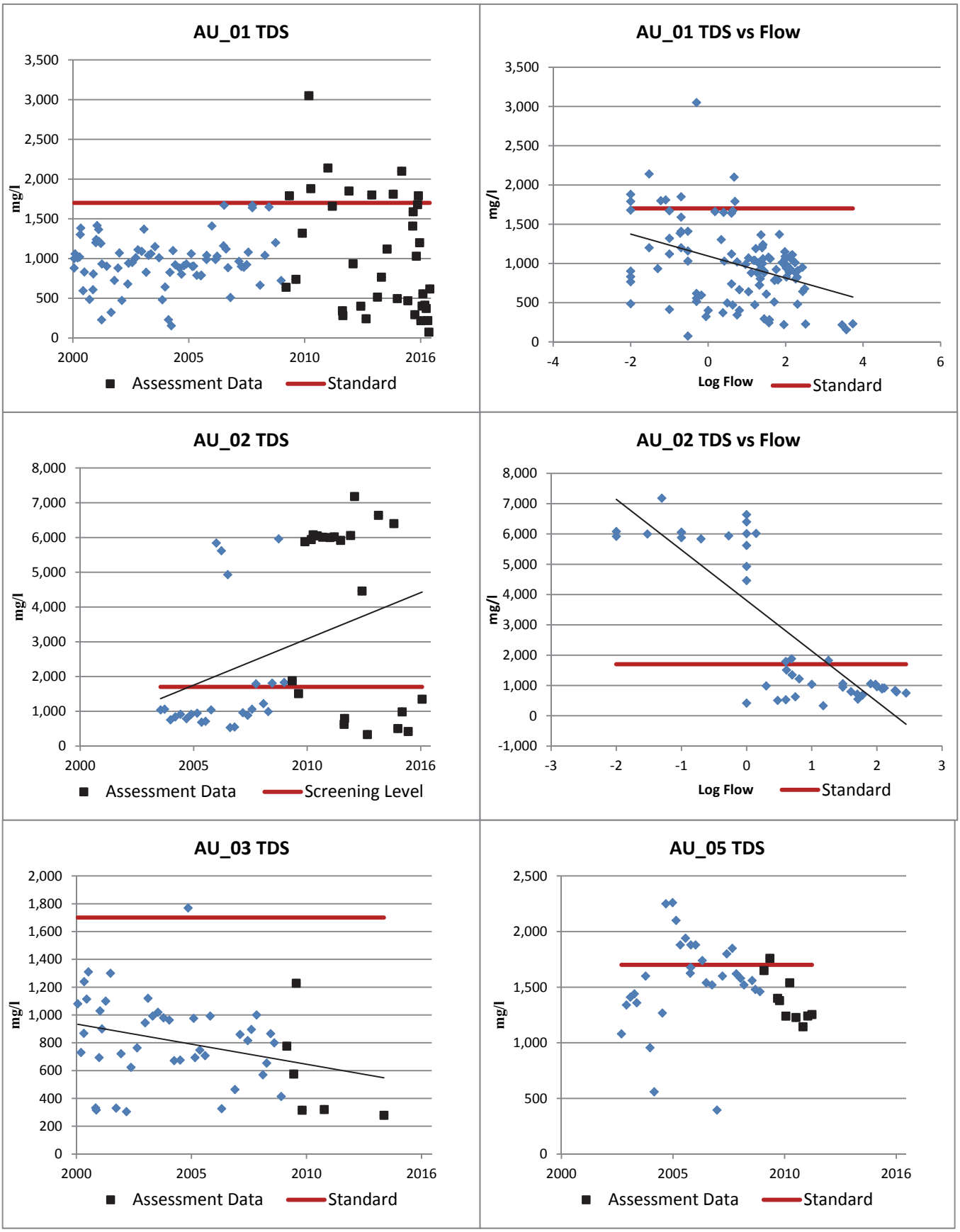




TDS		Status	# samples	Min	Max	Average	ND	>1700
AU_01	1700 mg/l	NS	37	74	3050	1033	0	9
AU_02		NS	22	333	7180	3957	0	14
AU_03		NS	6	279	1228	582	0	0
AU_05		NS	10	1144	1760	1384	0	1

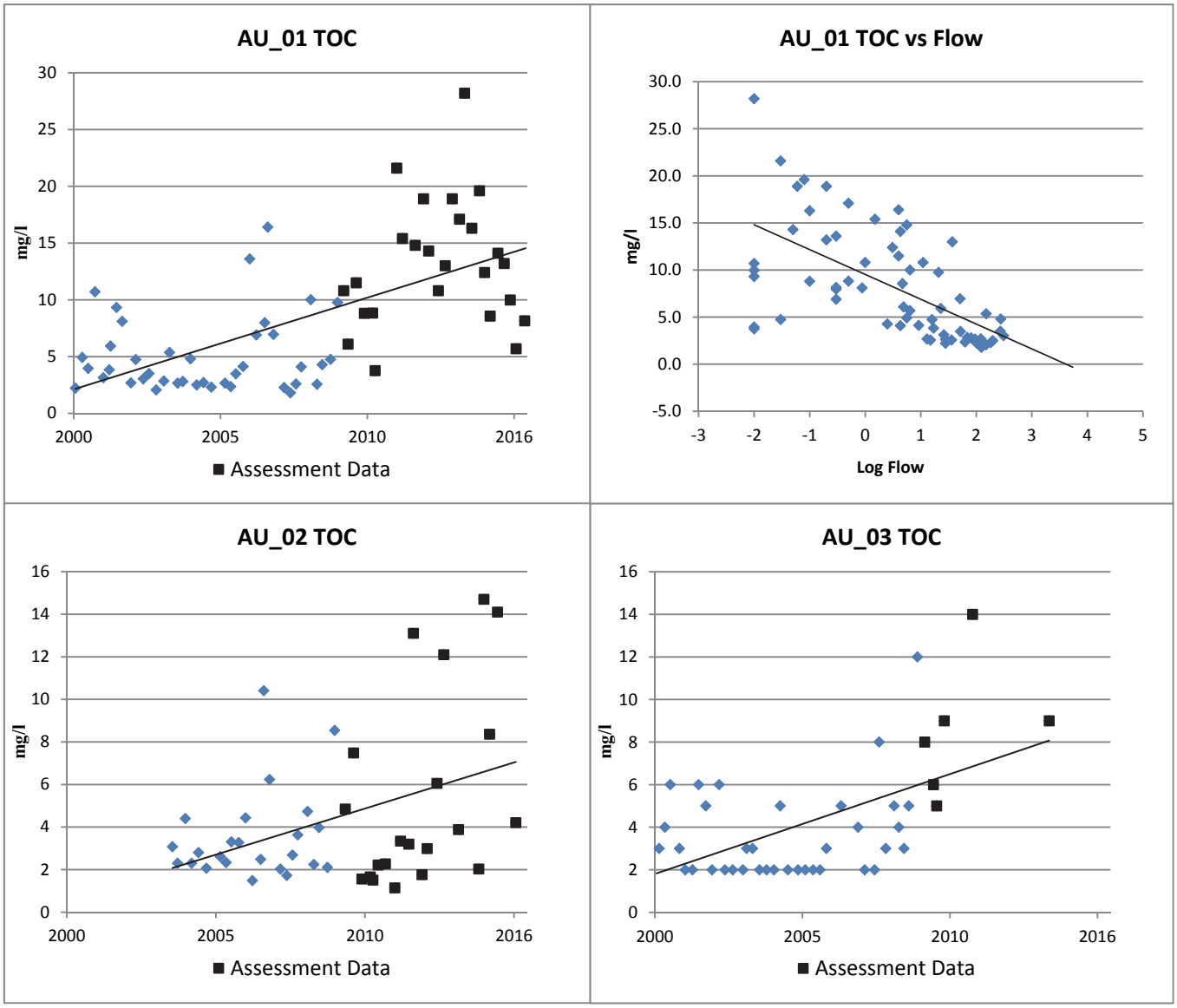
Since TDS is assessed over the entire segment, all AUs are listed as being impaired for this parameter. Individually, AU_02 is the only AU currently exceeding the standard. The highest values were recorded during low flow and the more active period of the Eagle Ford Shale oil and gas operations. They appear to be returning to normal levels.

Trend analysis indicates decreasing trends in TDS concentrations in AU_01 ($t = -3.81$, $p = 0.000$) and in AU_02 ($t = -6.30$, $p = 0.000$) with respect to flow. Trend analysis also indicates increasing trends in AU_02 ($t = 2.56$, $p = 0.014$) and in AU_03 ($t = 2.23$, $p = 0.030$) over time.


AU_01 TDS
mg/l
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2000
2005
2010
2016
Assessment Data
Standard
AU_01 TDS vs Flow
mg/l
3,500
3,000
2,500
2,000
1,500
1,000
500
0
-4
-2
0
2
4
6
Log Flow
Standard
AU_02 TDS
mg/l
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2005
2010
2016
Assessment Data
Screening Level
AU_02 TDS vs Flow
mg/l
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
-1,000
-3
-2
-1
0
1
2
3
Log Flow
Standard
AU_03 TDS
mg/l
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2005
2010
2016
Assessment Data
Standard
AU_05 TDS
mg/l
2,500
2,000
1,500
1,000
500
0
2000
2005
2010
2016
Assessment Data
Standard

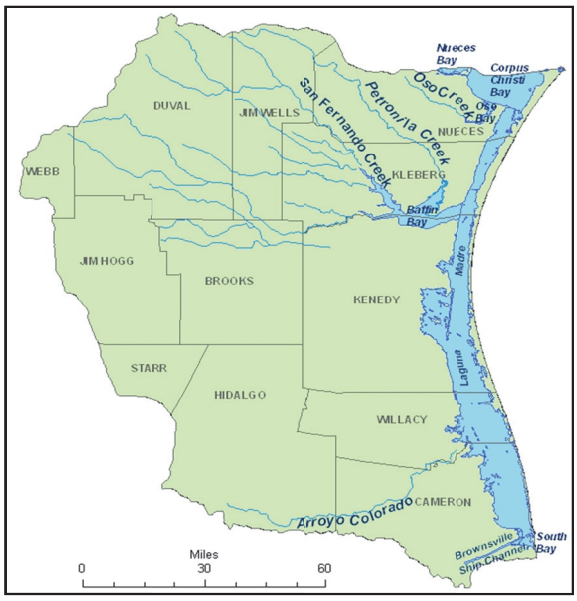
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	3.76	28.2	13
AU_02		N/A	21	1.14	14.7	3.34
AU-03		N/A	6	5	14	8.5
AU_05		N/A	9	<1	6	1

Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 6.46, p = 0.000), in AU_02 (t = 2.87, p = 0.006), and in AU_03 (t = 4.11, p = 0.000) over time. Trend analysis also indicates a decreasing trend in AU_01 (t = -6.38, p = 0.000) with respect to flow.



WATERSHED SUMMARIES OF NUECES – RIO GRANDE COASTAL BASIN

The Nueces – Rio Grande Coastal Basin lies on the coastal plain and drains into the Laguna Madre, Baffin Bay, and Oso Bay. The total basin drainage area covers approximately 10,400 square miles, encompassing all or part of 12 counties in South Texas. The basin is bordered by: the Nueces River Basin and the San Antonio – Nueces Coastal Basin to the north; bays, estuaries, and the Gulf of Mexico to the east; and the Rio Grande River Basin to the south and southwest.



The inland area of the basin is dominated by large ranches, including the King Ranch. State-operated recreational areas are primarily along the coast and include Mustang Island State Park, Port Isabel Light House State Historic Park in Port Isabel, and the Padre Island National Seashore.

The basin is located in the Western Gulf Coastal Plain ecoregion that is characterized by relatively flat topography with clay and sandy loams that support water tolerant hardwoods, grasslands, cacti, and scrub brush.

Water Quality Overview

Water in the Arroyo Colorado originates from the numerous effluent flows from the surrounding communities including wastewater effluent and irrigation return flows. The Arroyo Colorado also receives water diverted from the Rio Grande during flood events. Water quality issues in the Arroyo Colorado include the following: elevated nutrient (nitrogen and phosphorus) and bacteria loads, instances of low DO, high levels of chlorophyll-*a,* and legacy pollutants resulting in fish consumption advisories (the above tidal portion). In 2007, Phase I BMPs of the Arroyo Colorado WPP were initiated. Projects include improved wastewater infrastructure, large and small scale habitat restoration projects, implementation of agricultural BMPs on irrigated crop land, and a comprehensive education and outreach program. The WPP was updated in 2017. While the impairments and concerns continue on both the tidal and above tidal segments, there does seem to be some improvement in the above tidal segment.

Petronila creek is a shallow gradient coastal creek that begins near Banquete and flows approximately 49 miles into Kleberg County and Alazan Bay. The upper half of the watershed is more ephemeral in nature, only flowing in conjunction with rain events. There is an earthen impoundment just west of US 77 near the Lost Creek Colonia that maintains water on a perennial basis. Reports of water quality issues including fish kills have been reported and are usually attributed to pollution associated with runoff from rain events. Water flowing in the lower half of watershed is generally brackish in nature with extremely high concentrations of chloride, sulfate, and TDS associated with historical oil and gas operations in which brine water was discharged into tributaries and drainage ditches that drain into the creek. Brine discharges to the creek were suspended in 1987 but elevated levels of TDS, chloride, and sulfate remain. NRA has been monitoring on the tributaries to the creek to try and pinpoint the source areas. The chloride, sulfate, and TDS concentrations are inversely correlated with the three-week antecedent rainfall amounts. The concentrations rise quickly from groundwater seepage during low flow periods.

FY2018 Monitoring Locations in the Nueces – Rio Grande Coastal Basin

Segment Name	Station Id #	Description	Monitoring Entity	Conventional, Field	Other
2201 Arroyo Colorado Tidal	13782 (AU_01)	Near Marker 16 at Arroyo City 492 m downstream of confluence with Arroyo Colorado and Arroyo Colorado cutoff	TCEQ Region 15	Quarterly	
	13071 (AU_02)	At Mile 10 Marker 22 81 m upstream from San Vicente drain ditch	TCEQ Region 15	Quarterly	
	13073 (AU_04)	At Camp Perry north of Rio Hondo 177 m downstream from confluence with unnamed ditch west side of Arroyo Colorado	TCEQ Region 15	Quarterly	
	13072 (AU_05)	At FM 106 bridge at Rio Hondo	TCEQ Region 15	Quarterly	
2202 Arroyo Colorado Above Tidal	13074 (AU_01)	At low water bridge at Port Harlingen at Cemetery Rd bridge	TCEQ Region 15	Quarterly	
	13079 (AU_02)	At US 77 in SW Harlingen	NRA	Quarterly	
	13080 (AU_02)	At FM 506 south of La Feria	NRA	Quarterly	
	16445 (AU_02)	At low water crossing at Dilworth Rd east of La Feria	NRA	Quarterly	
	13081 (AU_03)	At FM 1015 south of Weslaco	TCEQ Region 15	Quarterly	
	13084 (AU_03)	At US 281 south of Pharr	TCEQ Region 15	Quarterly	
2204 Petronila Creek Above Tidal	13093 (AU_01)	At FM 70 Bridge East of Bishop	NRA	Quarterly	Monthly TDS, chloride, sulfate
	13094 (AU_01)	At FM 892 SE of Driscoll	NRA	Quarterly	
	13096 (AU_02)	At FM 665 east of Driscoll	NRA	Quarterly	
	20806 (AU_02)	At 181 m West and 6 m South from the intersection of Alice Road and Lost Creek road	NRA	Quarterly	

Permitted Discharges in the Nueces – Rio Grande Coastal Basin

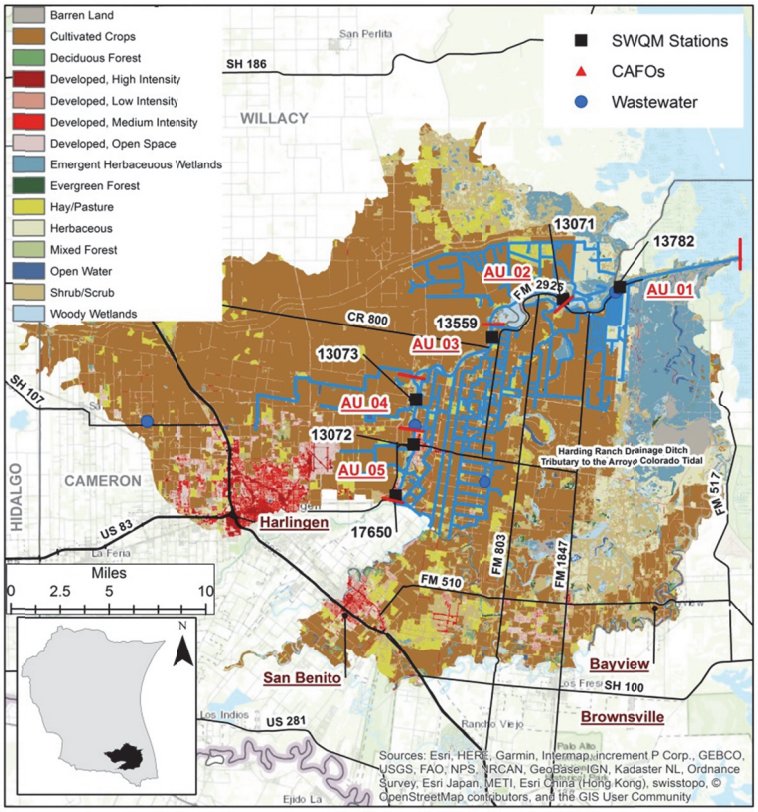
Segment	Permit Number	Entity	Permitted Discharge (gpd)
2201 Arroyo Colorado Tidal	WQ0003596-000	Taiwan Shrimp Village Association and Arroyo Aquaculture Association	100,000,000
	WQ0004792-000	Military Highway WSC	1,440,000
	WQ0005137-000	La Paloma Energy Center LLC	1,634,000
	WQ0005226-000	Denali Water Solutions, LLC	Sludge
	WQ0010475-002	City of Rio Hondo	400,000
	WQ0013462-008	Military Highway WSC Lago	510,000
	WQ0014558-001	East Rio Hondo WSC	160,000
	WQ0015265-001	City of San Benito	3,750,000
2201A Harding Ranch Drainage Ditch Tributary	WQ0005179-000	Denali Water Solutions LLC	Sludge
2201B Unnamed Drainage Ditch Tributary in Cameron County Drainage District #3	WQ0005025-000	Military Highway WSC	Reject Water

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2202 Arroyo Colorado Above Tidal	WQ0004184-000	Webb County – Colorado Acres Water Plant	28,800 Evaporation
	WQ0005091-000	MultiChem Group Three Rives Facility	11,500 Reject Water
	WQ0010088-001	Freer WCID	280,000 Irrigation
	WQ0013461-001	US Department of Justice (DOJ)	300,000
	WQ0013943-001	Encinal WSC	95,000 Irrigation
	WQ0004051-000	Frontera Generation Ltd	1,400,000
	WQ0004257-000	Watermill Express	1,000 Subsurface
	WQ0004754-000	Military Highway WSC Progresso Water Treatment Plant	520,000
	WQ0004861-000	Denali Water	Sludge
	WQ0004924-000	Denali Water	Sludge
	WQ0005186-000	Denali Water	Sludge
	WQ0010347-001	City of Mercedes	5,000,000
	WQ0010484-001	City of Mission	9,000,000
	WQ0010490-003	City of Harlingen Water Works Facility #2	10,000,000
	WQ0010504-001	City of Donna	2,300,000
	WQ0010596-001	City of Pharr	8,000,000
	WQ0010619-005	City of Weslaco South Plant	2,000,000
	WQ0010633-003	City of McAllen Facility No. 2	10,000,000
	WQ0010697-001	City of La Feria	500,000
	WQ0010697-002	City of La Feria	1,250,000
	WQ0010972-002	Palm Valley Estates	280,000 Irrigation
	WQ0011080-001	City of Hidalgo	2,700,000
	WQ0011512-001	City of San Juan	4,200,000
	WQ0011628-001	Winter Garden Park Corporation	11,000
	WQ0013462-001	Military Highway WSC Progresso	750,000
	WQ0013462-002	Military Highway WSC La Paloma	210,000 Irrigation
	WQ0013462-003	Military Highway WSC Santa Maria	230,000 Irrigation
	WQ0013462-004	Military Highway WSC San Pedro	160,000 Irrigation
	WQ0013462-005	Military Highway WSC Los Indios	135,000 Irrigation
	WQ0013462-006	Military Highway WSC South Alamo	510,000
	WQ0013523-007	La Joya Independent School District (ISD)	12,570 Subsurface
	WQ0013523-009	La Joya ISD	12,500 Subsurface
	WQ0013523-010	La Joya ISD	20,000 Subsurface
	WQ0013523-012	La Joya ISD	9,000 Subsurface
	WQ0013523-013	La Joya ISD	35,000 Subsurface
	WQ0013523-016	La Joya ISD	12,000 Subsurface
	WQ0013633-001	City of Alamo	2,000,000
	WQ0013680-002	Donna ISD Munoz Elementary	2,500 Subsurface

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2202 Arroyo Colorado Above Tidal (continued)	WQ0013680-003	Donna ISD Garza Elementary	12,500 Subsurface
	WQ0014178-001	US Fish and Wildlife Service Santa Ana National Wildlife Refuge	1,500 Evaporation
	WQ0014415-003 (pending)	Agua Special Utility District	7,550,000
2202A Donna Reservoir	WQ0015513-001 (pending)	North Alamo WSC	700,000
2204 Petronila Creek Above Tidal	WQ0002888-000	US Ecology Texas	Stormwater
	WQ0010140-001	City of Agua Dulce	160,000
	WQ0010592-001	City of Orange Grove	200,000
	WQ0011541-001	City of Driscoll	100,000
	WQ0011583-002	Nueces County WCID #5	8,000,000
	WQ0011754-001	Bishop Consolidated ISD	8,000
	WQ0014981-001	Adult and Teen Challenge of Texas	15,000

ARROYO COLORADO TIDAL – SEGMENT 2201

Segment 2201, Arroyo Colorado Tidal, flows 26 miles from 110 yards downstream of Cemetery Road, south of the Port of Harlingen, to its confluence with the Laguna Madre. The segment forms part of the county line between Cameron and Willacy Counties. The segment is divided into five AUs. **AU_01** is from the confluence with the Laguna Madre to the confluence with San Vicente Drainage Ditch. **AU_02** is from the confluence with San Vincente Drainage Ditch to the confluence with an unnamed drainage ditch at 26.31, -97.53. **AU_03** is from an unnamed drainage ditch at 26.31, -97.53 to the confluence with the Harding Ranch Ditch tributary. **AU_04** is from the confluence with the Harding Ranch Ditch tributary to just upstream of the City of Hondo wastewater discharge point. **AU_05** is from just upstream of the City of Rio Hondo wastewater discharge point to the upstream end of the segment. The area is predominately farmland. The Arroyo Colorado Tidal segment serves as the waterway from the Laguna Madre to the Port of Harlingen. Its watershed is 294,591 acres. The City of Rio Hondo is just downstream of the Port. Arroyo City is located along the southern shore, with many homes lining the river.



AU_05 is listed as being impaired for DDE, mercury, and PCBs in edible fish tissue. More information on fishing advisories and bans are available at https://dshs.texas.gov/seafood/advisories-bans.aspx.

Special Studies

An update to the 2007 Arroyo Colorado WPP was completed in completed in 2017. All of the impairments and concerns discussed below are being addressed by the WPP. For more information, visit the Arroyo Colorado website at http://arroyocolorad.org.

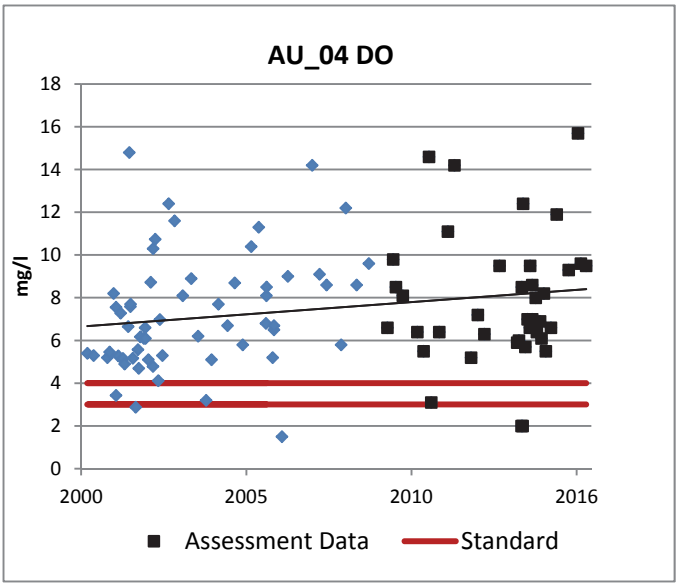
Water Quality Analysis

The analysis for AU_01 is based on data from **Station 13782** at Channel Marker (CM) 16. The analysis for AU_02 is based on data from **Station 13071** at CM 22. The analysis for AU_03 is based on data from **Station 13559** at CM 27. The analysis for AU_04 is based on data from **Station 13073** at Camp Perry. The analysis for AU_05 is based on data from **Station 13072** at FM 106.

Google Earth view of Stations 13071 and 13782 locations

Aquatic Life Use Assessment

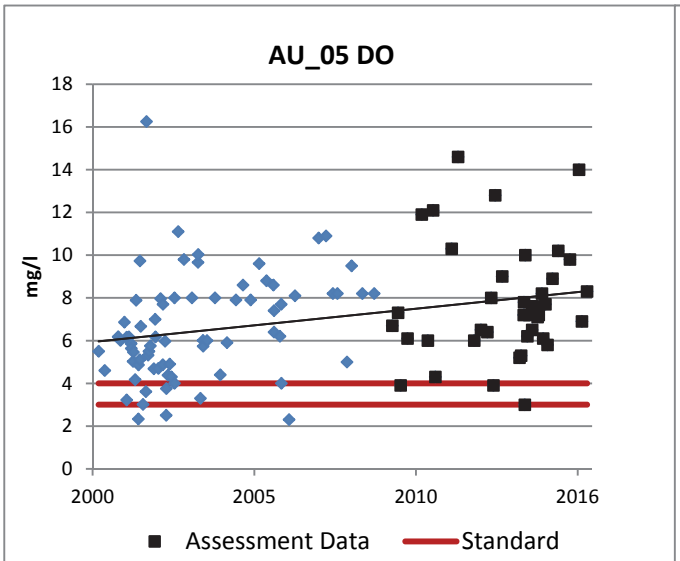
DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	37	4.5	24.4	9.6	0	0
	Screening Level 4.0 mg/l	NC						
AU-02	Minimum 3.0 mg/l	FS	27	4.1	23.4	9.3	0	0
	Screening Level 4.0 mg/l	NC						
AU_03	Minimum 3.0 mg/l	FS	32	3.0	16.5	7.9	0	4
	Screening Level 4.0 mg/l	NC						
AU-04	Minimum 3.0 mg/l	FS	39	2.0	15.7	7.0	2	3
	Screening Level 4.0 mg/l	NC						
AU-05	Minimum 3.0 mg/l	FS	41	3.0	14.6	7.2	0	3
	Screening Level 4.0 mg/l	CS						

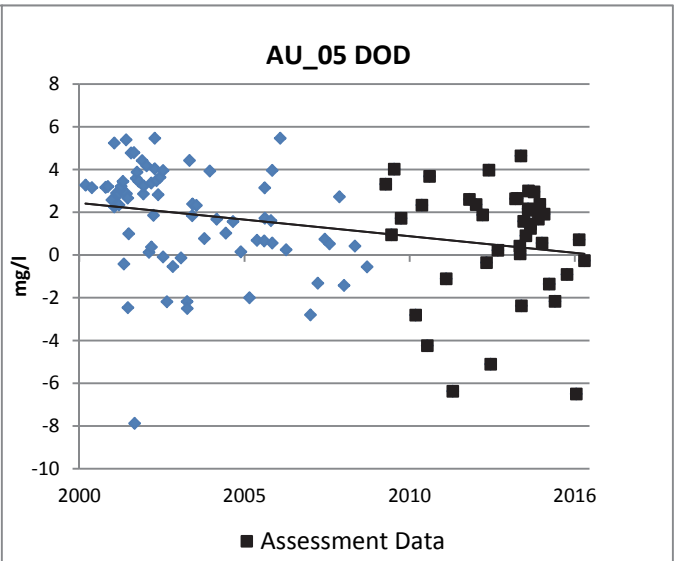


AU_05 impaired for low DO at the grab minimum level. Although the graph for the AU_05 grab samples does not reflect low DO, the Draft 2016 Integrate Report includes a data qualifier that the assessment method is superseded by another method.

AU_04 and AU_05 are listed as impaired for low DO based on the 24-Hr minimum, and AU_05 is assessed as having a concern for the 24-Hr average. The 24-Hr based impairments and concerns are based on older, limited data. There are currently no additional 24-Hr monitoring events planned.

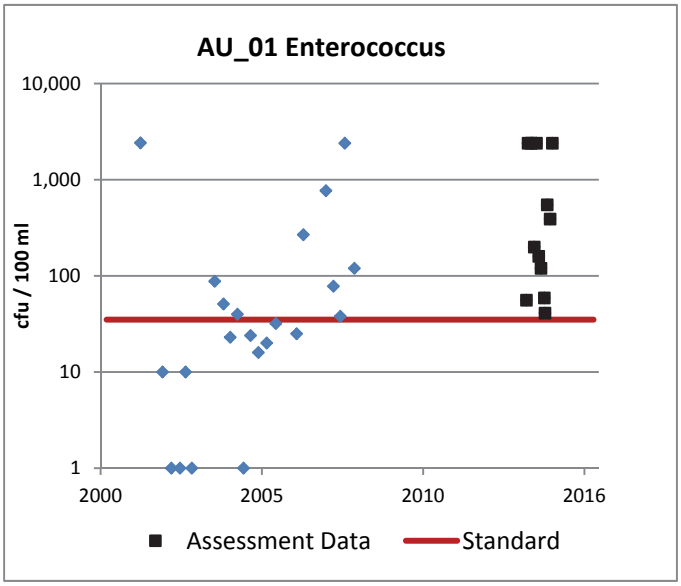
Trend analysis indicates increasing trends in AU_04 ($t = 2.07$, $p = 0.04$) and in AU_05 ($t = 3.38$, $p = 0.001$) over time. Trend analysis also indicates a decreasing trend in DOD in AU_05 ($t = -3.36$. $p = 0.001$) over time.



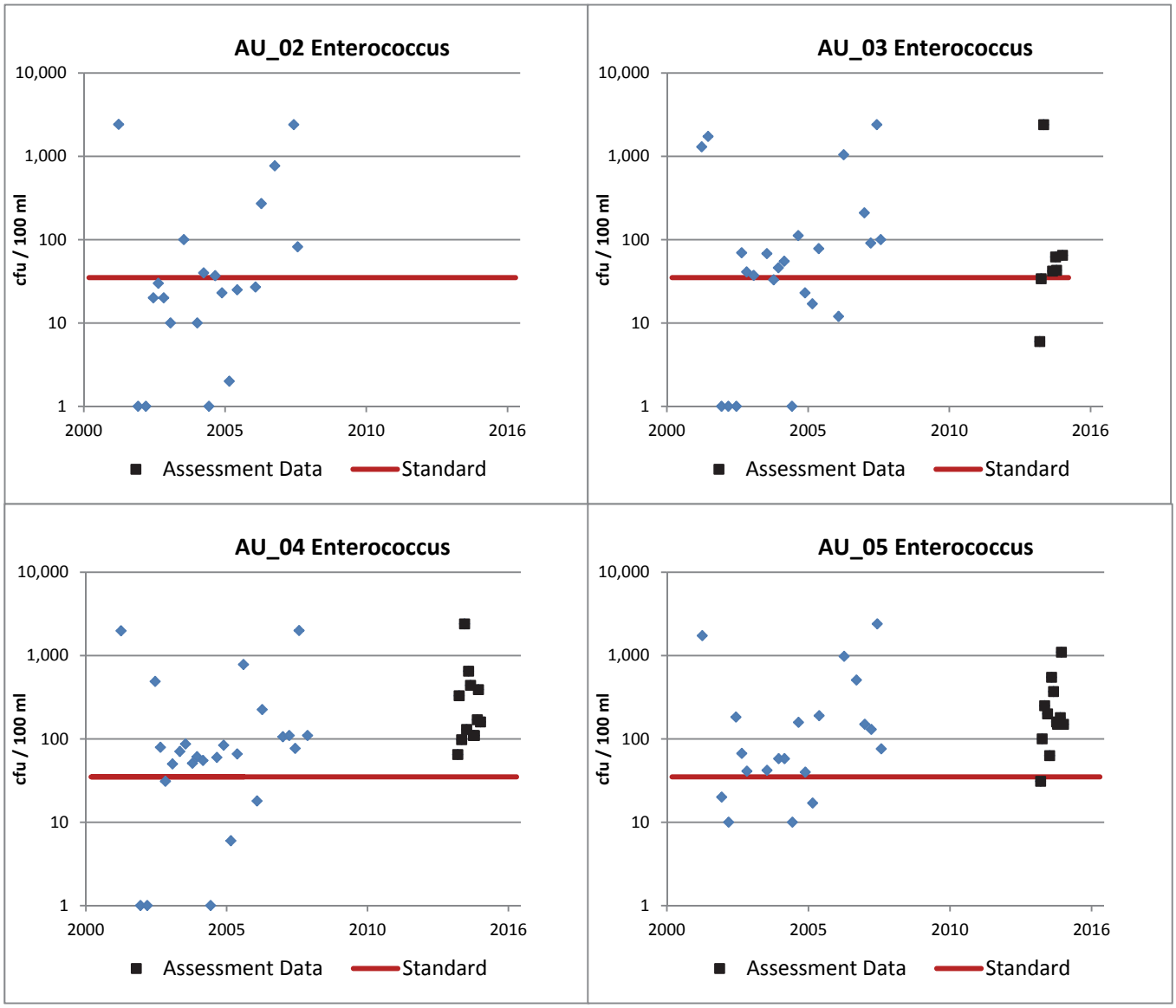


Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	NS	12	41	2400	353	0	12
AU_02		NS						
AU_03		NS	7	6	2400	62.1	0	5
AU_04		NS	12	65	2400	231	0	12
AU_05		NS	12	12	1100	183	0	11



All AUs are listed as being impaired for bacteria for contact recreation. There are no Enterococcus data in AU_02 during the analysis period, but the older data supports the listing. Trend analysis was not conducted due to insufficient data in AU_02 and the 2008 – 2014 data gap in the other AUs.



General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	38	14.6	32.0	26.4	0
AU_02		FS	28	16.2	31.9	27.2	0
AU_03		FS	33	15.2	32.2	26.1	0
AU_04		FS	40	14.4	32.2	26.4	0
AU_05		FS	42	14.7	31.7	27.0	0

Trend analysis did not indicate any trends in water temperature in any of the AUs over time.

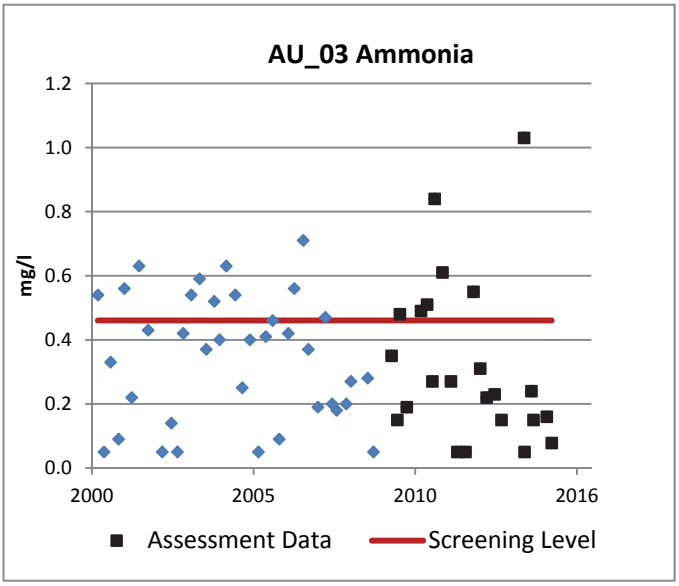
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	38	7.5	8.8	8.1	0	0
AU_02		FS	28	7.4	8.7	8.1	0	0
AU_03		FS	33	7.4	8.4	7.8	0	0
AU_04		FS	40	7.4	8.6	7.8	0	0
AU_05		FS	42	7.4	8.4	7.8	0	0

Trend analysis did not indicate any trends in pH levels in any of the AUs over time.

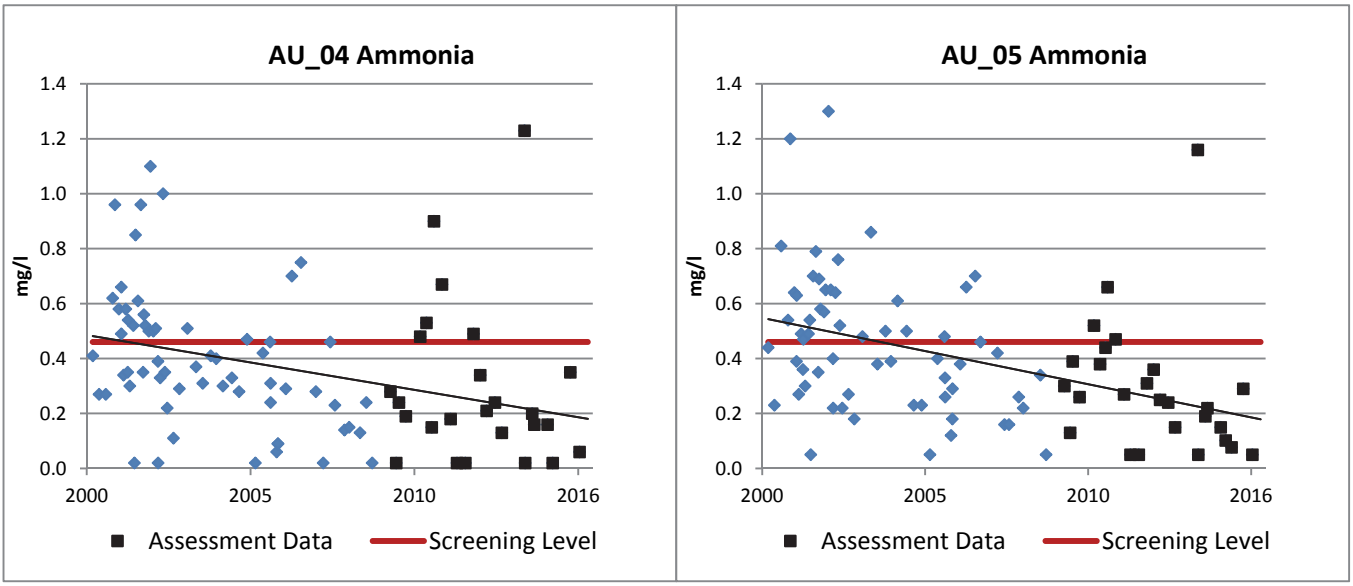
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	130	228	191
AU_02		N/A	29	150	240	197
AU_03		N/A	23	165	250	198
AU_04		N/A	28	162	258	199
AU_05		N/A	28	137	242	200

Trend analysis did not indicate any trends in alkalinity in any of the AUs over time.

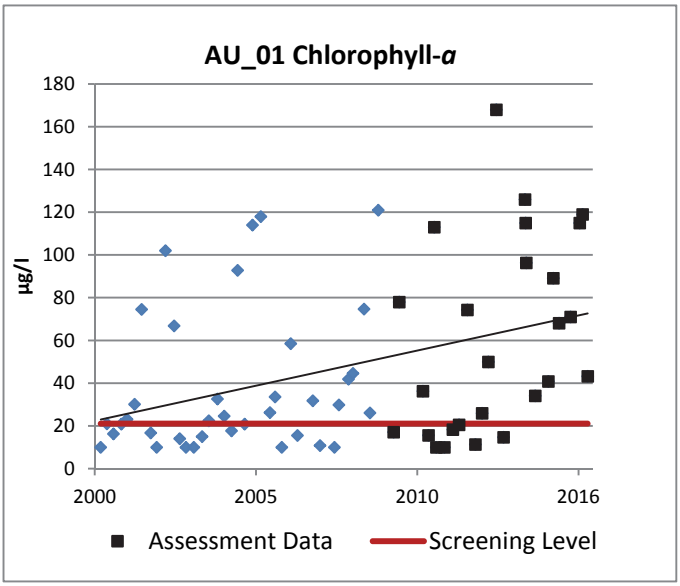
Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	26	<0.02	0.55	0.08	10	1
AU_02		NC	27	<0.02	0.65	0.12	0	3
AU_03		NC	23	<0.05	1.03	0.24	2	7
AU_04		NC	25	<0.02	1.23	0.2	5	6
AU_05		NC	26	<0.05	1.16	0.26	2	4



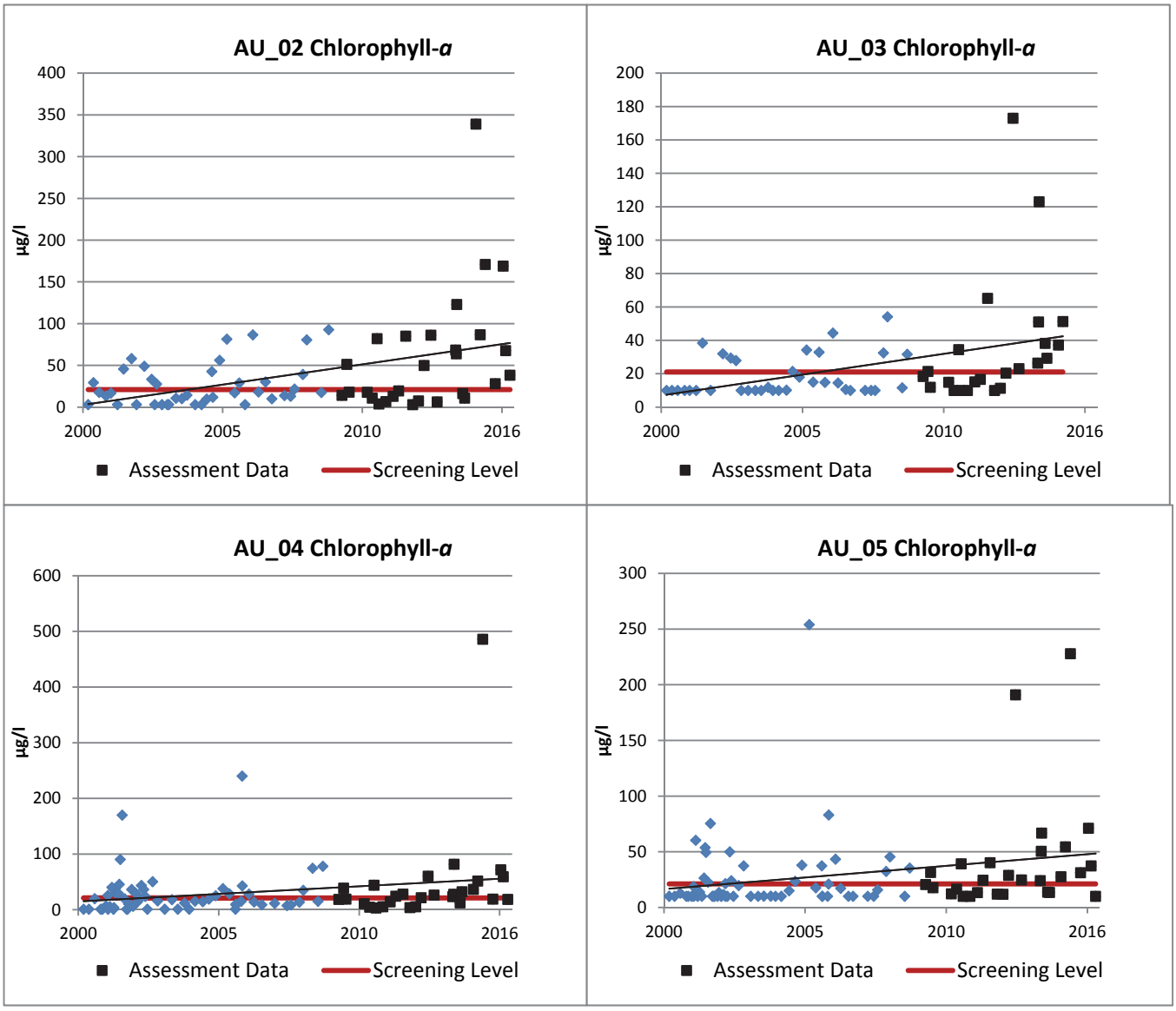
Although none of the AUs have been assessed as having a concern for ammonia, the data analysis for AU_03 and AU_04 indicate that >20% of the values are exceeding the screening level. Trend analysis indicates decreasing trends in AU_04 (t = --3.24, p = 0.002) and in AU_05 (t = -4.29, p = 0.000) over time.



Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21µg/l	CS	26	10	168	46.6	0	18
AU_02		CS	28	3.1	339	33.2	0	15
AU_03		CS	23	10	173	21.4	0	12
AU_04		CS	28	3.21	486	24.2	0	16
AU_05		CS	28	<10	228	24.6	3	16

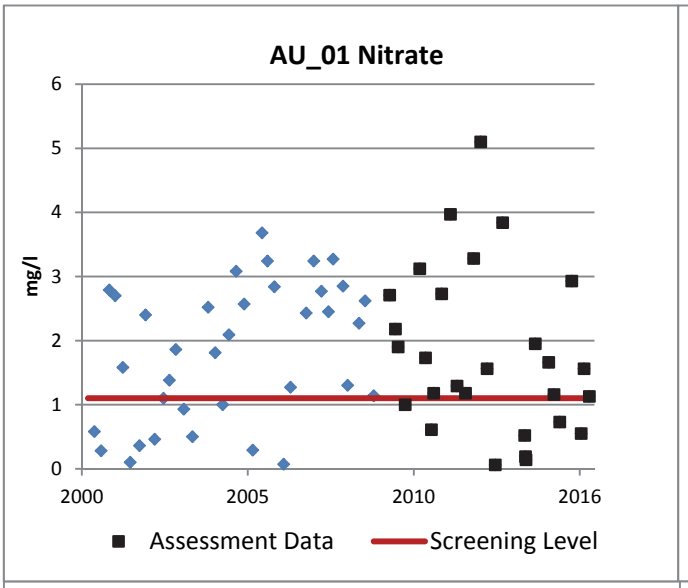


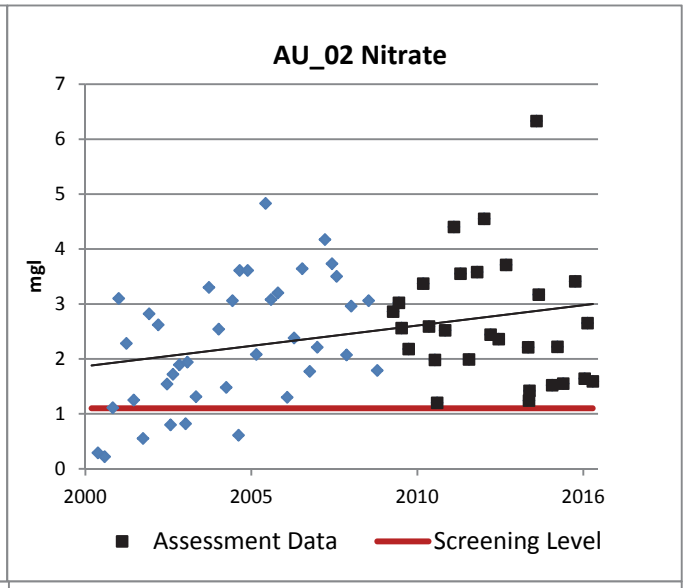
All of the AUs have been assessed as having a concern for chlorophyll-*a*. Trend analysis indicates increasing trends in AU_01 (t = 3.22, p = 0.002), in AU_02 (t = 3.82, p = 0.000), in AU_03 (t = 3.21, p = 0.002), in AU_04 (t = 2.06, p = 0.043), and in AU_05 (t = 2.32, p = 0.022) over time.



Nitrate		Status	# samples	Min	Max	Median	ND	>1.10
AU_01	1.10 mg/l	CS	28	0.06	5.1	1.56	0	20
AU_02		CS	29	1.2	6.33	2.52	0	29
AU_03		CS	23	1.13	6.15	3.15	0	23
AU_04		CS	28	1.03	5.4	3.07	0	26
AU_05		CS	28	1.22	6.53	3.50	0	28

All of the AUs have been assessed as having a concern for nitrate. Trend analysis indicates increasing trends in AU_02 (t = 2.39, p = 0.020), in AU_03 (t = 2.55, p = 0.014), in AU_04 (t = 4.02, p = 0.000), and in AU_05 (t = 3.39, p = 0.001) over time.


AU_01 Nitrate
mg/l
0
1
2
3
4
5
6
2000
2005
2010
2016
Assessment Data
Screening Level


AU_02 Nitrate
mgl
0
1
2
3
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5
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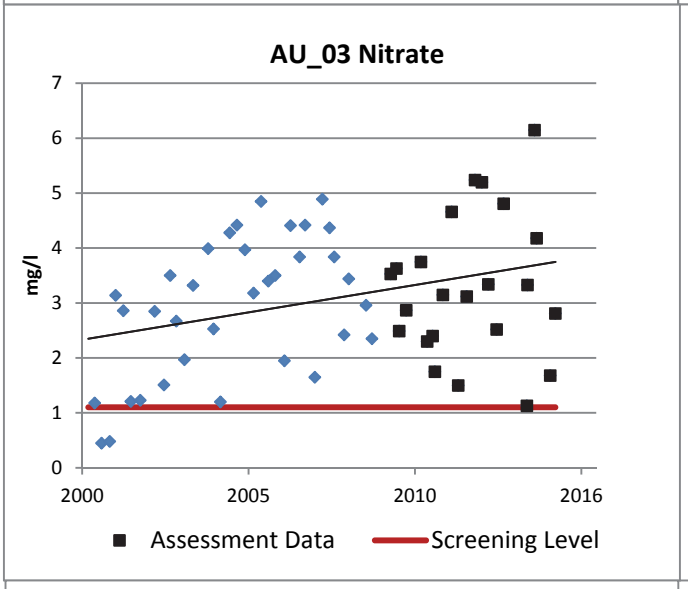
7
2000
2005
2010
2016
Assessment Data
Screening Level


AU_03 Nitrate
mg/l
0
1
2
3
4
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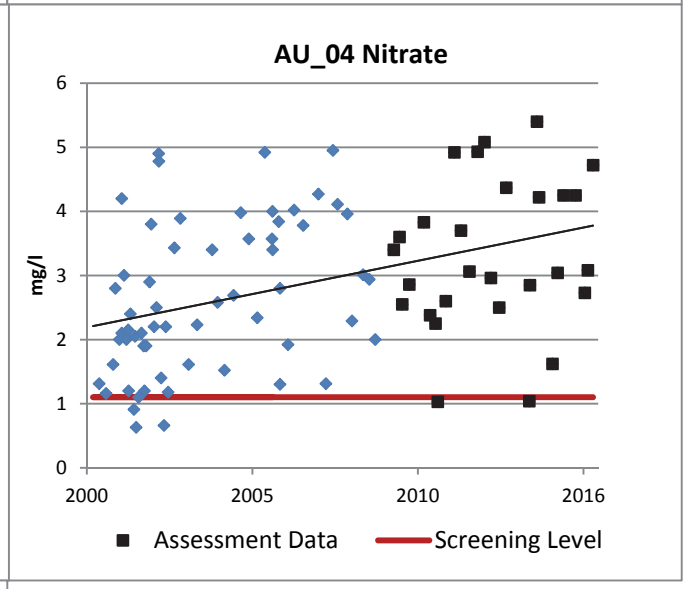
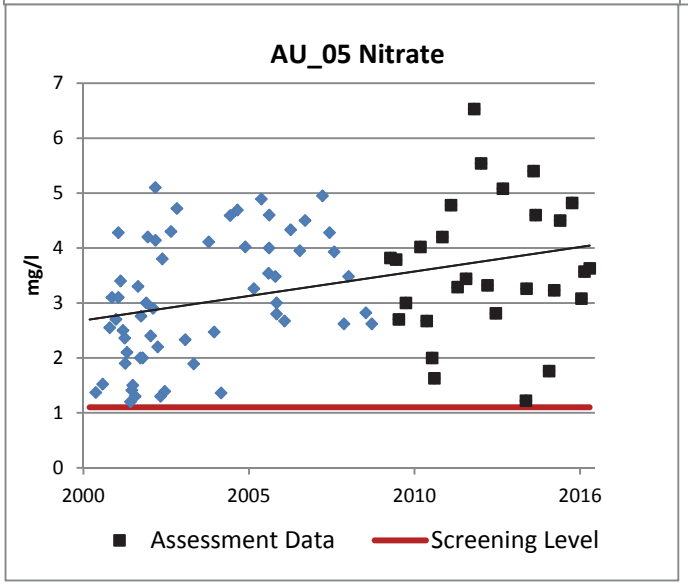
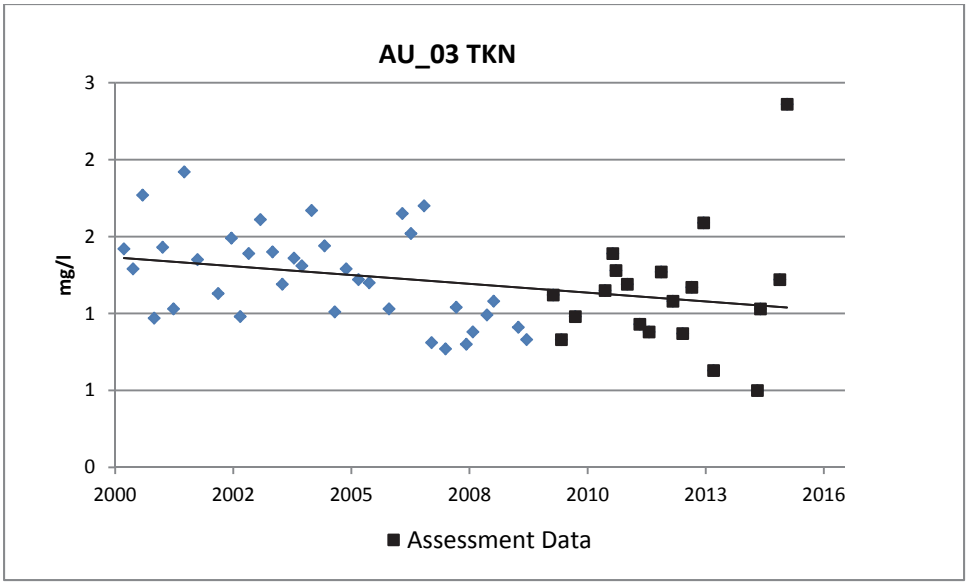
6
7
2000
2005
2010
2016
Assessment Data
Screening Level


AU_04 Nitrate
mg/l
0
1
2
3
4
5
6
2000
2005
2010
2016
Assessment Data
Screening Level


AU_05 Nitrate
mg/l
0
1
2
3
4
5
6
7
2000
2005
2010
2016
Assessment Data
Screening Level

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	0.76	3.56	1.55
AU_02		N/A	26	0.5	4.33	1.02
AU_03		N/A	19	0.5	2.36	1.12
AU_04		N/A	24	0.5	6.83	1.06
AU_05		N/A	23	<1	6.58	1.05

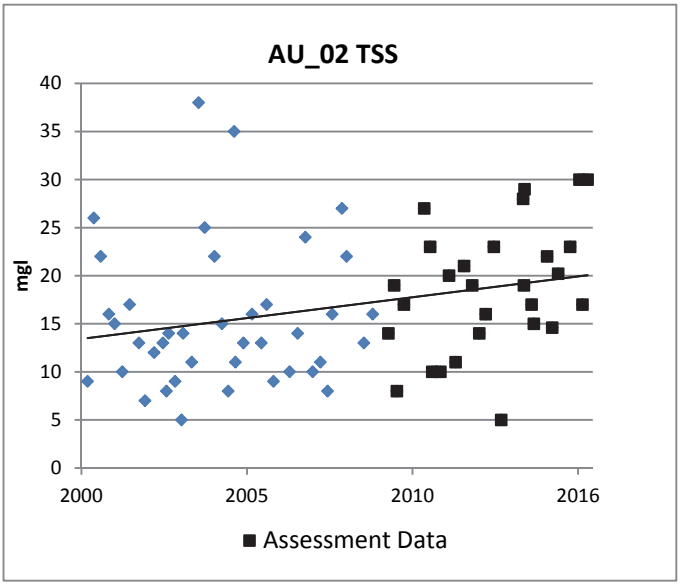
Trend analysis indicates a decreasing trend in TKN concentrations in AU_03 (t = -2.24, p = 0.029) over time.



Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	21	0.16	0.74	0.32	0	1
AU_02		NC	21	0.18	0.87	0.41	0	1
AU_03		NC	16	0.3	0.79	0.48	0	2
AU_04		NC	21	0.31	0.95	0.47	0	4
AU_05		NC	21	0.3	0.83	0.54	0	5

Trend analysis did not indicate any trends in total phosphorus concentrations in any of the AUs over time.

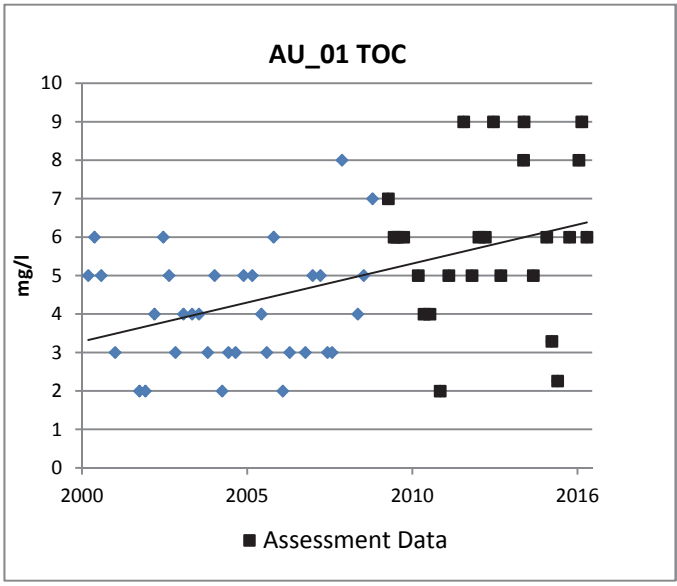
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	6	31	16
AU_02		N/A	28	5	30	19
AU_03		N/A	24	5	29	19
AU_04		N/A	29	8.4	43	16
AU_05		N/A	29	7	52	21

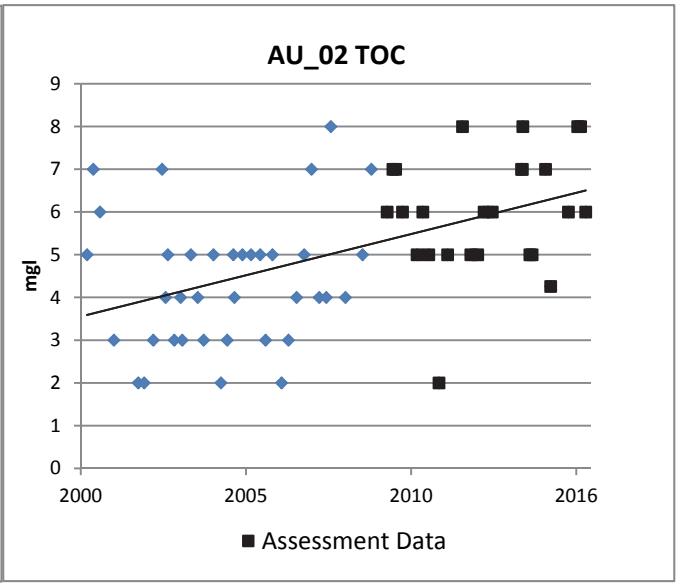


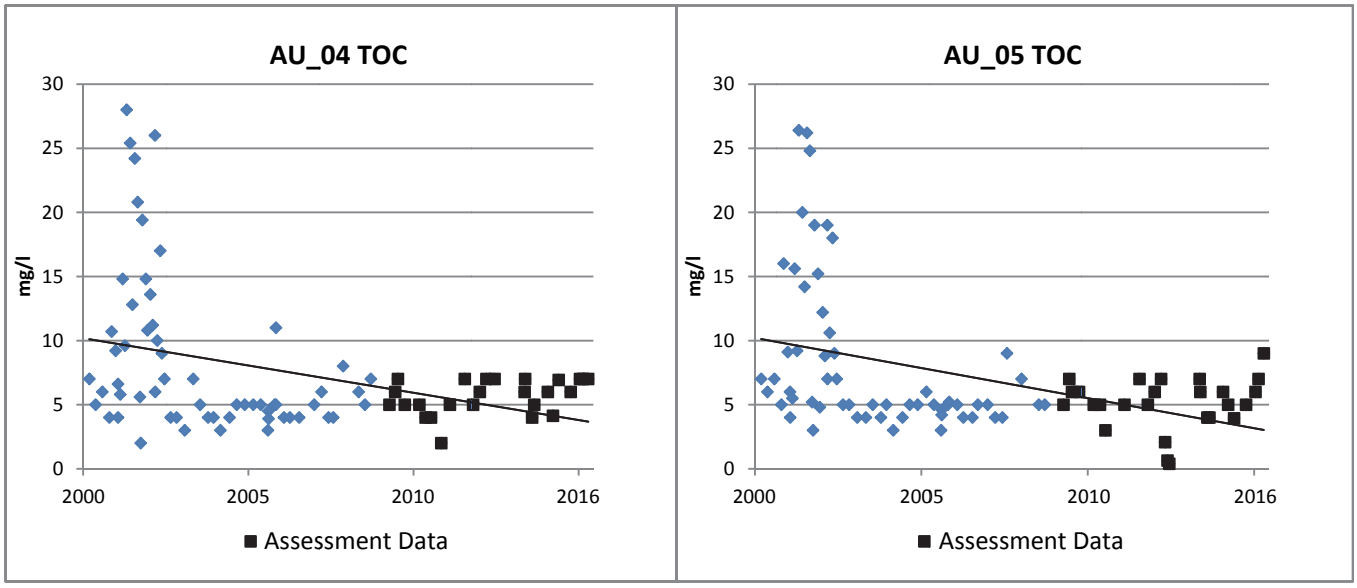
Trend analysis indicates an increasing trend in TSS concentration in AU_02 (t = 2.33, p = 0.023) over time.

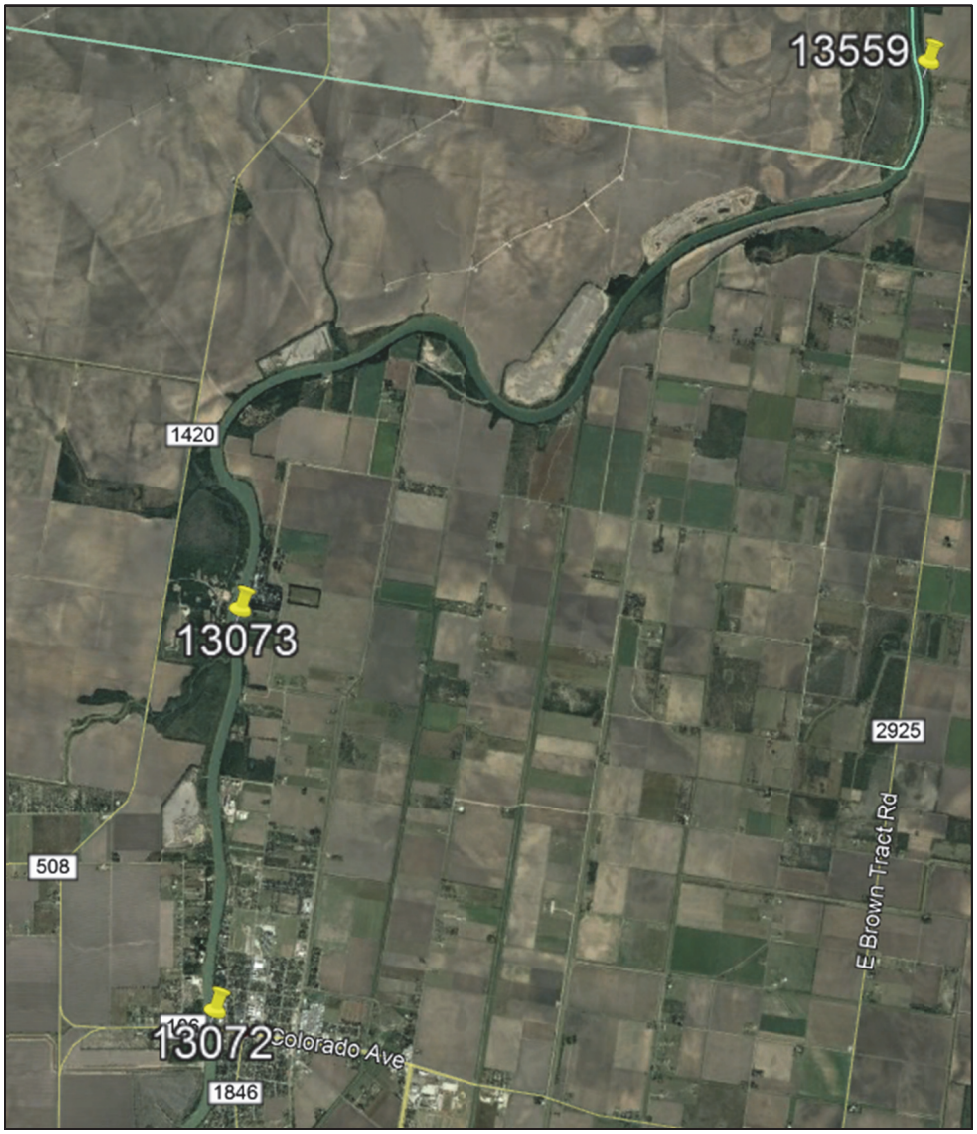
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	2	9	6
AU_02		N/A	25	2	8	6
AU_03		N/A	21	2	8	5
AU_04		N/A	25	2	7	6
AU_05		N/A	26	0.39	9	5

Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 4.07, p = 0.000) and in AU_02 (t = 4.55, p = 0.000) and decreasing trends in AU_04 (t = -3.49, p = 0.001) and in AU_05 (t = 4.10, p = 0.000) over time.





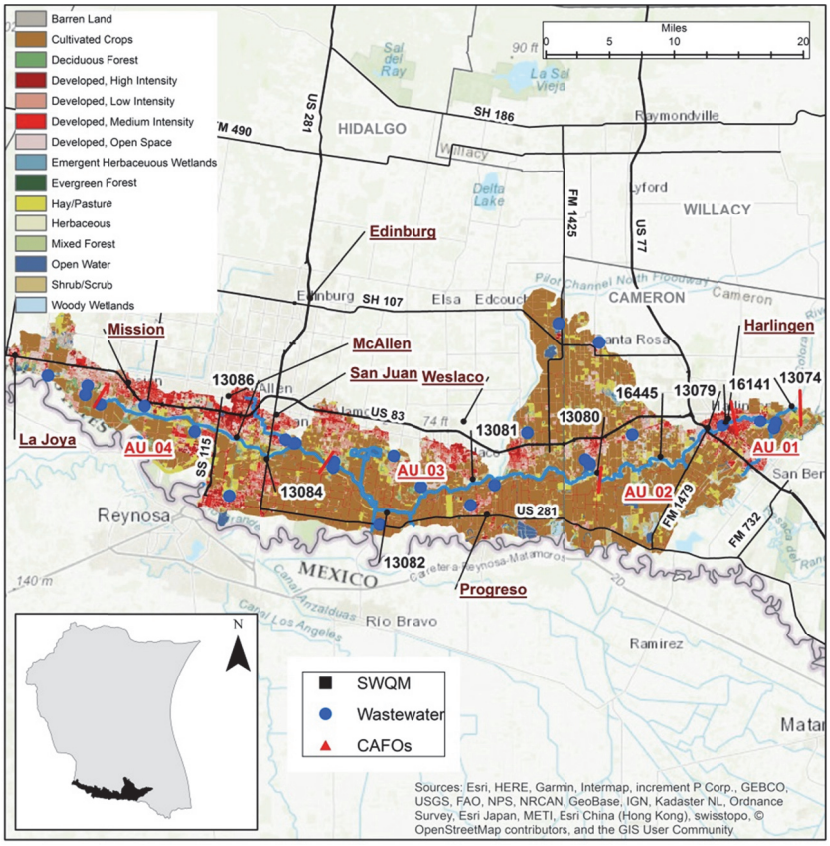




Google Earth view of Stations 13072, 13073, and 13559 locations

ARROYO COLORADO ABOVE TIDAL – SEGMENT 2202

Segment 2202, Arroyo Colorado Above Tidal, flows 63 miles FM 2062 in Hidalgo County to 110 yards downstream of Cemetery Road south of the Port of Harlingen. The segment is divided into four AUs. **AU_01** is from the downstream end of the segment to the confluence with Little Creek just upstream of State Loop 499. **AU_02** is from the confluence with Little Creek to the confluence with La Feria Main Canal just upstream of Dukes Highway. **AU_03** is from confluence with La Feria Main Canal to the confluence with La Cruz Resaca just downstream of FM 907. **AU_04** is from the confluence with La Cruz Resaca to the upstream end of the segment. Its watershed is 252,633 acres.



This area is one of the fastest growing areas in the State of Texas. There are numerous cities along US 83 just north of the Arroyo Colorado, with farming activities in between. The Arroyo Colorado is the primary conveyance of wastewater and agricultural runoff for this area.

All AUs are listed as being impaired for DDE, mercury, and PCBs in edible fish tissue. More information on fishing advisories and bans are available at https://dshs.texas.gov/seafood/advisories-bans.aspx.

Special Studies

An update to the 2007 Arroyo Colorado WPP was completed in completed in 2017. All of the impairments and concerns discussed below are being addressed by implementation of the management measures identified in the WPP. Numerous measures address agriculture, WWTP permits, sanitary sewer overflows, enhanced wastewater treatment and reuse, OSSFs and colonias, habitat, urban stormwater, illegal dumping, wildlife, the Port of Harlingen, instream aeration structures, and flood abatements. For more information, visit the Arroyo Colorado website at http://arroyocolorad.org.

An RUAA was also conducted by NRA, with funding from the TCEQ, in 2010 and 2011. The primary contact recreation standard was found to be appropriate for the segment since wading by children was observed. The Arroyo Colorado stakeholder group also wants this designation to remain to demonstrate the group's commitment to improving the water quality.

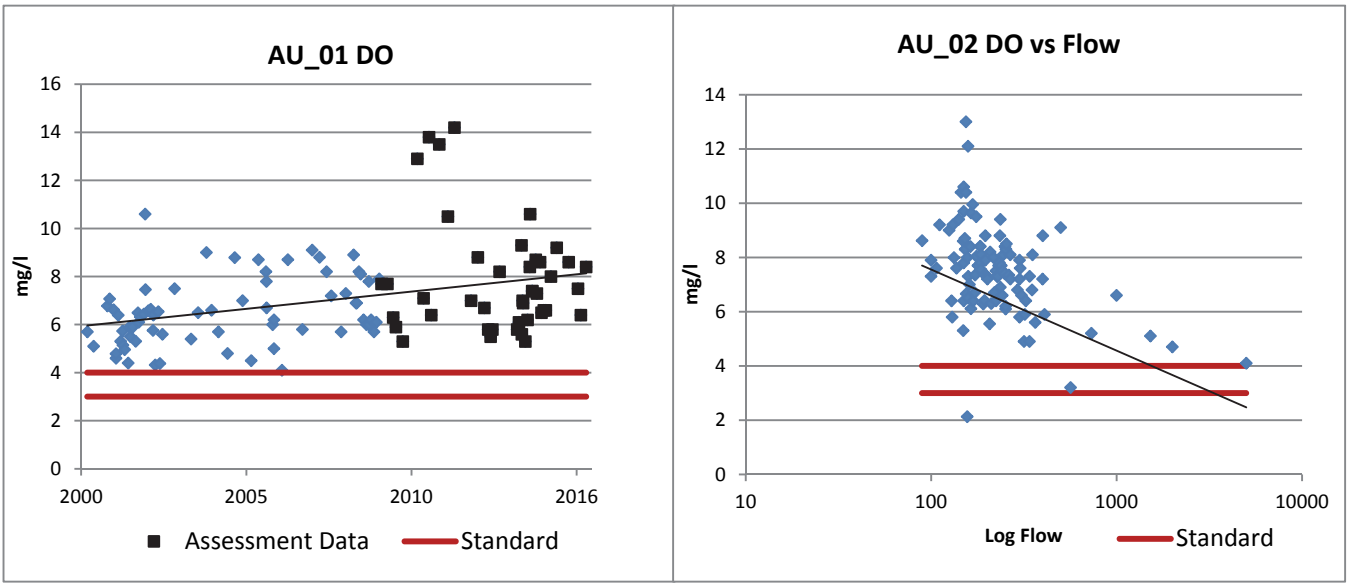
Water Quality Analysis

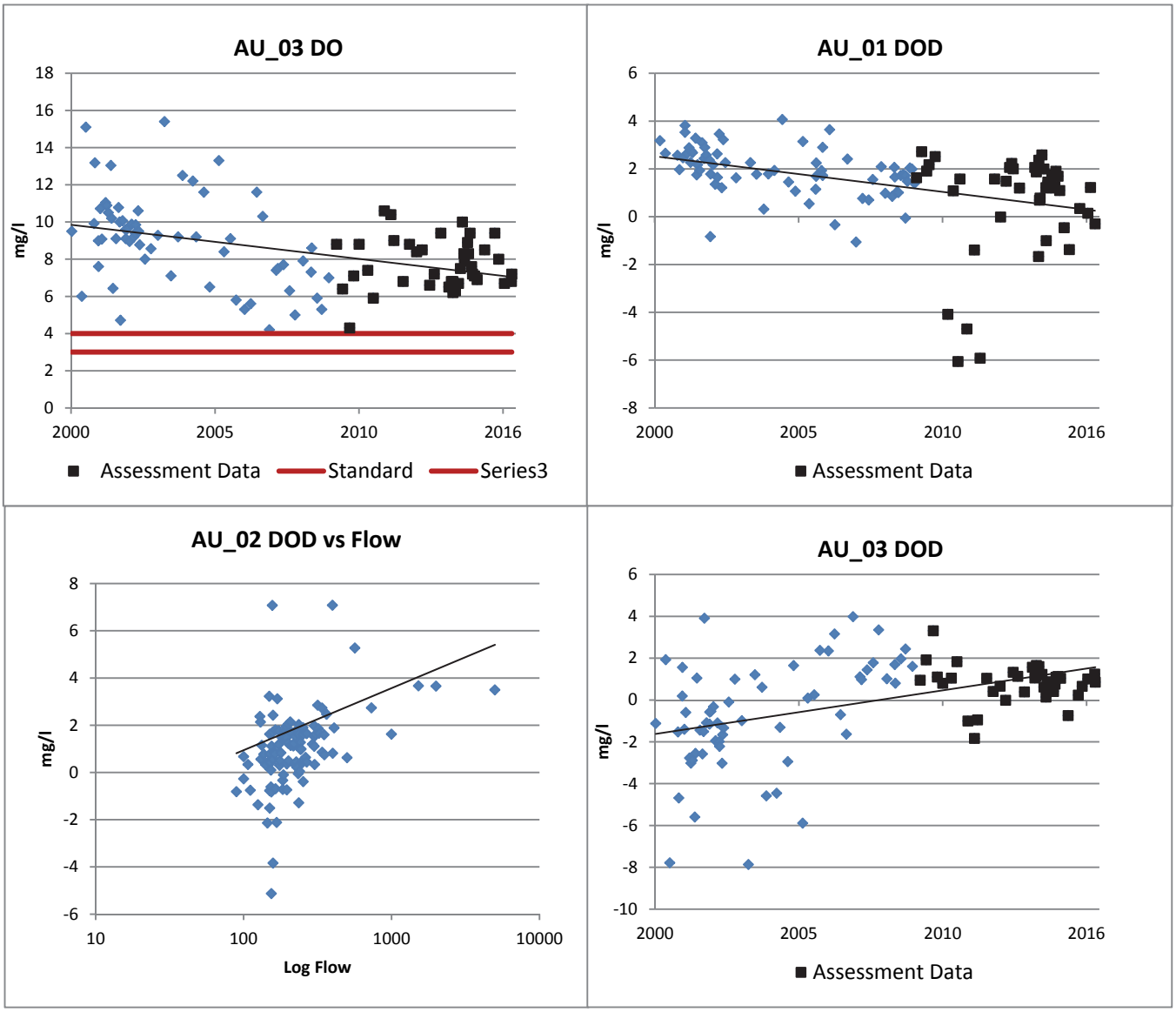
The analysis for AU-01 is based on data from **Station 13074** at the Port of Harlingen. The analysis for AU_02 is based on data from **Station 13079** at US 77. The analysis for AU_03 is based on data from **Station 13080** at FM 506. The analysis for AU_04 is based on data from **Station 13084** at US 281. AU-02 is the only AU that had enough flow data for trend analysis with respect to flow.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	43	5.3	14.2	7.3	0	0
	Screening Level 4.0 mg/l	NC						
AU-02	Minimum 3.0 mg/l	FS	40	4.1	10.4	8.0	0	0
	Screening Level 4.0 mg/l	NC						
AU_03	Minimum 3.0 mg/l	FS	40	4.3	10.6	7.4	0	4
	Screening Level 4.0 mg/l	NC						
AU-04	Minimum 3.0 mg/l	FS	35	3.9	13.8	6.8	0	1
	Screening Level 4.0 mg/l	NC						

Trend analysis indicates an increasing trend in DO levels in AU_01 (t = 4.10, p = 0.000) and a decreasing trend in AU_03 (t = -4.68, p = 0.000) over time, and a decreasing trend in AU_02 (t =-3.16, p = 0.002) with respect to flow. Trend analysis indicates a decreasing trend in DOD in AU_01 (t = -4.80, p = 0.000) and an increasing trend in AU_03 (t = 5.28, p = 0.000) over time, and an increasing trend in AU_02 (t = 5.01, p = 0.000) with respect to flow.

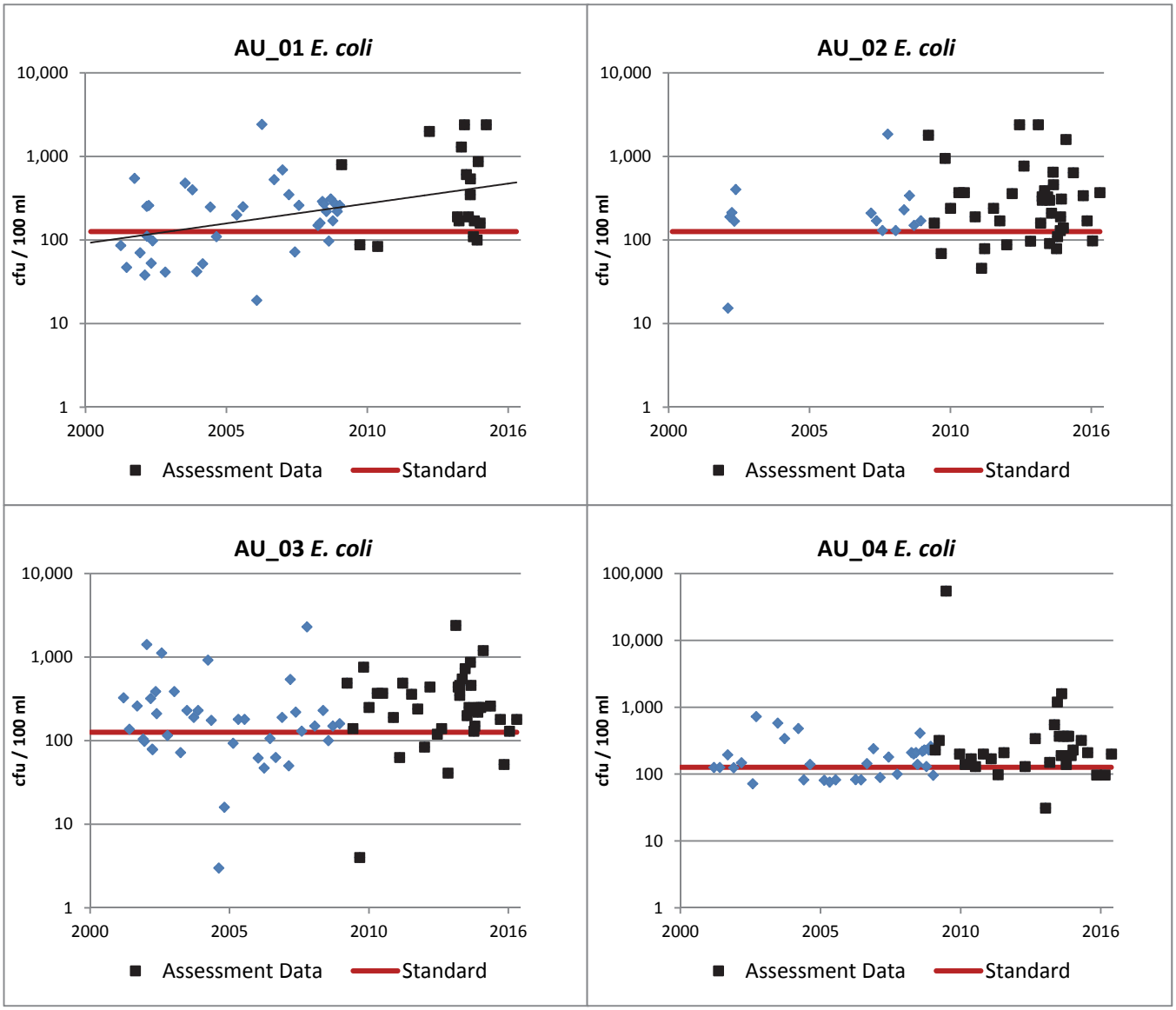




Recreation Use

Enterococci		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	18	84	2400	369	0	14
AU_02		NS	40	46	>2400	269	0	31
AU_03		NS	39	4	>2400	238	0	33
AU_04		NS	31	31	55,000	263	0	27

All AUs are listed as being impaired for bacteria for contact recreation. Trend analysis indicates an increasing trend in AU_01 ($t = 3.45$, $p = 0.001$) over time.



General Use

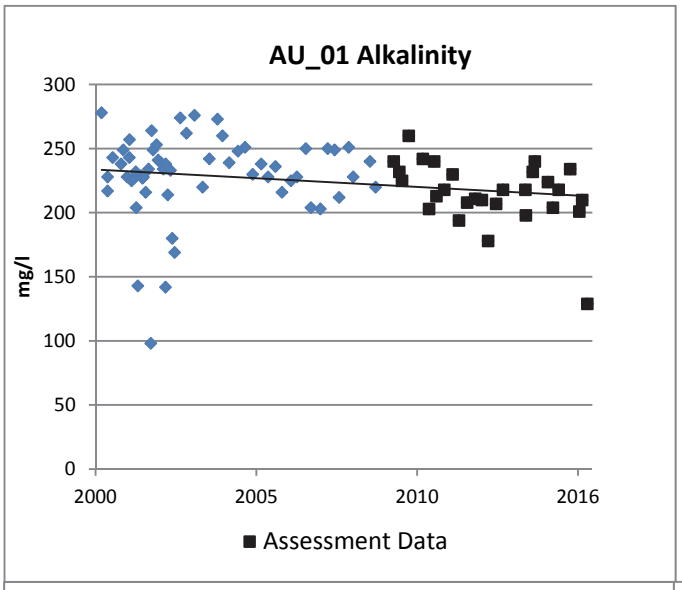
Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	44	13.0	31.3	26.1	0
AU_02		FS	40	15.6	30.8	24.6	0
AU_03		FS	40	14.3	30.7	25.2	0
AU_04		FS	37	14.2	30.0	24.4	0

Trend analysis did not indicate any trends in water temperature in any of the AUs over time or with respect to flow.

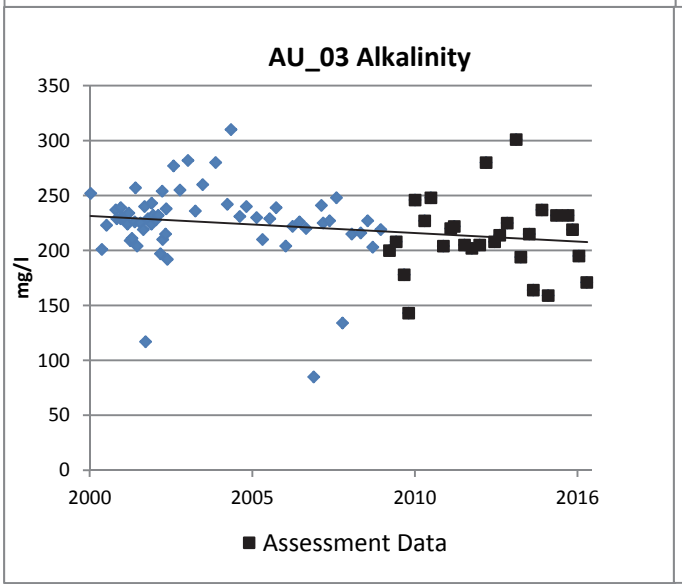
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	44	7.3	8.2	7.8	0	0
AU_02		FS	40	7.5	8.3	7.8	0	0
AU_03		FS	40	7.5	8.3	7.8	0	0
AU_04		FS	34	7.0	8.0	7.5	0	0

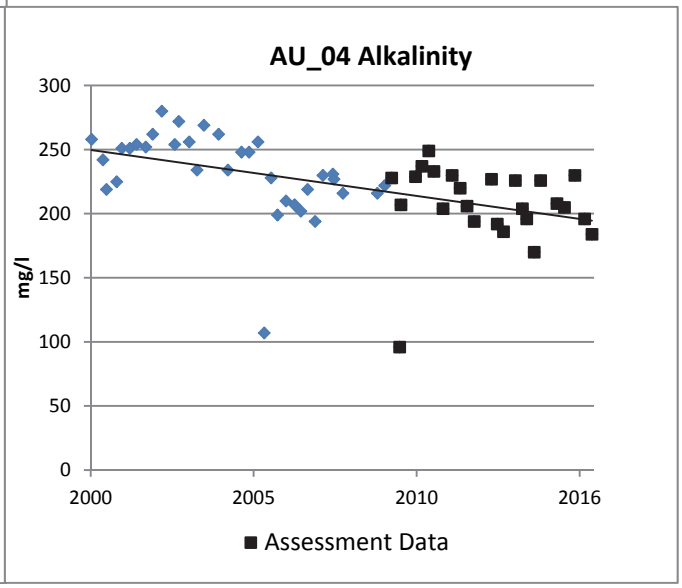
Trend analysis did not indicate any trends in pH levels in any of the AUs time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	129	260	218
AU_02		N/A	28	161	257	224
AU_03		N/A	28	143	301	211
AU_04		N/A	25	96	249	207



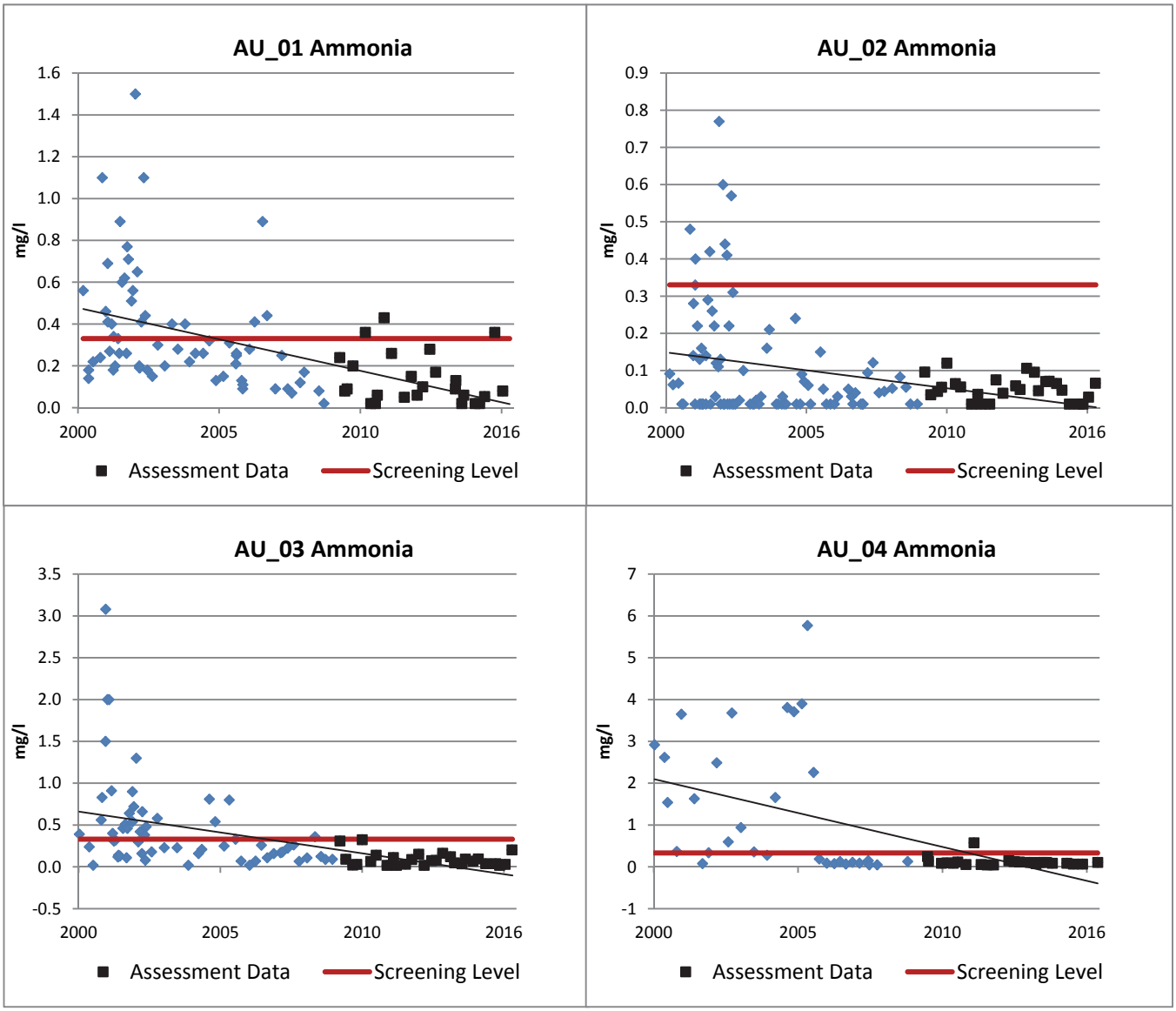
Trend analysis indicates decreasing trends in alkalinity in AU_01 (t = -2.00, p = 0.048), in AU_03 (t = -2.05, p = 0.044), and in AU_04 (t = -4.27, p = 0.000) over time.





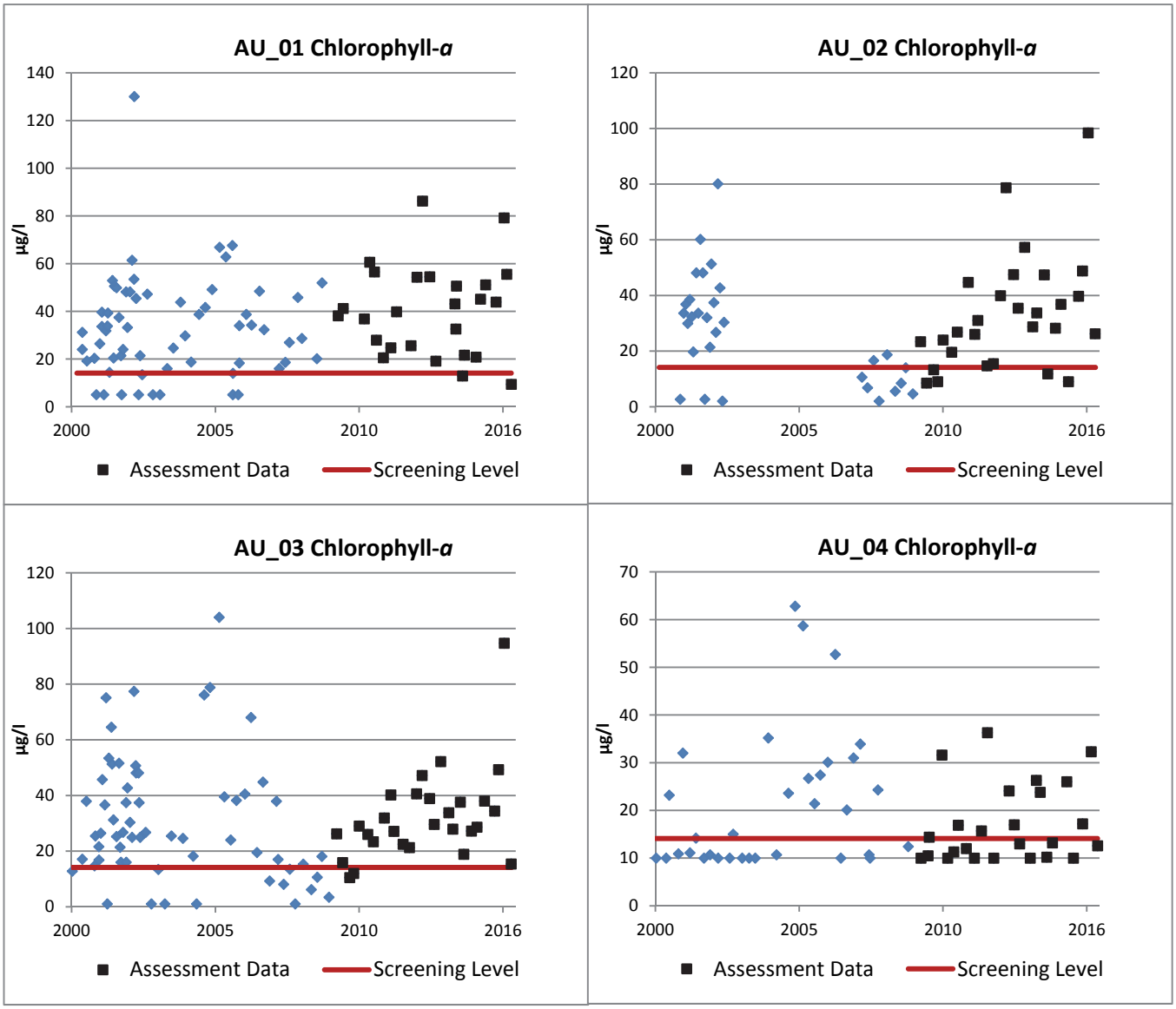
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	25	<0.02	0.43	0.09	5	3
AU_02		NC	27	<0.01	0.12	0.05	6	0
AU_03		NC	28	<0.02	0.32	0.07	4	0
AU_04		NC	3	<0.05	0.58	0.1	1	1

Trend analysis indicates decreasing trends in ammonia concentrations in AU_01 (t = --5.74, p = 0.000), in AU_02 (t = -2.82, p = 0.006), in AU_03 (t = -4.96, p = 0.000), and in AU_04 (t = -4.62, p = 0.000) over time.



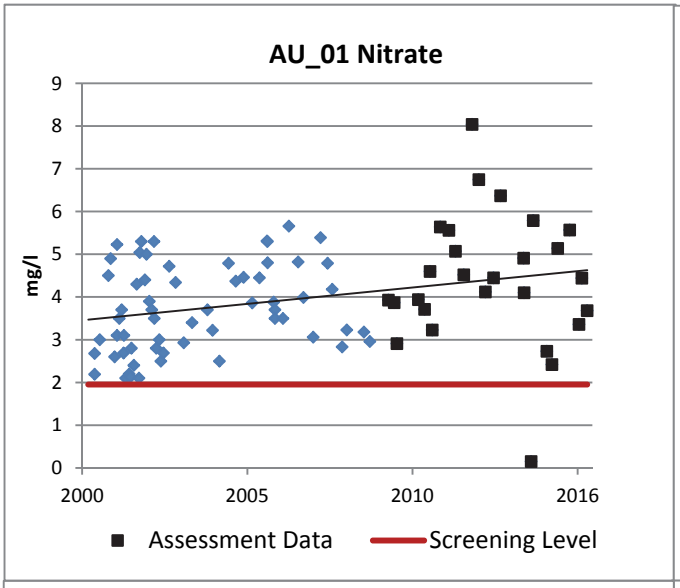
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	26	9.42	86.2	40.5	0	24
AU_02		CS	28	8.5	98.4	28.4	0	23
AU_03		CS	28	10.5	94.7	28.8	0	26
AU_04		CS	25	<10	36.3	13.2	6	12

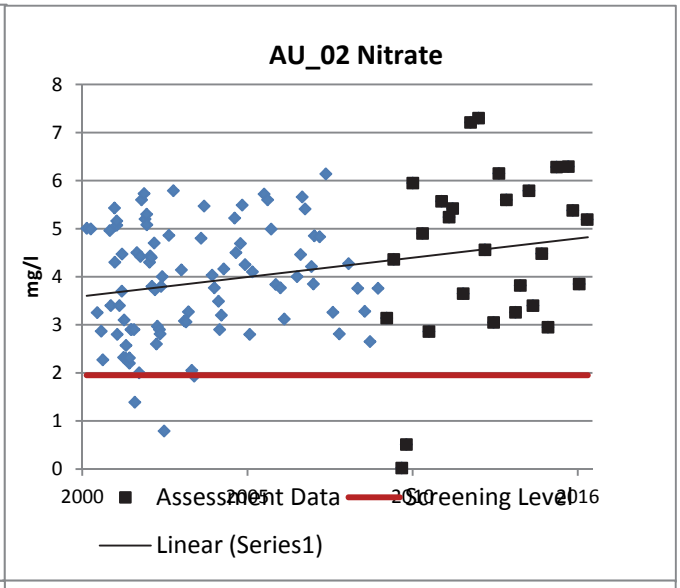
All of the AUs have been assessed as having a concern for chlorophyll-*a*. Trend analysis did not indicate any trends in any of the AUs time or with respect to flow.

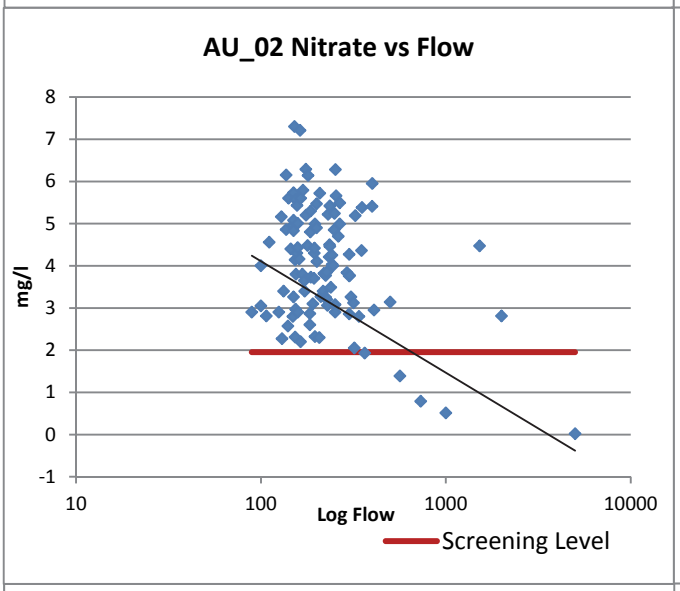


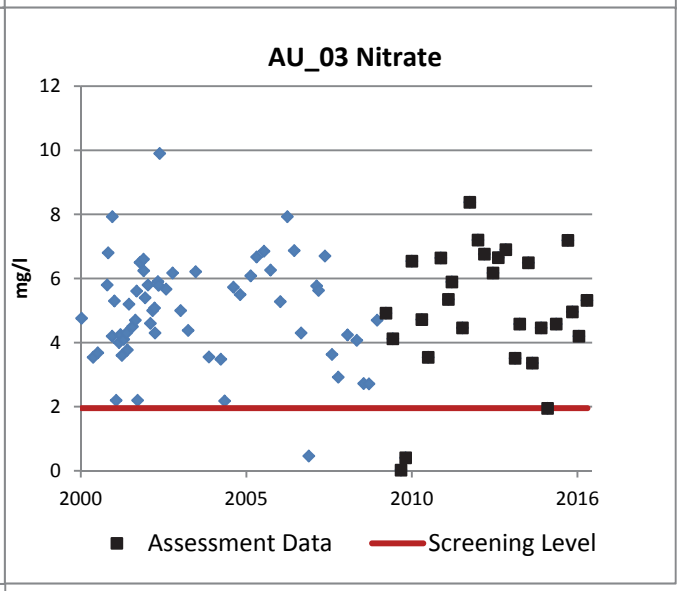
Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	CS	27	0.15	8.04	4.44	0	26
AU_02		CS	28	<0.02	7.3	4.73	1	26
AU_03		CS	28	<0.02	8.38	4.94	1	25
AU_04		CS	24	1.13	13.8	7.74	0	23

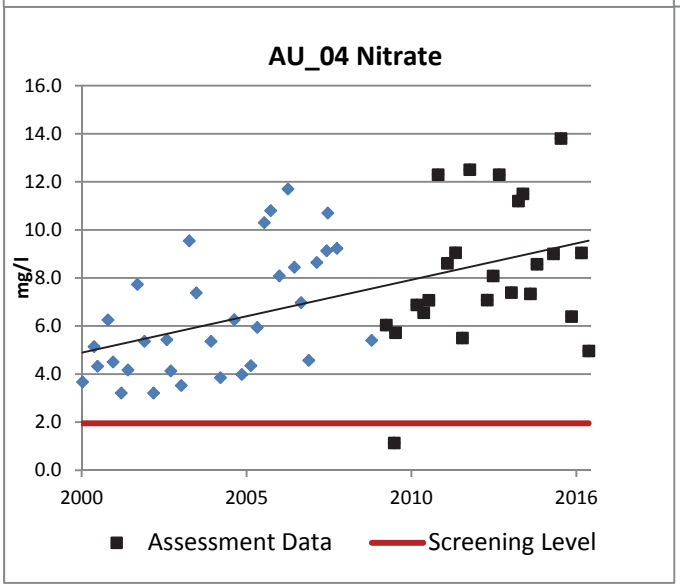
All of the AUs have been assessed as having a concern for nitrate. Trend analysis indicates increasing trends in AU_01 (t = 2.78, p = 0.007), in AU_02 (t = 2.95, p = 0.004), and in AU_04 (t = 4.29, p = 0.000) over time, and a decreasing trend in AU_02 (t = -3.48, p = 0.001) with respect to flow.


AU_01 Nitrate
mg/l
Assessment Data
Screening Level

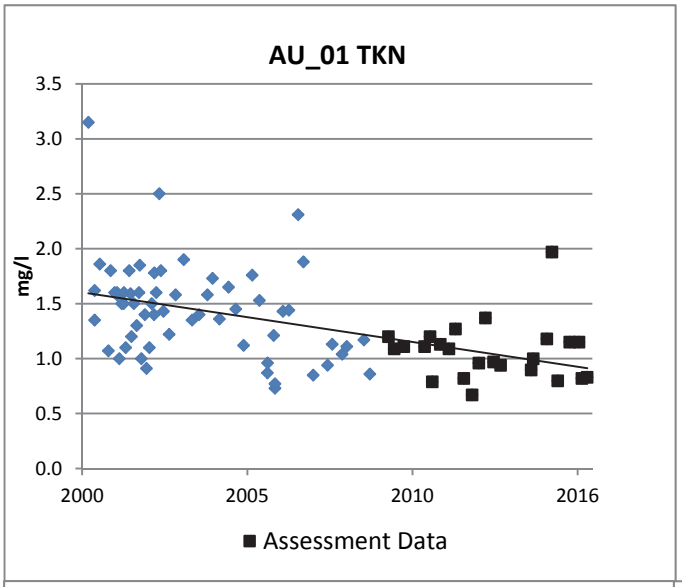

AU_02 Nitrate
mg/l
Assessment Data
Screening Level
Linear (Series1)


AU_02 Nitrate vs Flow
mg/l
Log Flow
Screening Level

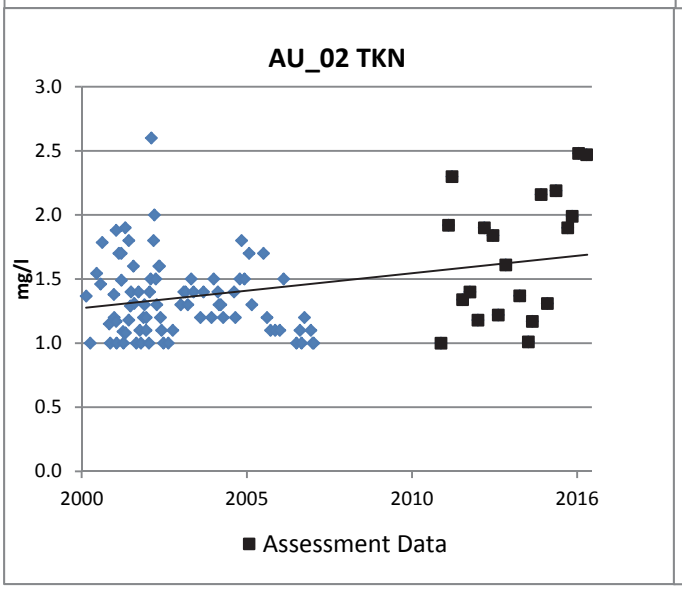

AU_03 Nitrate
mg/l
Assessment Data
Screening Level

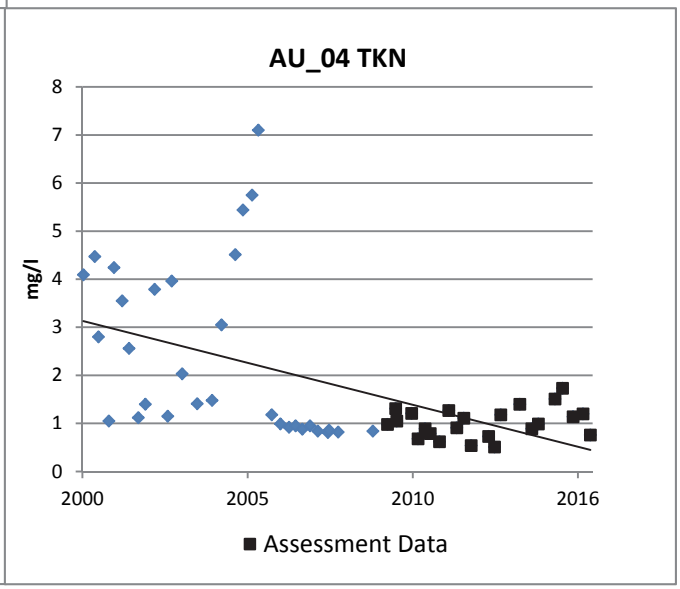

AU_04 Nitrate
mg/l
Assessment Data
Screening Level

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	0.67	1.97	1.09
AU_02		N/A	20	1	2.48	1.72
AU_03		N/A	21	0.8	3.29	1.52
AU_04		N/A	23	0.51	1.73	0.99



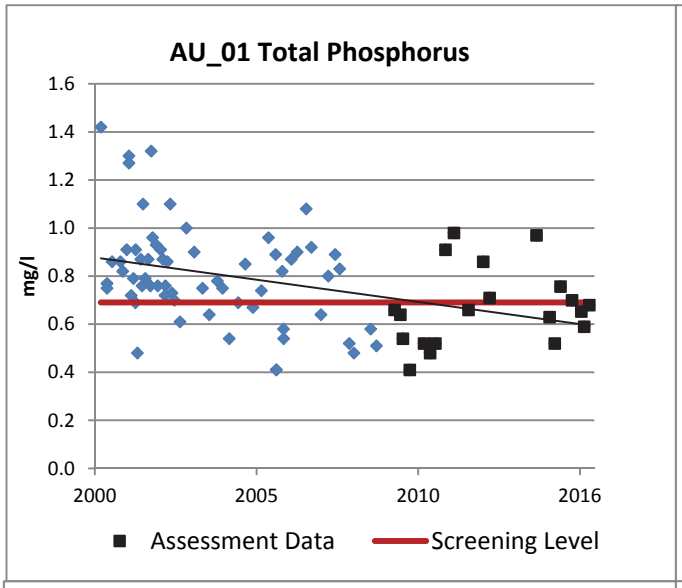
Trend analysis indicates decreasing trends in TKN concentrations in AU_01 (t = -5.10, p = 0.000) and in AU_04 (t = -4.49, p = 0.000) and an increasing trend in AU_02 (t = 3.61, p = 0.004) over time.

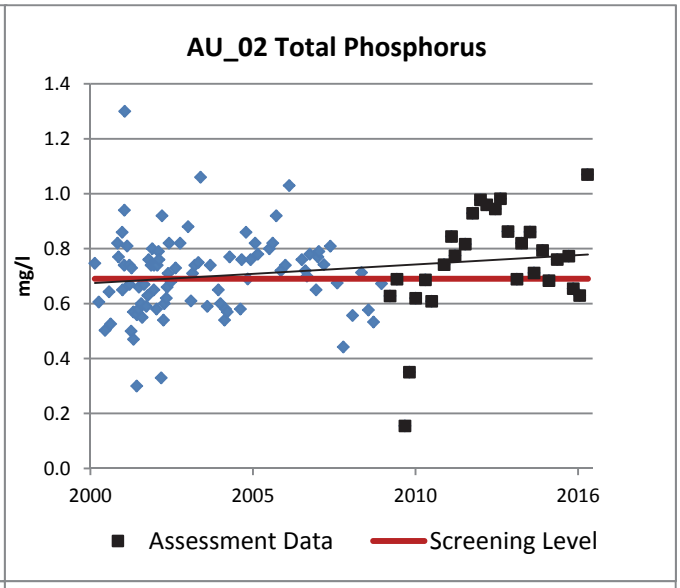


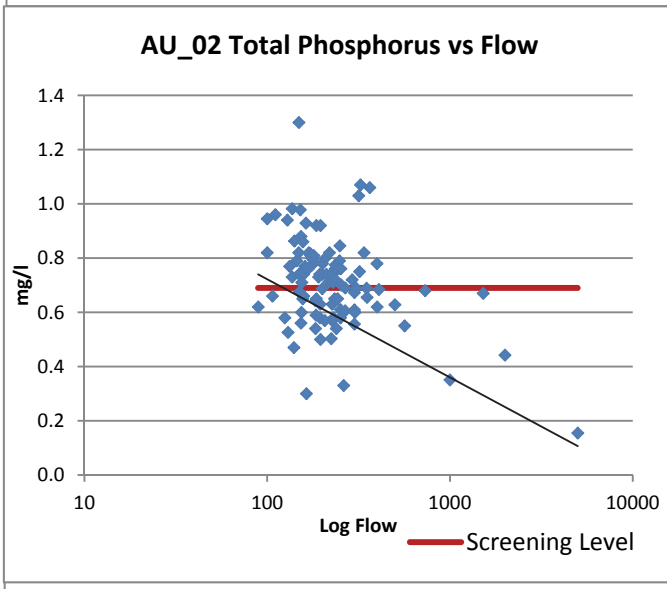


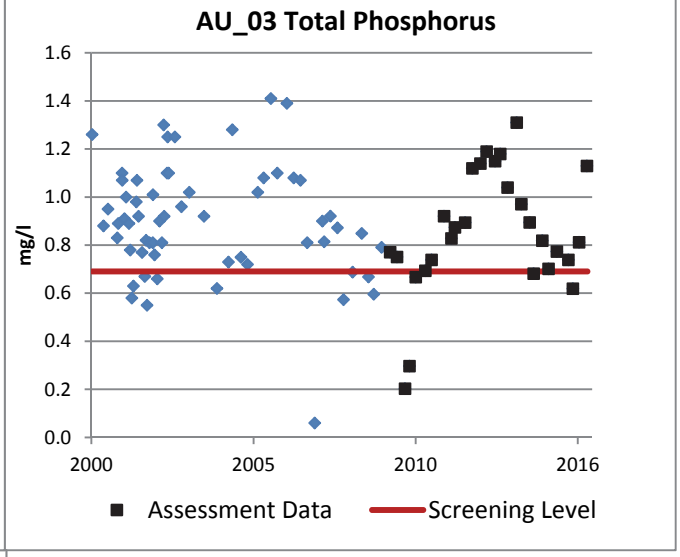
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0..69 mg/l	CS	21	0.16	0.74	0.32	0	7
AU_02		CS	28	0.16	1.07	0.77	0	17
AU_03		CS	28	0.20	1.31	0.82	0	23
AU_04		CS	20	0.79	2.41	1.43	0	20

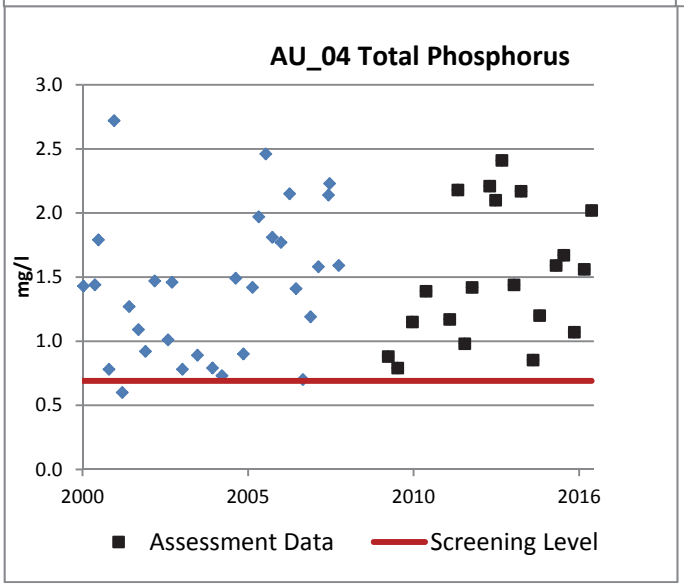
All of the AUs have been assessed as having a concern for total phosphorus. Trend analysis indicates a decreasing trend in AU_01 (t = -4.21, p = 0.000) and an increasing trend in AU_02 (t = 2.44, p = 0.016) over time, and a decreasing trend in AU_02 (t = -3.66, p = 0.000) with respect to flow.


AU_01 Total Phosphorus
mg/l
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2005
2010
2016
Assessment Data
Screening Level

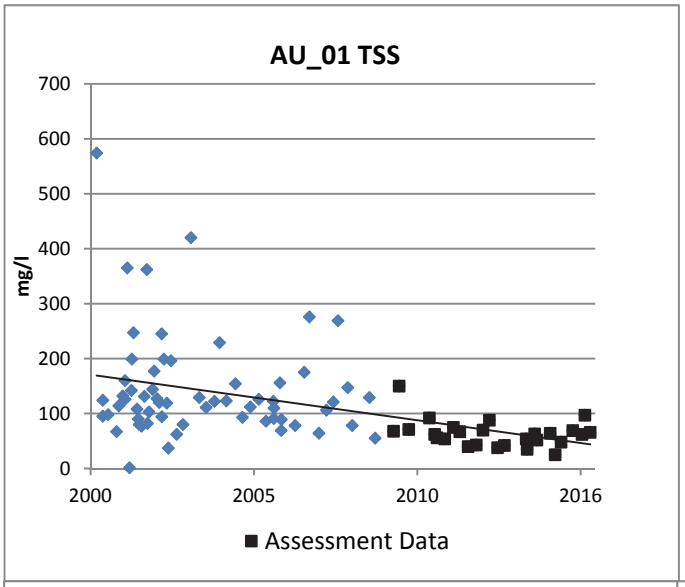

AU_02 Total Phosphorus
mg/l
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2005
2010
2016
Assessment Data
Screening Level


AU_02 Total Phosphorus vs Flow
mg/l
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
10
100
1000
10000
Log Flow
Screening Level

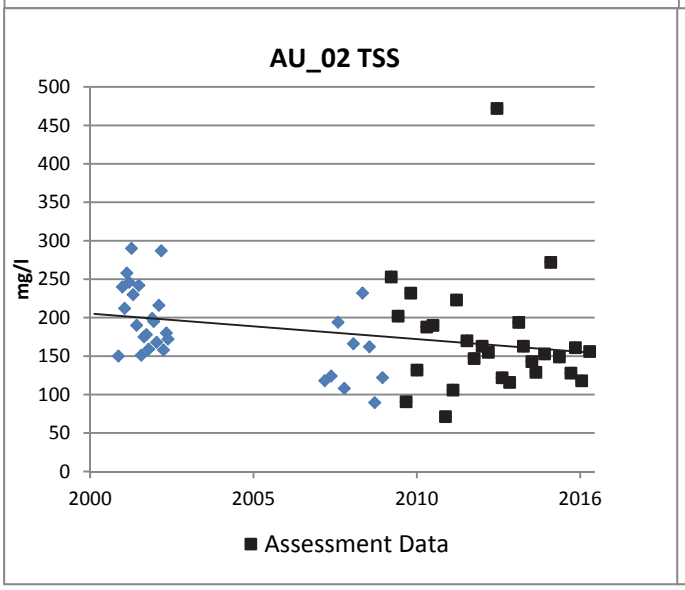

AU_03 Total Phosphorus
mg/l
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2005
2010
2016
Assessment Data
Screening Level

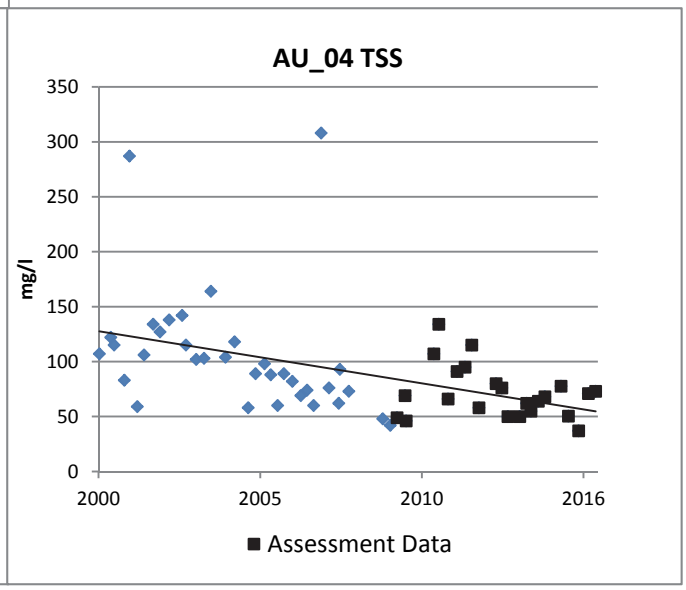

AU_04 Total Phosphorus
mg/l
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2005
2010
2016
Assessment Data
Screening Level

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	27	25.2	150	62
AU_02		N/A	28	71.5	472	156
AU_03		N/A	28	74.8	739	139
AU_04		N/A	23	37	134	68

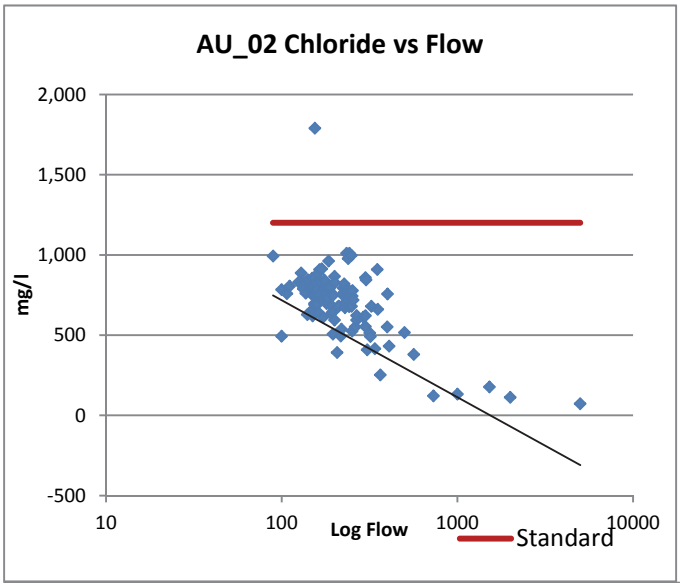


Trend analysis indicates decreasing trends in TSS concentration in AU_01 (t = -4.58, p = 0.000), in AU_02 (t = -2.04, 0.046), and in AU_04 (t = -3.73, p = 0.000) over time.

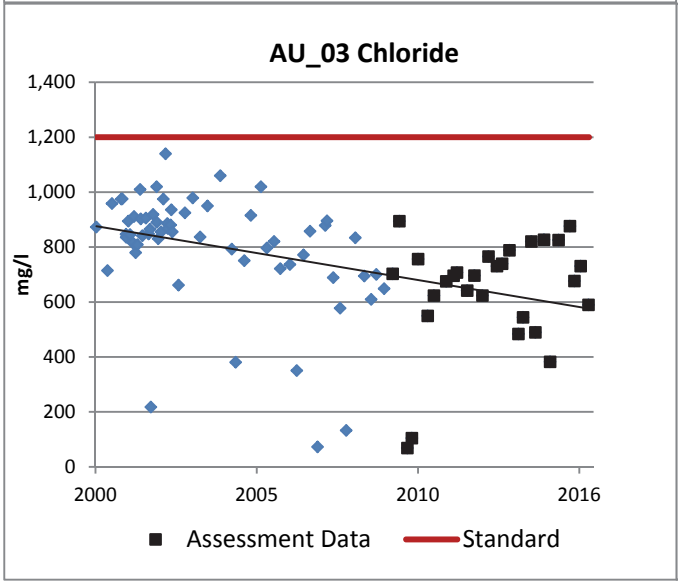


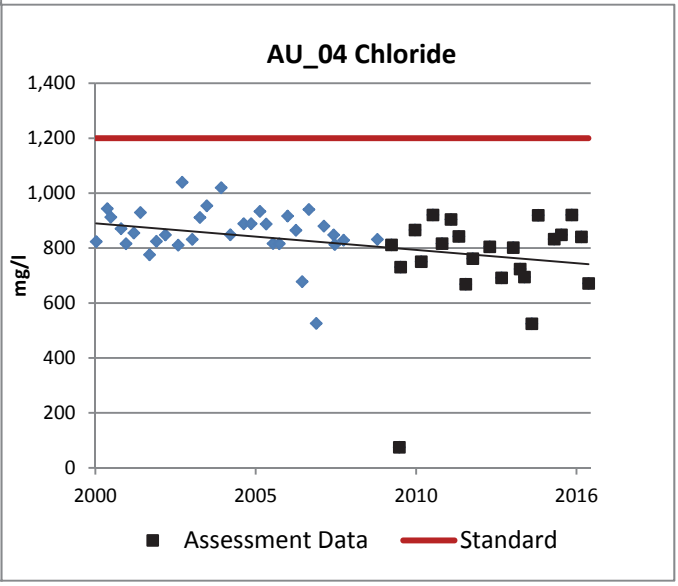


Chloride		Status	# samples	Min	Max	Average	ND	>1200
AU_01	1200 mg/l	FS	26	553	2030	873	0	2
AU_02		FS	28	72.4	909	536	0	0
AU_03		FS	28	69.1	895	644	0	0
AU_04		FS	23	75	921	758	0	0

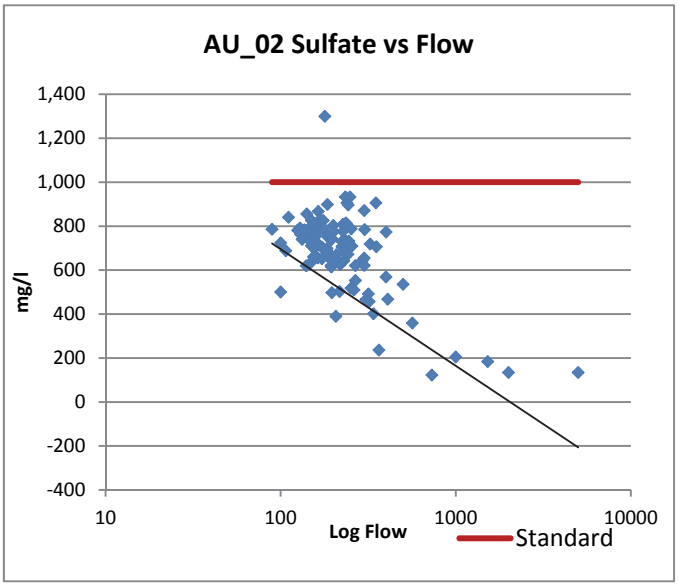


Trend analysis indicates decreasing trends in chloride concentrations in AU_03 (t = -4.28, p = 0.000) and in AU_04 (t = -2.45, p = 0.018) over time, and a decreasing trend in AU_02 (t = -7.51, p = 0.000) with respect to flow.



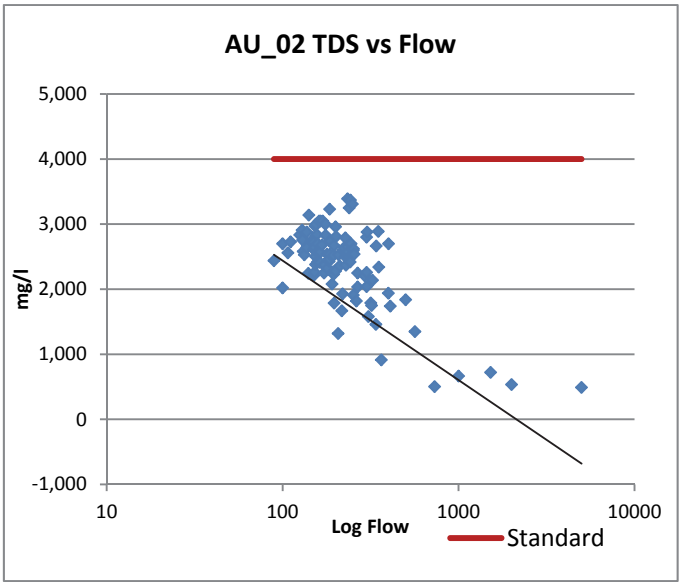


Sulfate		Status	# samples	Min	Max	Average	ND	>1100
AU_01	1000 mg/l	FS	27	586	1010	806	0	0
AU_02		FS	28	135	1300	349	0	1
AU_03		FS	28	134	901	662	0	0
AU_04		FS	24	89	858	688	0	0

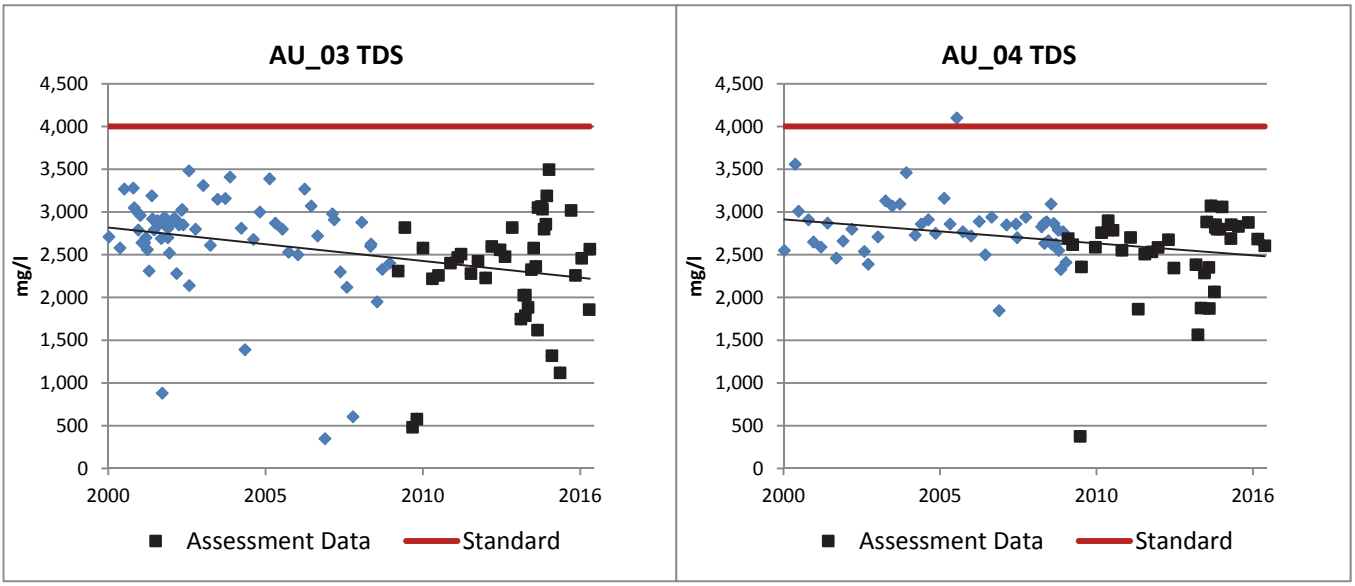


Trend analysis indicates a decreasing trend in sulfate concentrations AU_02 (t = -7.43, p = 0.000) with respect to flow.

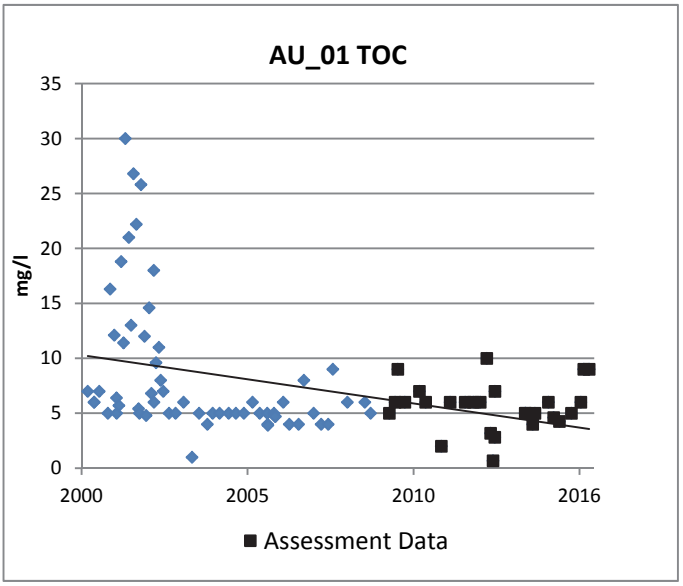
TDS		Status	# samples	Min	Max	Average	ND	>4000
AU_01	4000 mg/l	FS	41	845	4966	2734	0	1
AU_02		FS	40	492	3308	2358	0	0
AU_03		FS	40	484	3497	2313	0	0
AU_04		FS	36	376	3074	2503	0	0



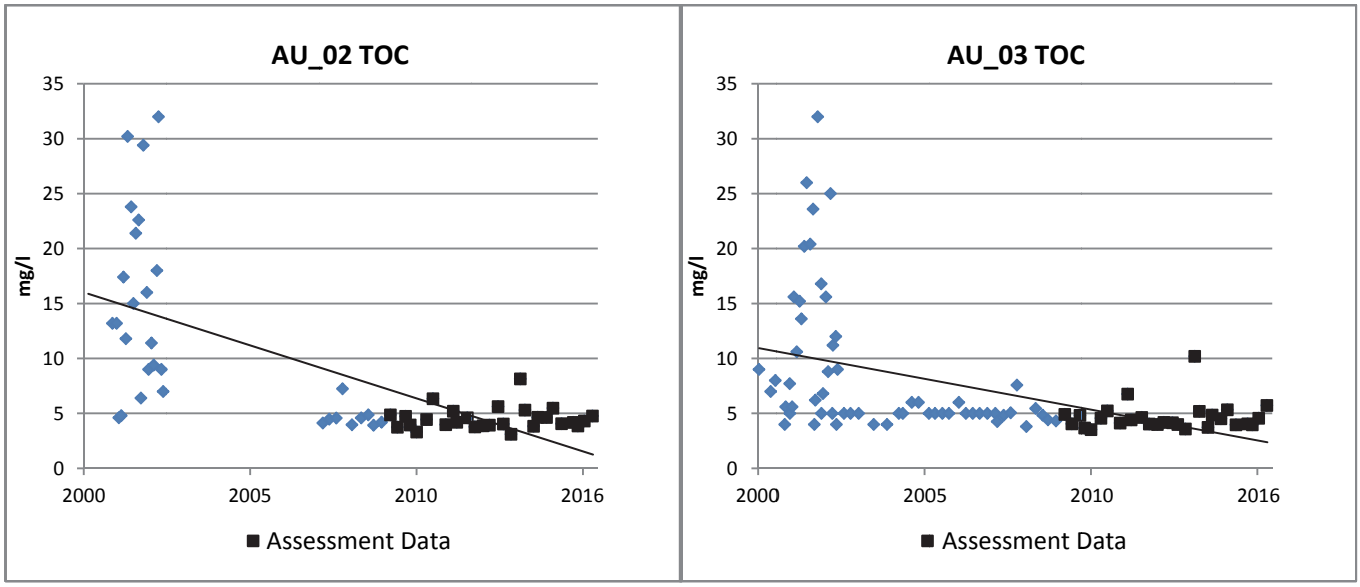
Trend analysis indicates decreasing trends in TDS concentrations in AU_03 (t = -3.26, p = 0.002) and in AU_04 (t = -2.60, p = 0.011) over time, and a decreasing trend in AU_02 (t = -10.04, p = 0.000) with respect to flow.



TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	27	0.68	10	6
AU_02		N/A	28	3.11	8.15	4.26
AU_03		N/A	28	3.53	10.2	4.30
AU_04		N/A	23	4	8	6



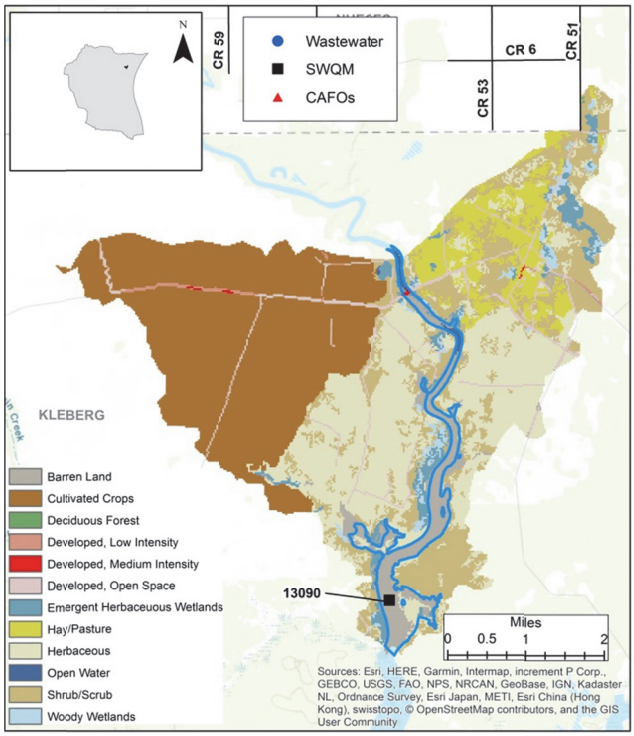
Trend analysis indicates decreasing trends in TOC concentrations in AU_01 (t = -3.76, p = 0.000), in AU_02 (t = -6.70, p = 0.000), and in AU_03 (t = 4.83, p = 0.000).



Sampling locations for Station 13079 at US 77 (left), Station 13080 at FM 506 (right) and Station 16445 at Dilworth Road (below)

PETRONILA CREEK TIDAL – SEGMENT 2203

Segment 2203, Petronila Creek above Tidal, flows 14 miles from a point 0.6 miles upstream of a private road crossing near Laureles Ranch in Kleberg County to the confluence with Chiltipin Creek / Alazan Bay in Kleberg County. Its watershed is 10,918 acres, and is almost entirely within the King Ranch, consisting primarily of crop and pasture lands.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13090** 1.2 km upstream of the confluence with Tunas Creek**.** Due to its location being on King Ranch property, accessibility is sometimes an issue.

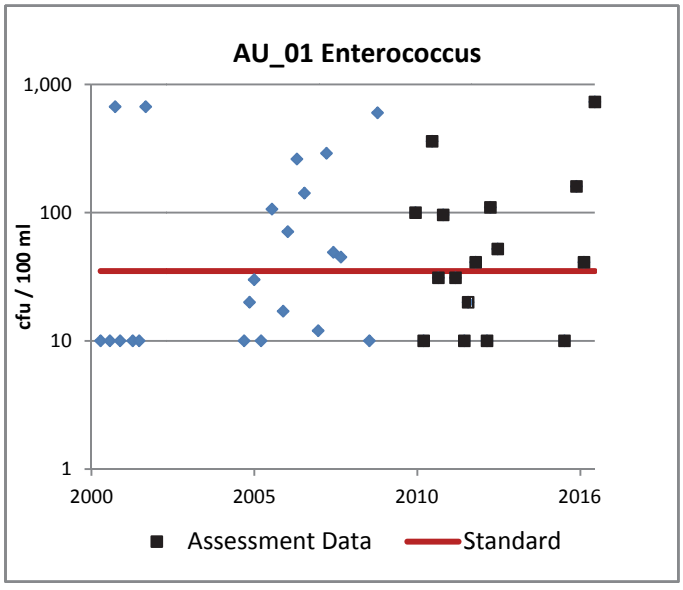
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	22	1.0	19.5	10.4	1	1
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	NS	16	<10	730	47.8	1	9



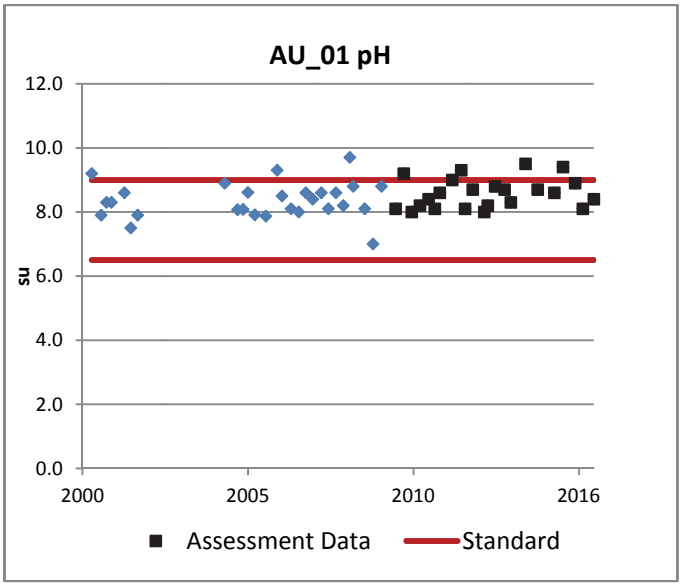
The segment is listed as being impaired for bacteria for contact recreation. There is no public access along this portion of the creek. Trend analysis did not indicate any trends in Enterococci concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	37	11.9	32.2	24.5	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	CN	23	8.0	9.5	8.6	0	4



The segment has been assessed as having a concern for pH. The pH levels do, on occasion, exceed the upper standard, but not on a regular basis. The source of these exceedances is unknown. Trend analysis did not indicate any trends over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	31	184	86

Trend analysis did not indicate any trends in alkalinity over time.

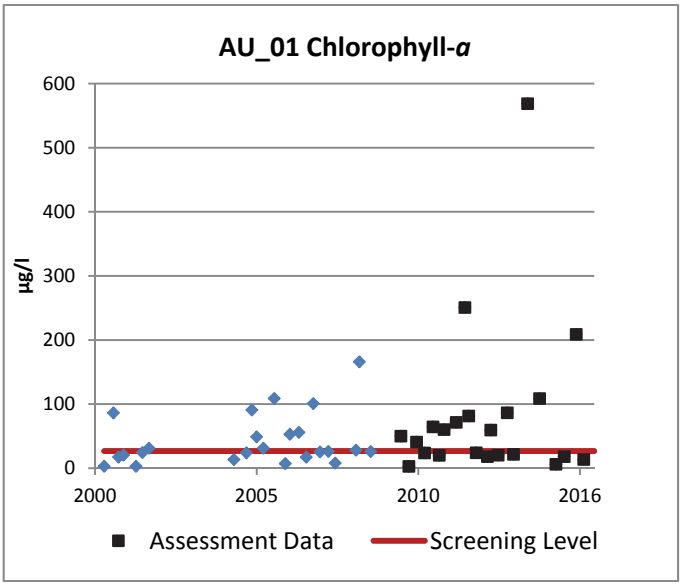
Ammonia		Status	# samples	Min	Max	Median	ND	>0.11
AU_01	0.11 mg/l	NC	21	<0.02	0.15	0.02	14	1

Trend analysis did not indicate any trends in ammonia concentrations over time.

As mentioned in the opening description, the Petronila Creek Tidal segment and its watershed are located within the King Ranch. This area is circled on the adjacent map.

Map copied from https://king-ranch.com/about-us/maps/.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>26.7
AU_01	26.7µg/l	CS	22	<3	569	45.6	1	12



The segment has been assessed as having a concern for chlorophyll-*a*. Trend analysis did not indicate any trends over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.37
AU_01	0.37 mg/l	NC	22	<0.02	0.04	0.02	21	0

Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	0.76	3.56	1.55

Trend analysis did not indicate any trends in TKN concentrations over time.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	16	<0.02	0.48	0.28	2	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	4	650	63

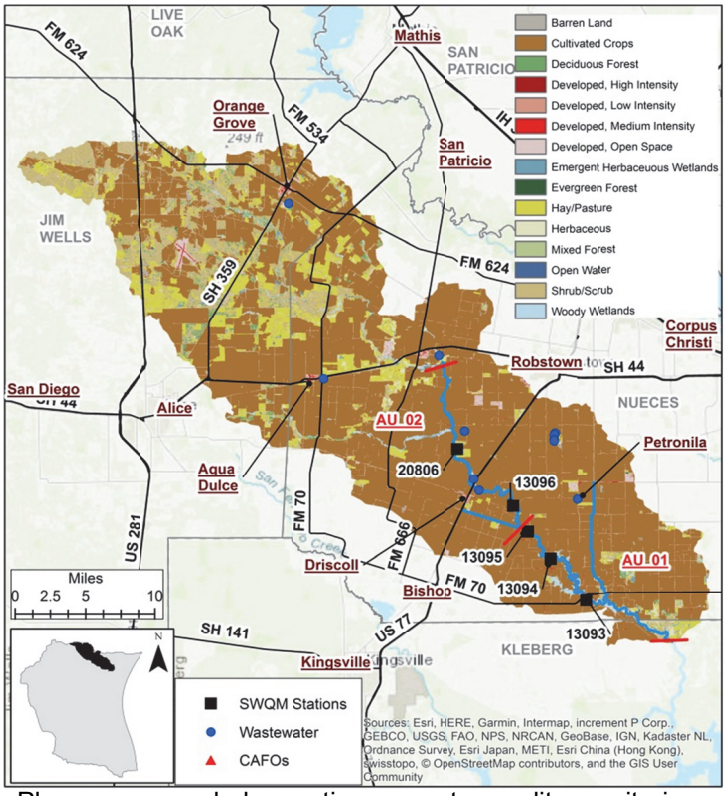
Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	4.71	75	13.6

Trend analysis did not indicate any trends in TOC concentrations over time.

PETRONILA CREEK ABOVE TIDAL – SEGMENT 2204

Segment 2204, Petronila Creek above Tidal, flows 35 miles from the confluence of Agua Dulce and Banquete Creeks in Nueces County to a point 0.6 miles upstream of a private road crossing near Laureles Ranch in Kleberg County. The segment is divided into two AUs. **AU_01** is from the downstream end to the confluence with 2204A, an unnamed drainage ditch at -97.7, 27.65. **AU_02** is from the confluence with 2204A to the upstream end of the segment. Its watershed is 1,867,755 acres.



There are a number of WWTPs that discharge to this segment and a storm water discharge permit for a hazardous waste landfill.

Special Studies

The segment has been impaired for TDS, chloride, and sulfate since 1999. A TMDL was conducted and concluded that the impairments were the result of historic oil and gas operations. The Implementation Plan recommended a continuous water quality monitoring (CWQM) station and a program to properly plug and abandon wells that are no longer active. The CWQM instrumentation was installed by TCEQ at the location of Station 13093 at FM 70 in December 2006. NRA performed the routine maintenance. The CWQM station was discontinued in February 2016 after it was determined that sufficient data had been gathered to help understand the relationship between water level and pollutant concentrations.

The Railroad Commission of Texas (RRC) has been working with identified operators to properly plug and abandon wells and to remove contaminated soils. Where operators cannot be identified, the RRC has been doing the work as funding is available.

NRA completed a review of the Implementation Plan in FY 2014. Continued routine monitoring and monthly monitoring in the creek and tributaries were recommended and implemented. This monitoring began in FY 2015 and will continue at least through FY 2019.

Water Quality Analysis

The analysis for AU_01 is based on data from **Station 13094** at the FM 892. The analysis for AU_02 is based on data from **Station 13096** at FM 665.

Aquatic Life Use Assessment

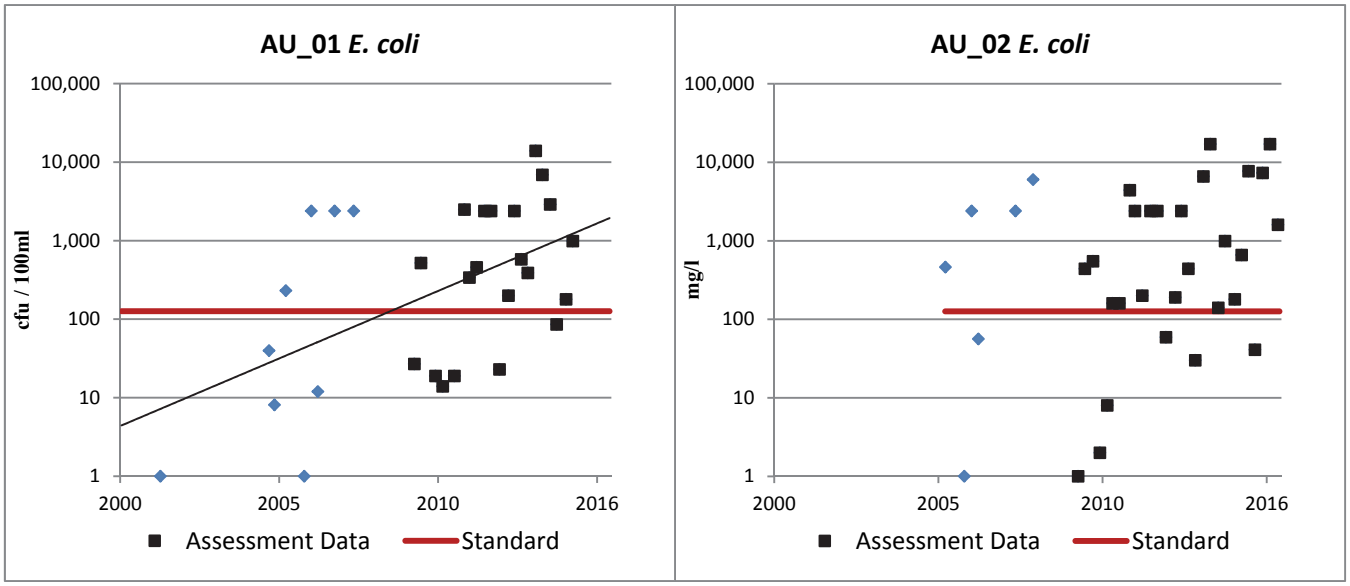
DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	81	3.6	19.6	7.7	0	2
	Screening Level 4.0 mg/l	NC						
AU_02	Minimum 3.0 mg/l	FS	81	2.8	19.3	8.6	1	2
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD in either AU over time or with respect to flow.

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	21	11	14,000	382.4	0	15
AU_02		FS	28	<1	17,000	428.5	1	22

AU_01 is listed as being impaired for bacteria for contact recreation. The data shown for AU_02 exceed the standard is based on data from a single sampling location. Lower bacteria levels at other sampling locations may be low enough to reduce the geomean and keep this AU from being listed. Trend analysis indicates an increasing trend in AU_01 (t = 3.28, p = 0.003) over time. The source of the bacteria could be from colonias and/or WWTP discharges.



General Use

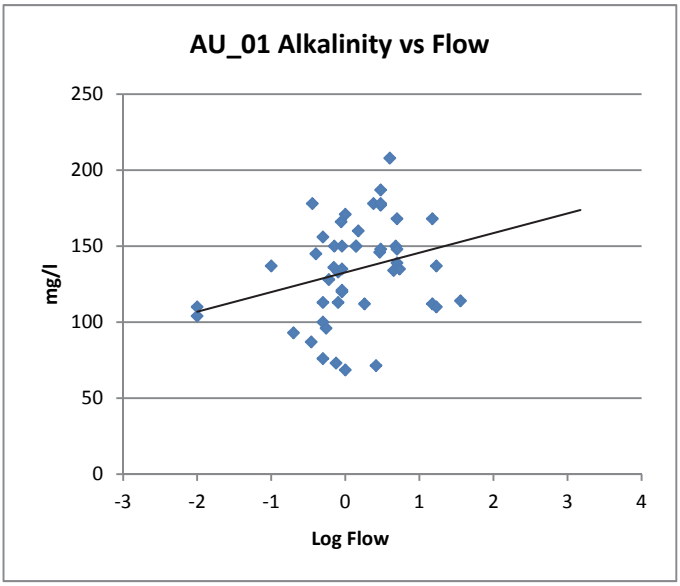
Water Temperature		Status	# samples	Min	Max	Median	>35.0
AU_01	35.0 °C	FS	81	8.2	31.1	23.3	0
AU_02		FS	81	8.2	32.9	22.9	0

Trend analysis did not indicate any trends in water temperature in either AU over time or with respect to flow.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	80	7.0	8.3	7.6	0	0
AU_02		FS	54	7.0	8.3	7.6	0	0

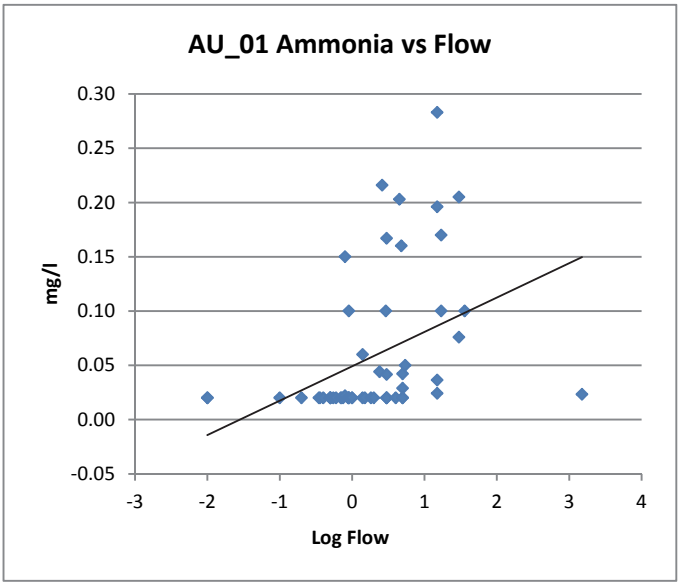
Trend analysis did not indicate any trends in pH in either AU over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	68.6	208	135.5
AU_02		N/A	28	72.2	201	117



Trend analysis indicates an increasing trend in alkalinity in AU_01 (t = 2.12, p = 0.036) with respect to flow.

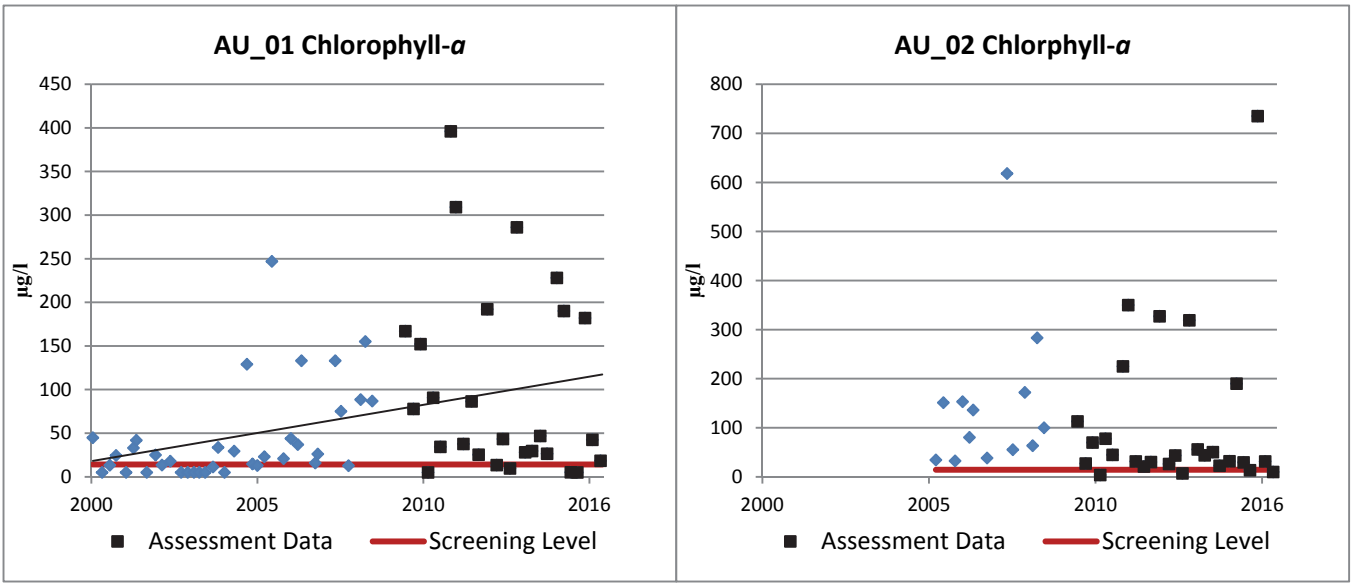
Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	36	<0.02	0.283	0.02	19	0
AU_02		NC	28	<0.02	0.686	0.03	13	2



Trend analysis indicates an increasing trend in ammonia concentrations in AU_01 (t = 2.32, p = 0.022) with respect to flow. However, all values are below the screening level.

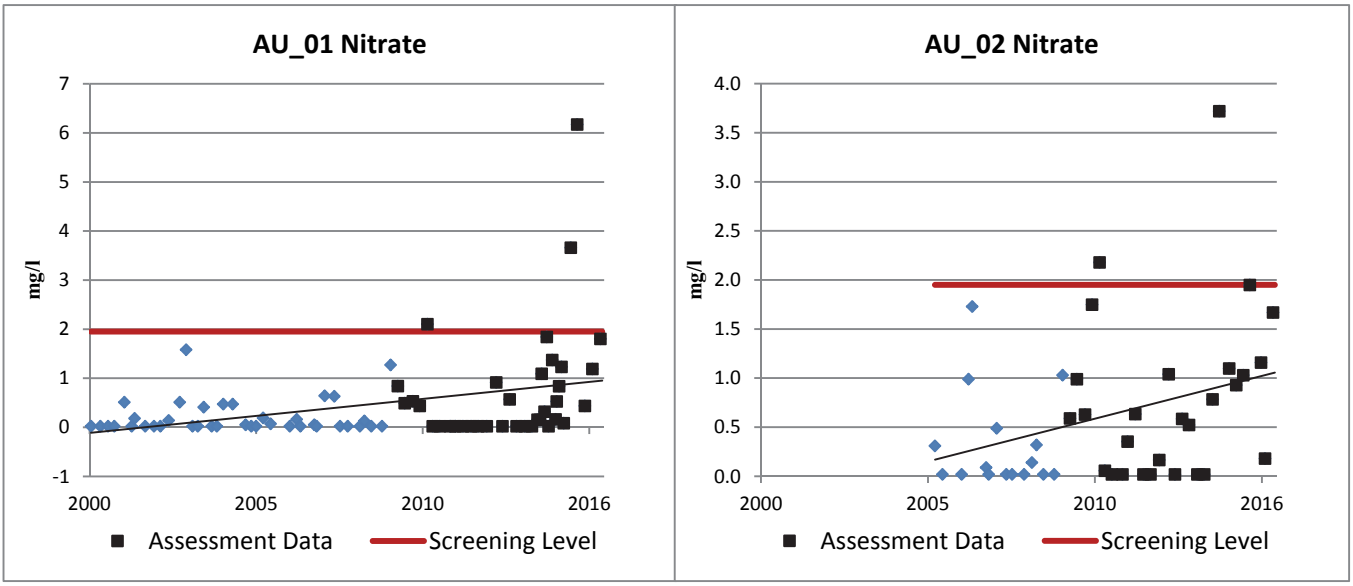
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	27	<5	396	43.3	2	22
AU_02		CS	27	3.8	735	43.6	0	23

Both AUs have been assessed as having concerns for chlorophyll-*a*. Trend analysis indicates an increasing trend in AU_01 (t = 2.50, p = 0.00) over time. Most of the more recent data in both AUs have been well above the screening level.

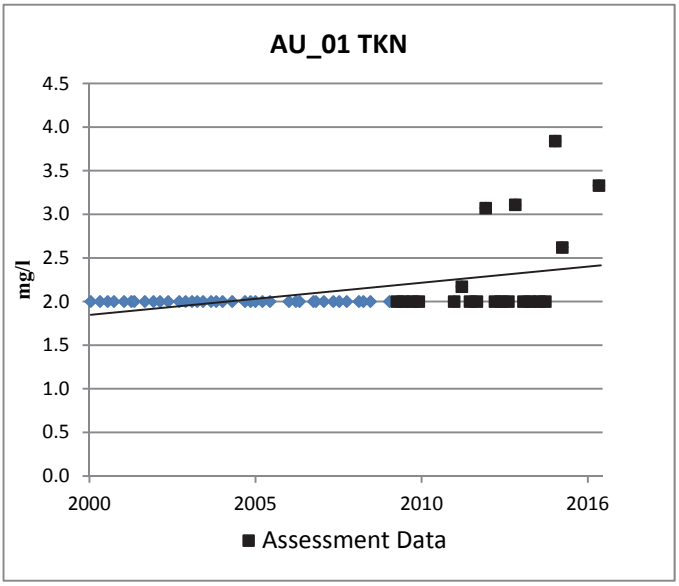


Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	NC	36	<0.02	6.17	0.377	13	3
AU_02		NC	28	<0.02	3.72	0.61	7	2

Trend analysis indicates increasing trends in nitrate concentrations in AU_01 (t = 3.17, p = 0.002) and in AU_02 (t = 2.31, p = 0.026) over time, and some of the more recent data have exceeded the screening level.

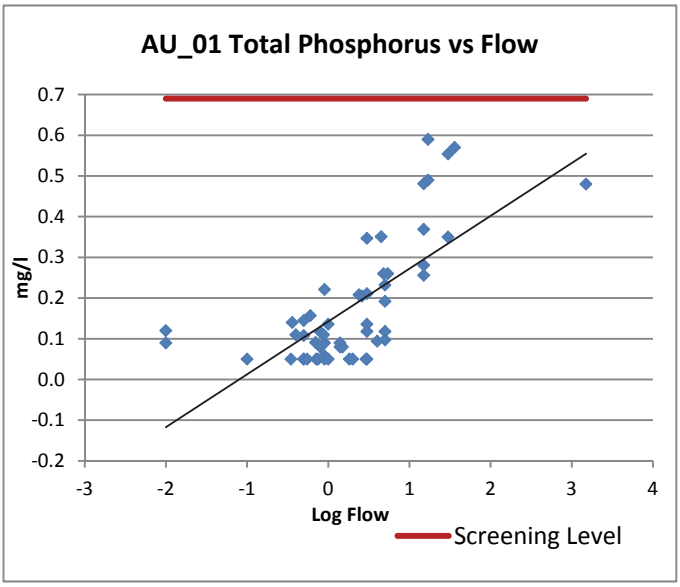


TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	20	<2	3.84	2
AU_02		N/A	20	<0.02	4.64	1.67



Trend analysis indicates an increasing trend in TKN concentrations in AU_01 (t = 3.72, p = 0.000) over time, similar to the nitrate trend.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	NC	35	<0.05	0.554	0.157	6	0
AU_02		NC	27	<0.06	0.857	0.237	2	1



Trend analysis indicates an increasing trend in total phosphorus concentrations in AU_01 (t = 4.26, p = 0.000) with respect to flow.

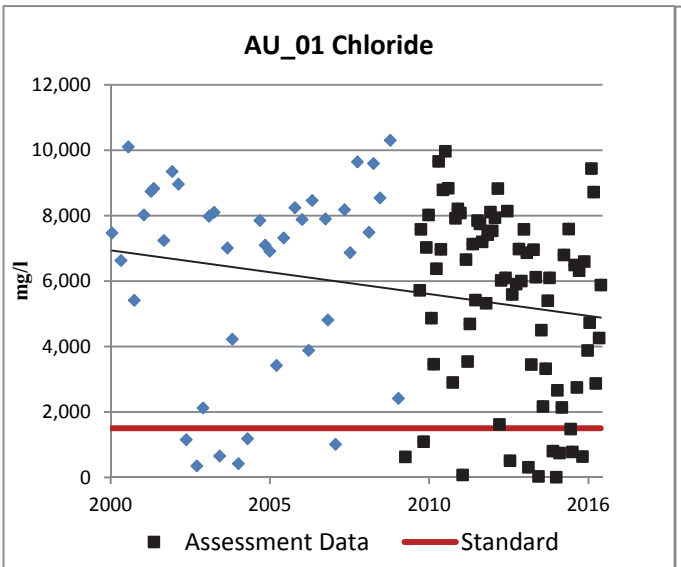
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	11	158	41.4
AU_02		N/A	28	13.9	178	39.4

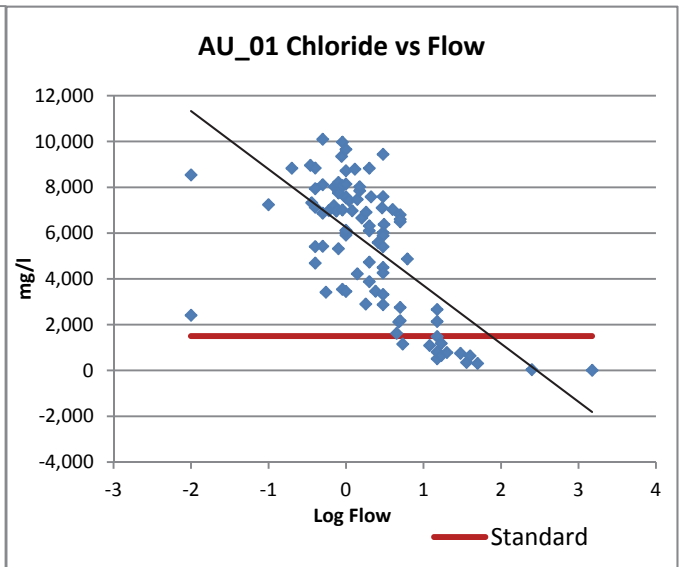
Trend analysis did not indicate any trends in TSS concentrations in either AU over time or with respect to flow.

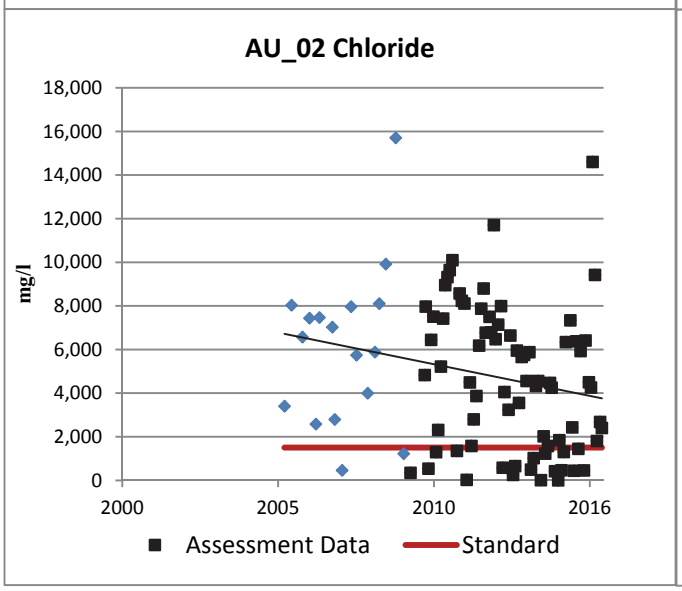
Chloride		Status	# samples	Min	Max	Average	ND	>1500
AU_01	1500 mg/l	NS	75	<5	9970	5291	1	63
AU_02		NS	76	<5	14,600	4602	1	57

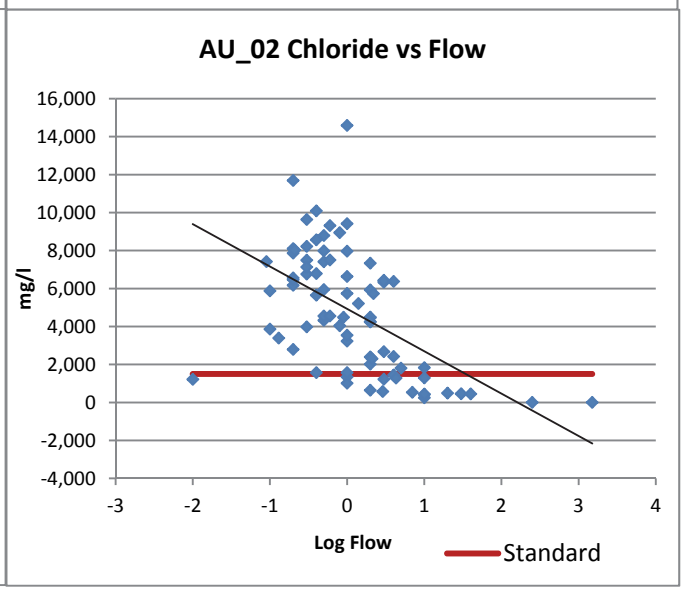
The chloride impairment in this segment is attributed to historical oil and gas production practices of discharging produced waters into the creek, ditches, and unlined ponds. These practices have also affected the groundwater. The analysis that has been conducted for the I-Plan review and sampling shows an inverse relationship between the measured chloride concentrations and the preceding three-week rainfall. The greater the rainfall totals, the lower the concentrations.

Trend analysis indicates decreasing trends in in AU_01 (t = -2.17, p = 0.032) and in AU_02 (t = -2.23, p = 0.026) over time, and also decreasing trends in AU_01 (t = -8.95, p = 0.000) and in AU_02 (t = -5.47, p = 0.000) with respect to flow. Although there is a slight improvement in the concentrations over time, the impairment will remain for the foreseeable future.



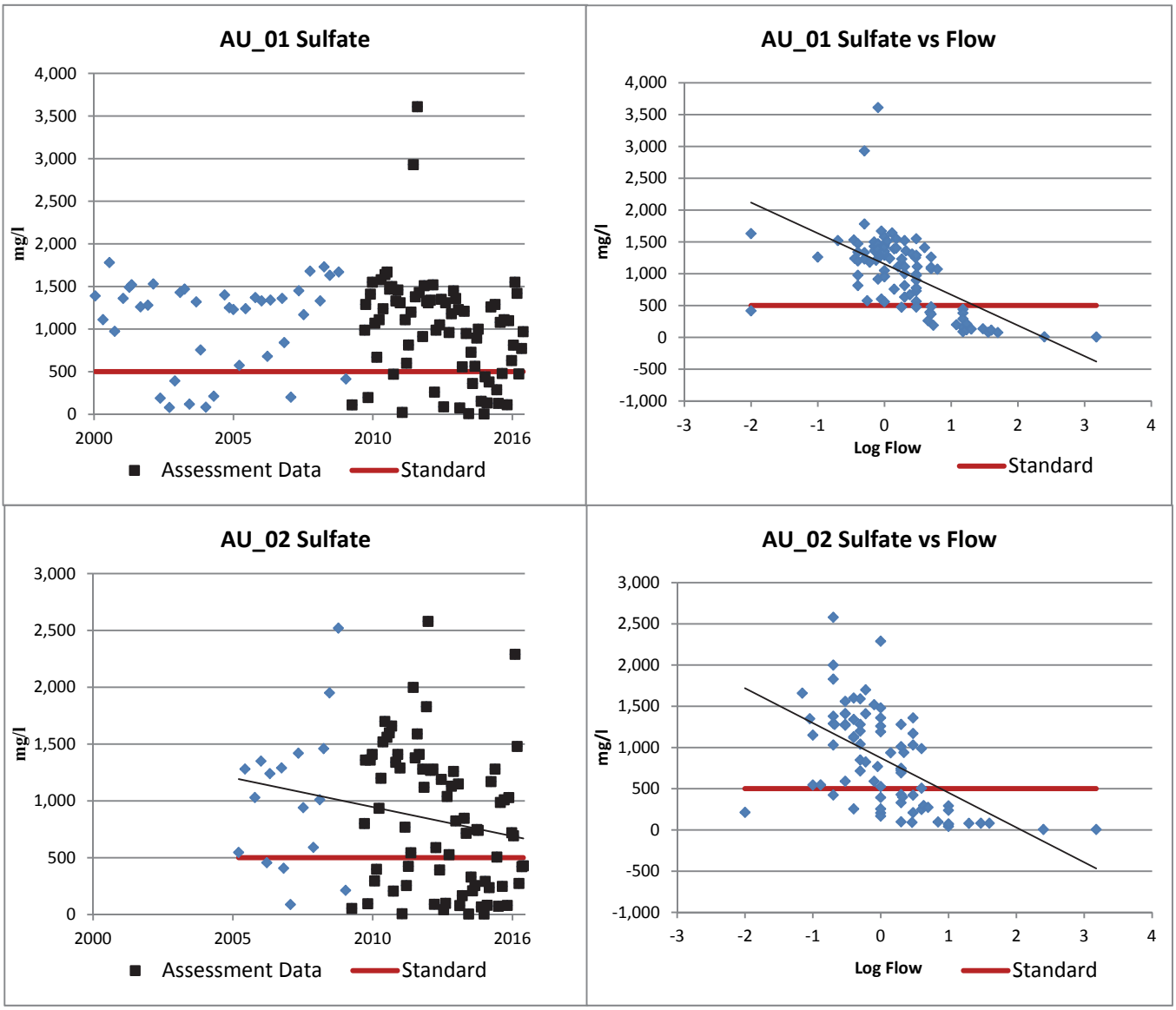






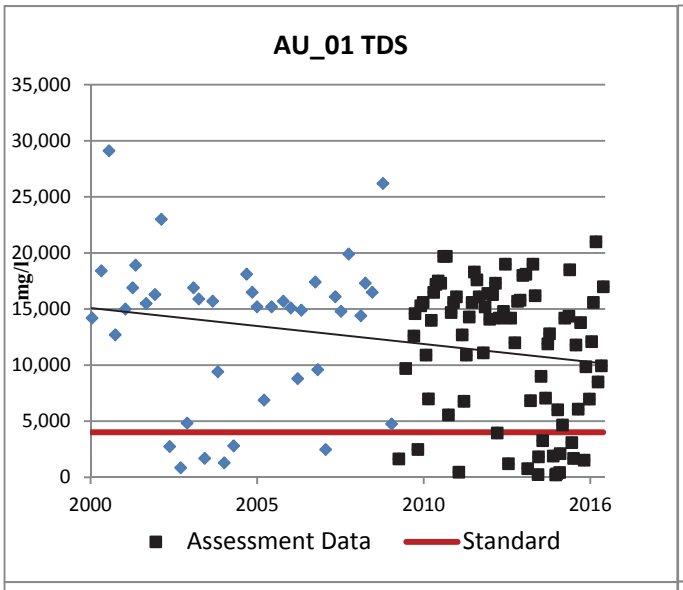
Sulfate		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	NS	76	<5	3610	990	1	57
AU_02		NS	77	<5	2580	828	2	48

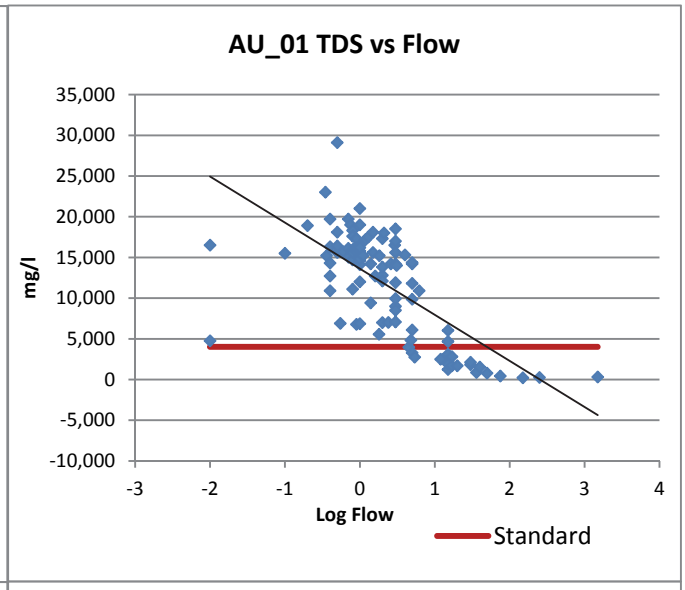
The brine discharges of the historical oil and gas production practices are also the cause of the sulfate impairment on this segment. The data analysis is similar to the analysis of the chloride data, except that there is no statistical decreasing trend over time in AU_01. Trend analysis indicates a decreasing trend in AU_02 (t = -2.16, p = 0.033) over time, and decreasing trends in AU_01 (t = -8.03, p = 000) and in AU_02 (t = -6.27, p = 0.000) with respect to flow. The impairment will remain for the foreseeable future.

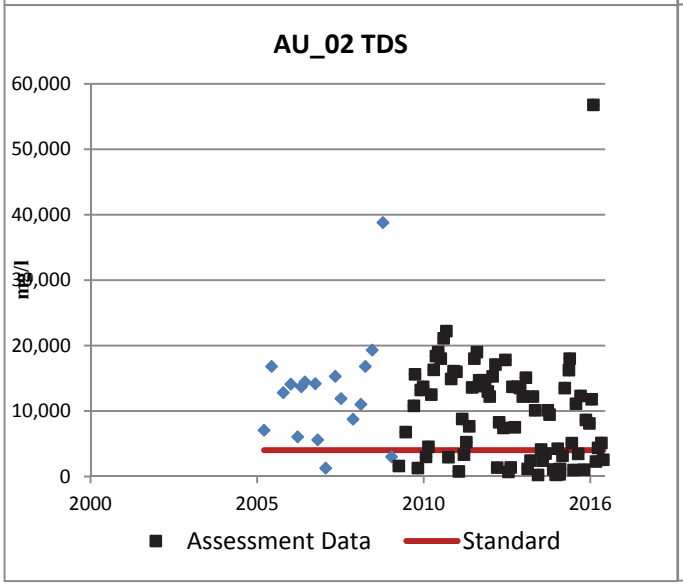


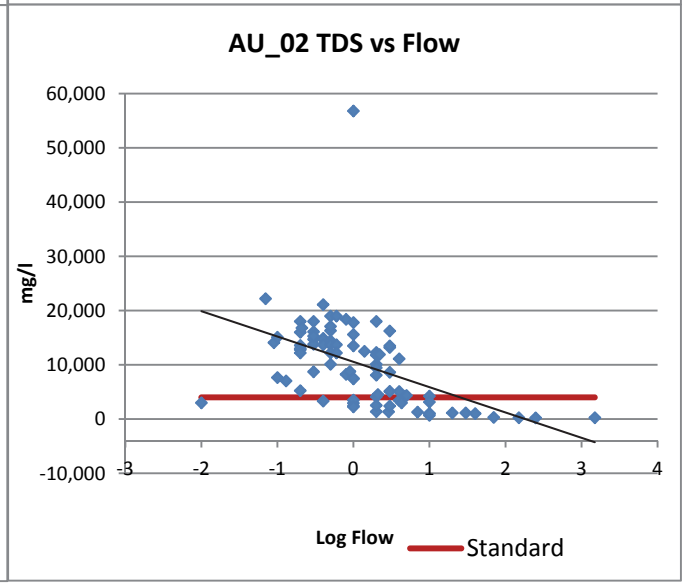
TDS		Status	# samples	Min	Max	Average	ND	>4000
AU_01	4000 mg/l	NS	81	214	21,000	11,166	0	64
AU_02		NS	81	232	56,800	9693	0	56

The brine discharges of the historical oil and gas production practices are also the cause of the TDS impairment on this segment. The data analysis is similar to the analysis of the chloride data, except that there is no statistical decreasing trend over time in AU_02. Trend analysis indicates a decreasing trend in AU_01 (t = -2.41, p = 0.017) over time, and decreasing trends in AU_01 (t = -9.25, p = 000) and in AU_02 (t = -4.92, p = 0.000) with respect to flow. The impairment will remain for the foreseeable future.

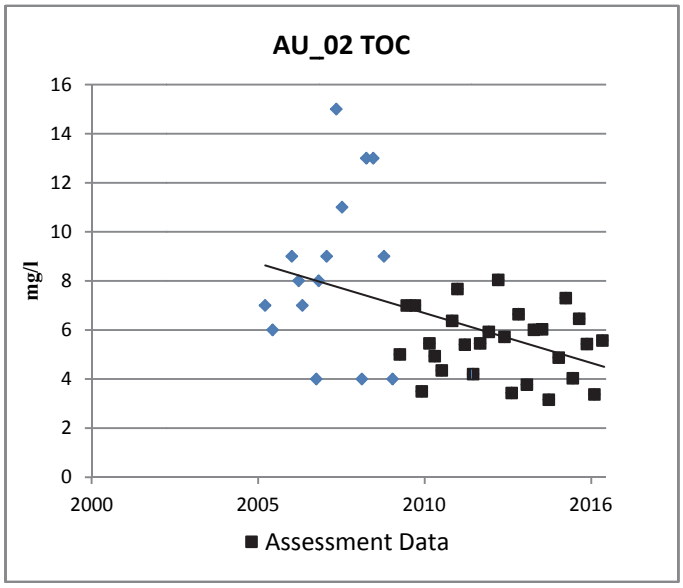

AU_01 TDS
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
mg/l
2000
2005
2010
2016
Assessment Data
Standard


AU_01 TDS vs Flow
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
mg/l
-3
-2
-1
0
1
2
3
4
Log Flow
Standard


AU_02 TDS
60,000
50,000
40,000
30,000
20,000
10,000
0
mg/l
2000
2005
2010
2016
Assessment Data
Standard


AU_02 TDS vs Flow
60,000
50,000
40,000
30,000
20,000
10,000
0
-10,000
mg/l
-3
-2
-1
0
1
2
3
4
Log Flow
Standard

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	5.31	9.05	7.29
AU_02		N/A	28	3.16	8.04	5.45



Trend analysis indicates a decreasing trend in TOC in AU_02 (t = -3.23, p = 0.00) over time.

Sampling location for Station 13094 at FM 892

Sampling location for Station 13096 at FM 665

WATERSHED SUMMARIES OF THE BAYS AND ESTUARIES AND GULF OF MEXICO

The characteristics of the bays and estuaries along the south Texas coast vary greatly. The systems in the north receive more freshwater inflows than those in the south. The Laguna Madre (Segment 2491) extends from Corpus Christi Bay (Segment 2481) south to Port Isabel, and is one of the few hypersaline systems in the world.

Water Quality Overview

Low DO, nitrate, and chlorophyll-*a* are the most common concerns in the bays, and low DO and bacteria are the most common impairments. Four of the bays, Mesquite Bay, Aransas Bay, Redfish Bay, and South Bay, do not have any concerns or impairments.

The low DO, based on current standards, in Oso Bay and the Laguna Madre, are naturally occurring and do not appear to negatively affect aquatic life. Many studies have been conducted and proposed changes to the standards are being evaluated.

A TMDL and Implementation Plan to address the bacteria impairment in Oso Creek is under development. Management measures include creating habitat away from the creek for birds and wildlife, addressing failing OSSFs, and how the maintenance of the drainage ditches from the City of Corpus Christi to the creek can be improved to reduce loadings from rainfall runoff events.

Although not an assessed concern, local fishermen and women are concerned about nitrate and the health of Baffin Bay fisheries. Local scientists have conducted studies that concluded that the nitrogen levels are from organic nitrogen. A Baffin Bay work group has been formed and is working towards the development of a WPP for the bay. The tributaries to the bay, Petronila Creek, San Fernando Creek, and Los Olmos Creek will be included in the WPP. Additional monitoring is being planned on these creeks to better understand their contributions to pollutant loadings to the bay.

FY2018 Monitoring Locations in the Bays and Estuaries and Gulf of Mexico

Segment Name	Station Id	Description	Monitoring Entity	Conventional Bacteria, Field	Other
2462 San Antonio Bay / Hynes Bay/ Guadalupe Bay	13397	At Intercoastal Waterway (ICWW) Buoy C-17	TCEQ Region 14	Bi-annually	1 Metals in Sediment
2463 Mesquite Bay	13400	South of ICWW Marker 13	TCEQ Region 14	Bi-annually	
2471 Aransas Bay	13402	At intersection of Intracoastal Canal and Lydia Ann Channel south of Rockport	TCEQ Region 14	Bi-annually	
2471A Little Bay	16232	At Broadway and the inlet Canal to Canoe Lake in Rockport	TCEQ Region 14	Bi-annually	
2472 Copano Bay / Port Bay / Mission Bay	13405	Port Bay at middle of SH 118 west of Rockport	NRA	Quarterly	
	14783	125 m south and 655 m east of Copano Bay Dr. at Spoonbill east of Bayside	TCEQ Region 14	Bi-annually	
	17724	At Approx 3.5 mile west of Copano Bay Fishing pier at South end of Copano Bay Causeway SH 35	TCEQ Region 14	Bi-annually	
2473 St. Charles Bay	17692	Approx 0.5 mi NE of Hail Point on Lamar Peninsula	TCEQ Region 14	Bi-annually	
2481 Corpus Christi Bay	13409 (AU_01)	La Quinta CM 16	TCEQ Region 14	Bi-annually	1 Metals in Water 1 Metals in Sediment 1 Organics in Sediment
	13411 (AU_02)	1 km NE of Intersection of Doddridge St. and Ocean Dr.	TCEQ Region 14	Bi-annually	
	14355 (AU_03)	0.4 km east of Shamrock Island and 1.5 km NE of Shamrock Point	TCEQ Region 14	Bi-annually	
2482 Nueces Bay	13422	0.5 mi from south shore at east overhead powerline	TCEQ Region 14	Bi-annually	1 Metals in Water 1 Metals in Sediment 1 Organics in Sediment
2483 Redfish Bay	13426	At SH 361 at 3rd bridge between Aransas Pass and Port Aransas	NRA	Quarterly	
2483A Conn Brown Harbor	18848	Mid harbor 50 m northeast of the intersection of Huff St and E Maddox Ave in Aransas Pass	NRA	Quarterly	
2484 Corpus Christi Inner Harbor	13432	0.4 km east of Navigation Blvd draw bridge	TCEQ Region 14	Bi-annually	
	13439	Viola turning basin	TCEQ Region 14	Bi-annually	1 Metals in water
2485 Oso Bay	13440	Immediately offshore at tip of peninsula at Padre Island Drive/southbound SH 358	NRA	Quarterly	
2485A Oso Creek	13028	Immediately downstream of SH 286 south of Corpus Christi	NRA	Quarterly	
	13029	Immediately downstream of FM783 SW of Corpus Christi	NRA	Quarterly	

Segment Name	Station Id	Description	Monitoring Entity	Conventional Bacteria, Field	Other
2491 Laguna Madre	13445 (AU_01)	at ICWW approx. 1.6 km southwest from the southernmost point of south Bird Island	TCEQ Region 14	Bi-annually	
	13446 (AU_03)	ICWW at Marker 129 east of Port Isabel	TCEQ Region 15	Quarterly	
	13447 (AU_02)	Intersection of ICWW and Arroyo Colorado	TCEQ Region 15	Quarterly	10 Organics in Sediment
	13448 (AU_01)	Intersection of ICWW and Port Mansfield Channel	TCEQ Region 15	Bi-annually	
	13449 (AU_01)	CM C-225A north of Port Mansfield	TCEQ Region 15	Bi-annually	
	14870 (AU_03)	200 yds off Laguna Vista shoreline	TCEQ Region 15	Quarterly	
2491B North Floodway	20930	North Floodway at US77 South of Intersection of US77 and FM 2629 in Sebastian	TCEQ Region 15	Quarterly	
2492 Baffin Bay / Alazan Bay / Cayo Del Grullo / Laguna Salada	13450	At CM 14	TCEQ Region 14	Bi-annually	
2492A San Fernando Creek	13033	At US 77 at Kingsville	NRA	Quarterly	
2493 South Bay	13459	Near ship CM 17	TCEQ Region 15	Quarterly	
	14865	Middle of bay	TCEQ Region 15	Quarterly	
2494 Brownsville Ship Channel	13460	Near ship CM35 / black buoy	TCEQ Region 15	Quarterly	
	14871	Mid-channel 595 m east of SH 48 at Foust Rd.	TCEQ Region 15	Quarterly	
	14875	Mid-channel at entrance to San Martin Lake	TCEQ Region 15	Quarterly	
2494A Port Isabel Fishing Harbor	13285	Port Isabel Fishing Harbor	TCEQ Region 15	Quarterly	
2501 Gulf of Mexico	13468 (AU_06)	At Aransas Pass 165 m south and 413 m east of tip of South Jetty near Marker R-7	TCEQ Region 14	Bi-annually	
	13470 (AU_08)	At Port Isabel, 1.18 km east and 35 m south of Brazos Santiago Pass North Jetty	TCEQ Region 15	Quarterly	

Permitted Discharges in the Bays and Estuaries and Gulf of Mexico

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2462 San Antonio Bay / Hynes Bay/ Guadalupe Bay	WQ0003995-000	Austwell Aqua Farm, Inc.	3,700.000
	WQ0004917-000	Aransas National Wildlife Refuge	937 Subsurface
	WQ0010256-001	Refugio WCID No. 1	75,000
	WQ0011117-0	City of Austwell	60,000
2471 Aransas Bay	WQ0011624-001	Aransas County MUD #1	263,000
2471A Little Bay	WQ0010054-001	City of Rockport	2,500,000
2472 Copano Bay / Port Bay / Mission Bay	WQ0004290-000	Holiday Beach WSC	120,000
	WQ0004956-000	Aransas Bay Utilities Co	61,000
	WQ0010705-001	City of Taft	900,000
	WQ0013892-001	Town of Bayside	64,200
	WQ0014925-001	City of Rockport, Port B	550,000
	WQ0011624-001	Aransas County MUD #1	88,000 Irrigation
2473 St. Charles Bay	WQ0011624-001	Aransas County MUD #1	263,000
2481 Corpus Christi Bay	WQ0001651-000	E. I. Du Pont De Nemours & Co	4,610,000 and Stormwater
	WQ0002317-000	US Department of the Navy Corpus Christi Naval Air Station (NAS)	1,500,000
	WQ0003083-000	Occidental Chemical Corporation	790,000
	WQ0005097-000	voestalpine	6,020,000
	WQ0005218-000	Nashtec	Stormwater
	WQ0005228-000	GCGV Asset Holding	Stormwater
	WQ0005254-000	Port of Corpus Christi	19,1000,000 Reject Water
	WQ0010092-001	City of Gregory	320,000
	WQ0010422-001	City of Ingleside	1,200,000
	WQ0010846-001	Nueces Co. WCID No. 4 Mustang Island North Plant	1,880,000
	WQ0010846-001	Nueces Co. WCID No. 4 Mustang Island South Plant	1,200,000
2482 Nueces Bay	WQ0001244-000	Nueces Bay WLE LP	500,000,000 Cooling Water
	WQ0010237-002	City of Odem	475,000
	WQ0010478-001	City of Portland	2,500,000
	WQ0011096-001	Sublight Enterprises, Inc. (Portland Inn)	9,000
2483 Redfish Bay	WQ0002077-000	Evonik Degussa Corporation	Stormwater
	WQ0003012-000	Gulf Marine Fabricators	4,000
	WQ0005162-000	Mile 533 Marine Ways	5,000
	WQ0010521-002	City of Aransas Pass	1,600,000
	WQ0012064-001	Gulf Marine Fabricators	12,000
	WQ0012731-001	Martin Operating Partnership, LP	3,800

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2484 Corpus Christi Inner Harbor	WQ0000349-000	Elementis Chromium LP	20,000,000
	WQ0000457-000	Flint Hills Resources LP	2,160,000
	WQ0000465-000	Valero Refining-Texas LP	3,000,000 and Stormwater
	WQ0000467-000	Citgo Refining and Chemicals	500,000 and Stormwater
	WQ0000531-000	Flint Hills Resources LP	145,000 Irrrigation and Stormwater
	WQ0001909-000	WQ0001909-000	50,000 and Stormwater
	WQ0002070-000	Magellen Terminals Holdings	1,060,000
	WQ0002075-000 (1 outfall)	Equistar Chemicals LP	2,000,000
	WQ0002540-000	Coastal Refining and Marketing	Stormwater
	WQ0002614-000	Citgo Refining and Chemicals	Stormwater
	WQ0002720-000	BTB Refining LCC	120,000 and Stormwater
	WQ0003137-000	Markwest Company	288,000 +100,000 Irrigation
	WQ0003562-000	Citgo Refining and Chemicals	Stormwater
	WQ0004158-000	Corpus Christi Cogeneration	11,000,000
	WQ0004889-000	John Bludworth Shipyard, LLC	Ballast Water
	WQ0004977-000	Citgo Refining and Chemical Co, LPP	Ballast Water
	WQ0005019-000	M&G Resins	38,500,000 Reject Water
	WQ0005024-000	Buckeye Texas Processing	197,600
	WQ0005217-000	Koch Sulfur Products Company LLC	600,000
	WQ0010401-005	City of Corpus Christi Broadway Plant:	10,000,000
2485 Oso Bay	WQ0001490-000	AEP Texas Central Barney M. Davis Plant	540,000,000 Cooling Water
	WQ0010401-004	City of Corpus Christi Oso Facility	16,200,000
2485A Oso Creek	WQ0002075-000 (2 outfalls)	Equistar Chemicals LP – Corpus Christi Plant	Stormwater
	WQ0010261-001	City of Robstown	3,000,000
	WQ0010401-003	City of Corpus Christi – Greenwood Plant	16,000,000
	WQ0011134-002	Corpus Christi Peoples Baptist Church	20,000
	WQ0014228-001	MPB Properties, Cuddihy Airfield	60,000

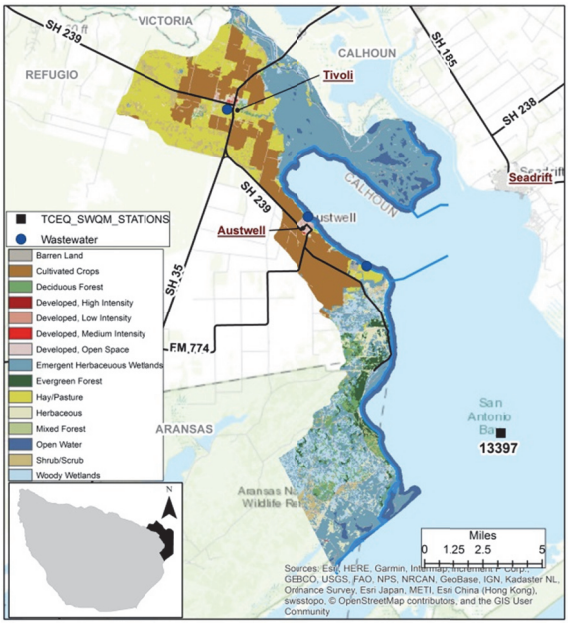
Segment	Permit Number	Entity	Permitted Discharge (gpd)
2491 Laguna Madre	WQ0002525-000	Azteca Milling	300,000 Irrigation
	WQ0002803-000	WQ0002803-000	Irrigation
	WQ0003946-000	Harlingen Shrimp Farms, LTD	8,000,000
	WQ0004480-000	North Alamo WSC	1,000,000
	WQ0004782-000	North Alamo WSC	2,000,000
	WQ0004789-000	North Alamo WSC	2,000,000
	WQ0004915-000	North Alamo WSC	1,000,000
	WQ0005159-000	Denali Water Solutions LLC	Sludge
	WQ0010365-001	City of Raymondville	1,500,000
	WQ0010401-008	City of Corpus Christi Laguna Madre	3,000,000
	WQ0010401-009	City of Corpus Christi Whitecap	2,500,000
	WQ0010682-003	Willacy Co. Navigation District:	221,000
	WQ0010757-001	Laguna Madre Water District Isla Blanca Plant	2,600,000 Irrigation
	WQ0010799-001	Jim Hogg County WCID No. 2 (Hebbronville Plant):	796,000
	WQ0010973-002 (pending)	County of Hidalgo Delta Lake Park	5,000
	WQ0012321-001	U.S. Department of Homeland Security Immigration and Customs Enforcement	160,000
	WQ0013344-002	US Department of the Interior	25,000
	WQ0013523-014	La Joya ISD	13,500
	WQ0013747-001	North Alamo WSC	100,000
	WQ0013747-002	North Alamo WSC	210,000 Subsurface
	WQ0013747-003	North Alamo WSC	122,000 Subsurface
	WQ0013747-004	North Alamo WSC	300,000
	WQ0013772-001	Laguna Madre Water District Andy Bowie Park Plant	1,500,000
	WQ0013924-001	Bruni Rural WSC	62,500
	WQ0014069-001	Laguna Madre Water District Laguna Plant	650,000
	WQ0014076-001	City of San Perlita	100,000 Irrigation
	WQ0014698-001	TxDOT	13,000
	WQ0014950-001	Hidalgo County MUD #1	950,000
	WQ0014950-001	Hidalgo County MUD #1	950,000
	WQ0015163-001	North Alamo	500,000
2491B North Floodway	WQ0001752-000	Rio Grande Valley Sugar Growers	289,000
	WQ0004040-000	Calpine Construction Finance	1,110,000
	WQ0004138-000	Calpine Hidalgo Energy Center	920,000
	WQ0004758-000	P.E.N. Joint Tenants and North Cameron Regional WSC	2,000,000
	WQ0004782-000	North Alamo WSC	2,000,000
	WQ0004789-000	North Alamo WSC	2,000,000
	WQ0010330-001	City of Santa Rosa	390,000
	WQ0010503-002	City of Edinburg	5,900,000
	WQ0010619-001	City of Weslaco	250,000
	WQ0010619-003	City of Weslaco	3,000,000
	WQ0010633-004	City of McAllen	15,000,000
	WQ0011210-001	City of Lyford	270,000
	WQ0011510-002	City of Elsa	800,000
	WQ0014781-002	City of La Villa	399,000
	WQ0014919-001	City of Edcouch	700,000

Segment	Permit Number	Entity	Permitted Discharge (gpd)
2492 Baffin Bay / Alazan Bay / Cayo Del Grullo / Laguna Salada	WQ0010067-002	Duval County Conservation and Reclamation District (CRD)	40,000
	WQ0010084-001	Utility Board of Falfurias	460,000 Irrigation
	WQ0010253-001	City of Premont	350,000 Subsurface
	WQ0011515-001	Riviera ISD	16,000 Subsurface
	WQ0013361-002	Kenedy County Sarita Sewer Service and WSC	44,000 Evaporation
	WQ0013374-001	Kleberg County Kaufer Hubert Memorial Park	33,000
	WQ0013374-002	Riviera WCID	60,000
	WQ0013374-003	County of Kleberg Ricardo Plant	48,500
	WQ0014808-001	King Ranch Inc.	25,500 Evaporation
2492A San Fernando Creek	WQ0011144-001	Medina County WCID 002	80,000
	WQ0000579-000	Ticona Polymers, Inc. (Celanese)	Stormwater
	WQ0004819-000	SNBL USA Ltd	55,000 Evaporation
	WQ0010067-001	Duval CRD	250,000
	WQ0010270-001	San Diego MUD	750,000
	WQ0010427-001	City of Bishop	320,000
	WQ0010536-002	City of Alice	2,600,000
	WQ0010536-004	City of Alice	2,020,000 and Irrigation
	WQ0010696-001	City of Kingsville – Plant 1	3,000,000
	WQ0010696-004	City of Kingsville	1,000,000 and Irrigation
	WQ0012035-001	US Department of the Navy (Kingsville NAS)	400,000
2494 Brownsville Ship Channel	WQ0002597-000	Brownsville Navigation District:	100,000 Evaporation
	WQ0002817-000	Brownsville Navigation District Fishing Harbor	250,000
	WQ0003936-000	Texas Pack, Inc	150,000 Irrigation
	WQ0004541-000	Southmost Regional Water Authority and Brownsville Public Utilities Board	4,000,000
	WQ0005005-000	Tenaska Brownsville Partners	Stormwater
	WQ0005208-000 (pending)	Maverick Terminals	Stormwater
	WQ0005209-000 (pending)	Maverick Fuel Oil Terminal	Stormwater
	WQ0010332-001	Brownsville Navigation District Northside Plant	98,000
	WQ0010350-001	Laguna Madre Water District Port Isabel Plant	1,100,000 and sludge
	WQ0010397-005	Brownsville Public Utilities N. Robindale Plant	14,500,000
	WQ0010590-002	City of Los Fresnos	1,000,000
	WQ0011348-001	Valley MUD No. 2	400,000
	WQ0013817-001	Olmito WSC (Olmito Plant)	750,000
	WQ0014355-001	Brownsville Navigation District	100,000
	WQ0015162-001	East Rio Hondo Water Supply	100,000
	WQ0015586-002	Hill McKnight Dishman	40,000

SAN ANTONIO BAY / HYNES BAY – SEGMENT 2462

Segment 2461, San Antonio Bay / Hynes Bay, is primarily in Refugio and Calhoun Counties and includes Guadalupe Bay. The official boundary for the San Antonio – Nueces Coastal Basin includes all of Hynes Bay and only a portion of San Antonio Bay. Its watershed is 69,939 acres. The area around the bay is dominated by farm and ranch lands. The small town of Austwell is on the bay is the only community in the area

The bay is included in the Department of State Health Service's (DSHS) shellfish restrictions for bacteria in oyster waters.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13997** at Intracoastal Waterway (ICWW) CM 17**.**

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	27	5.6	10.4	8.1	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	20	<10	79	11.4	15	1

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	27	15.2	31.5	23.6	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	27	7.9	8.6	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time.

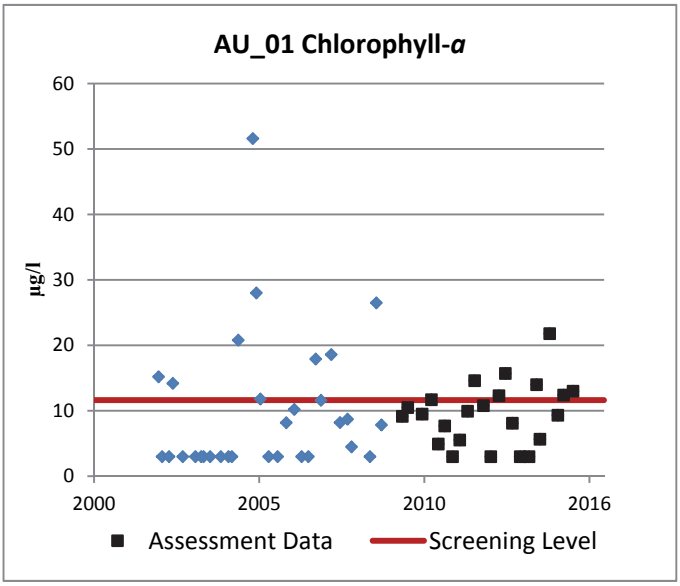
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	125	157	139

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	26	<0.02	0.11	0.02	22	2

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	CS	23	<3	21.8	9.5	4	8



The segment has been assessed as having a concern for chlorophyll-*a*. Trend analysis did not indicate any trends over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	26	<0.04	0.3	0.04	20	1

Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	0.28	2.91	0.58

Trend analysis did not indicate any trends in TKN concentrations over time.

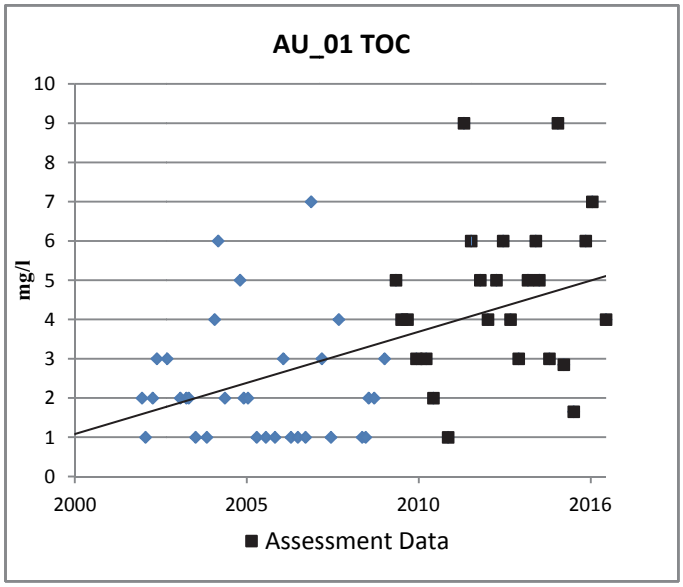
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	24	<0.02	0.3	0.1	1	1

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

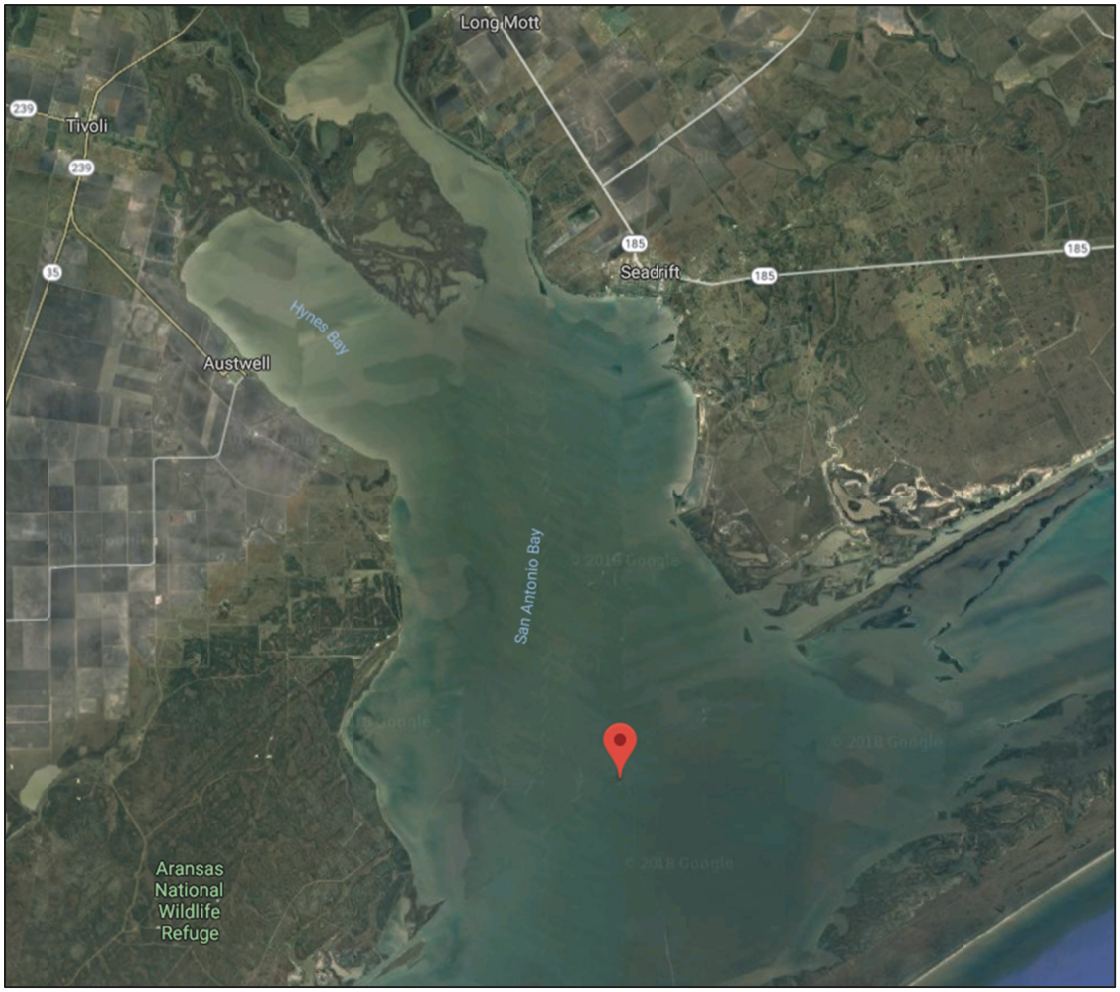
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	7	119	26

Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	1	9	4



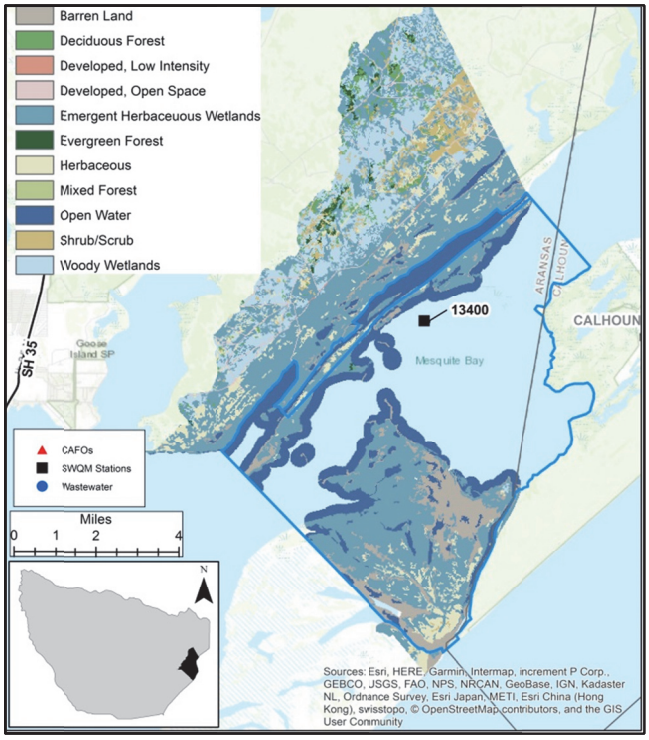
Trend analysis indicates an increasing trend (t = 4.39, p = 0.000) in TOC concentrations over time.



Google Earth view of Station 13397 location

MESQUITE BAY – SEGMENT 2463

Segment 2463, Mesquite Bay, is in Aransas County. Its watershed is 37,323 acres. The bay is surrounded by natural areas. The Aransas Wildlife Refuge is to the northwest and uninhabited San Jose and Matagorda Islands are to the southeast.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13400** at ICWW CM 13**.**

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	25	5.8	10.3	7.6	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	21	<1	280	1.8	17	1

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	25	13.4	31.3	23.6	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	25	7.6	8.5	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	115	160	133

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	23	<0.02	0.09	0.02	20	0

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	22	<3	30.2	4.6	4	1

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	25	<0.04	0.21	0.04	21	1

Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	0.34	1.97	0.6

Trend analysis did not indicate any trends in TKN concentrations over time.

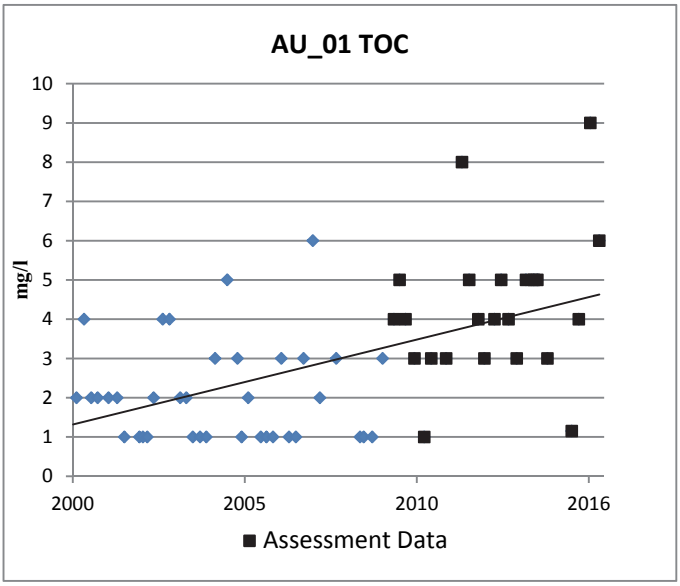
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	22	<0.05	0.25	0.08	3	1

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	4	202	23

Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	1	9	4

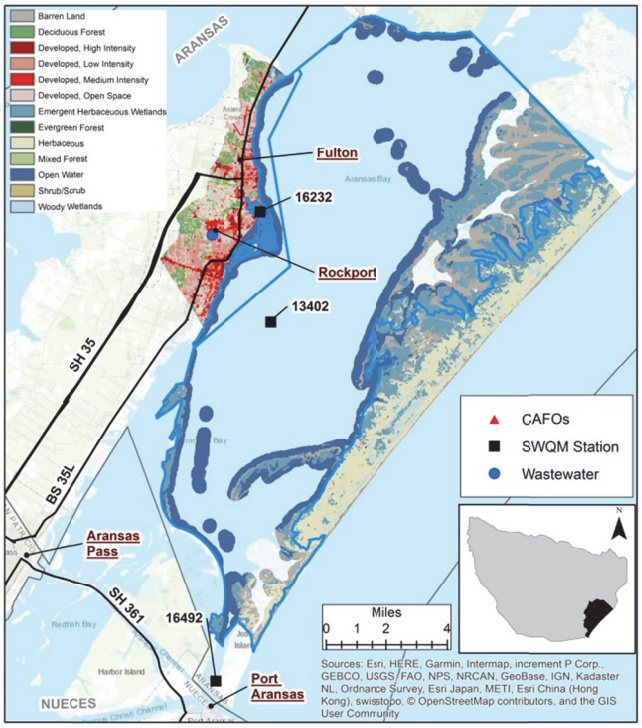


Trend analysis indicates an increasing trend (t = 4.80, p = 0.000) in TOC concentrations over time.

ARANSAS BAY – SEGMENT 2471 & LITTLE BAY – SEGMENT 2471A

Segment 2471, Aransas Bay, is primarily in Aransas County. Its watershed is 85,724 acres. The City of Rockport is along the western shore of the bay and the uninhabited Matagorda Island is on the east. The Aransas Wildlife Refuge is to the north. Segment 2471A, Little Bay, is located between Aransas Bay, Broadway Street in Rockport, and Rockport Beach.

Aransas Bay is included in the DSHS shellfish restrictions for bacteria in oyster waters.

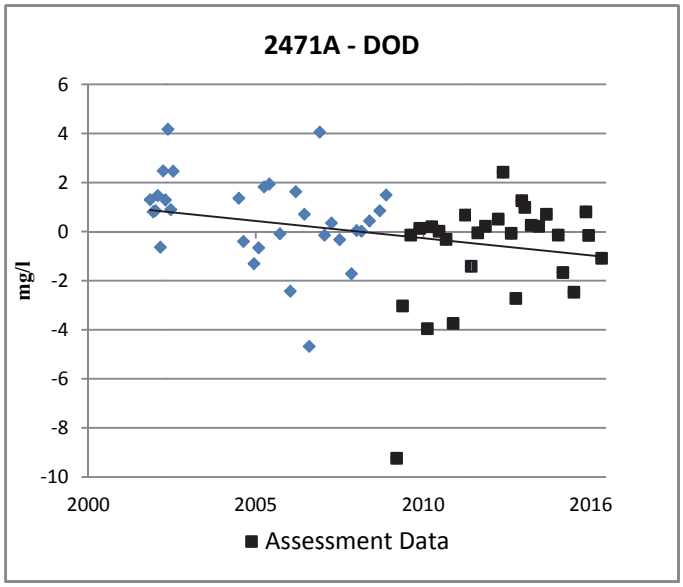


Water Quality Analysis

The analysis for Aransas Bay based on data from **Station 13402** at the intersection of ICWW and Lydia Ann Channel**.** The analysis for Little Bay is based on data from **Station 16232** at Broadway and the inlet canal to Canoe Lake in Rockport**.**

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4 / <3	<5 / <4
AU_01	Minimum 4.0 mg/l	FS	25	5.8	11.5	7.6	0	0
	Screening Level 5.0 mg/l	NC						
2471A	Minimum 3.0 mg/l	FS	28	5.5	18.6	8.2	0	0
	Screening Level 4.0 mg/l	NC						



Trend analysis indicates a decreasing trend in DOD in Little Bay (t = -2.14, p = 0.037) over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	17	<1	210	1.8	14	1
2471A		NC	19	<10	>2400	19.0	5	3

Trend analysis did not indicate any trends in Enterococcus concentrations over time in either bay.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	25	7.5	31.0	23.3	0
2471A		FS	28	15.1	32.4	25.3	0

Trend analysis did not indicate any trends in water temperature over time in either bay.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	25	8.0	8.4	8.2	0	0
2471A		FS	28	8.1	8.8	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time in either bay.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	102	136	128
2471A		N/A	27	100	148	136

Trend analysis did not indicate any trends in alkalinity over time in either bay.

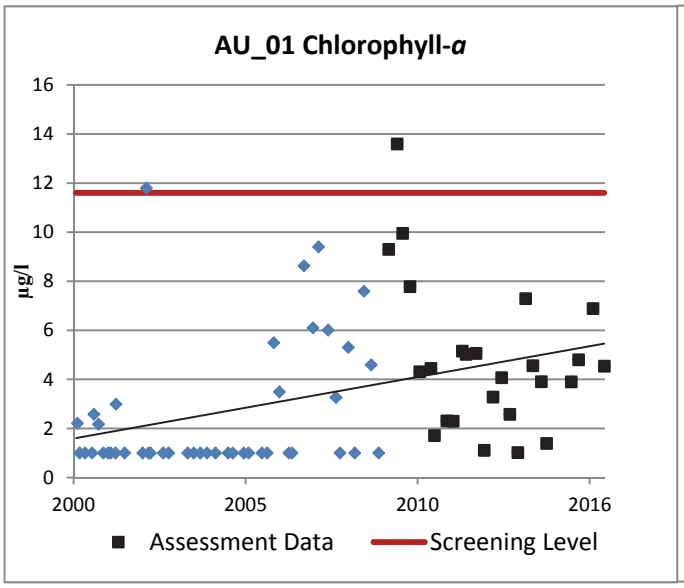
Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	23	<0.02	0.21	0.02	22	1
2471A		NC	26	<0.02	0.07	0.02	25	0

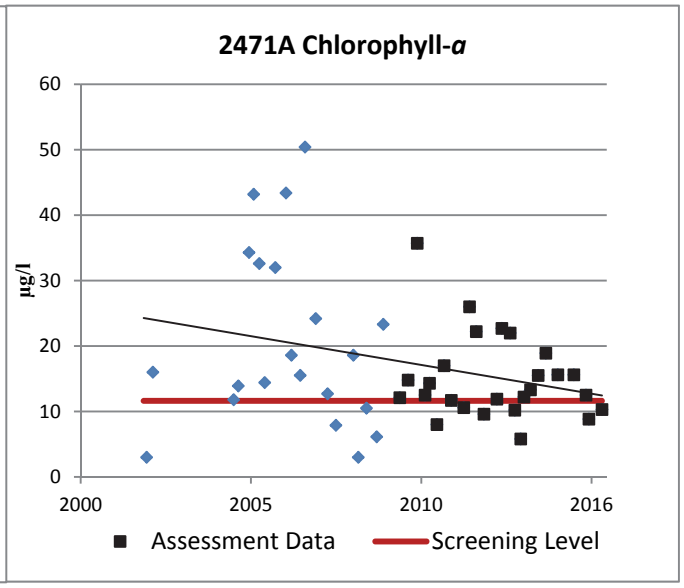
Trend analysis did not indicate any trends in ammonia concentrations over time in either bay.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	25	1.02	13.6	4.45	0	1
2471A		CS	26	5.8	35.7	12.9	0	19

Trend analysis indicates an increasing trend in Aransas Bay ($t = 3.39$, $p = 0.001$) in chlorophyll-*a* concentrations over time. However, the measured values are below the screening level.

Little Bay has been assessed as having a concern for chlorophyll-*a*. Trend analysis indicates a decreasing trend ($t = -2.06$, $p = 0.045$) over time. The measured values are beginning to meet the screening level more often.





Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	25	<0.04	0.08	0.04	23	0
2471A		NC	27	<0.04	0.59	0.04	22	1

Trend analysis did not indicate any trends in nitrate concentrations over time in either bay.

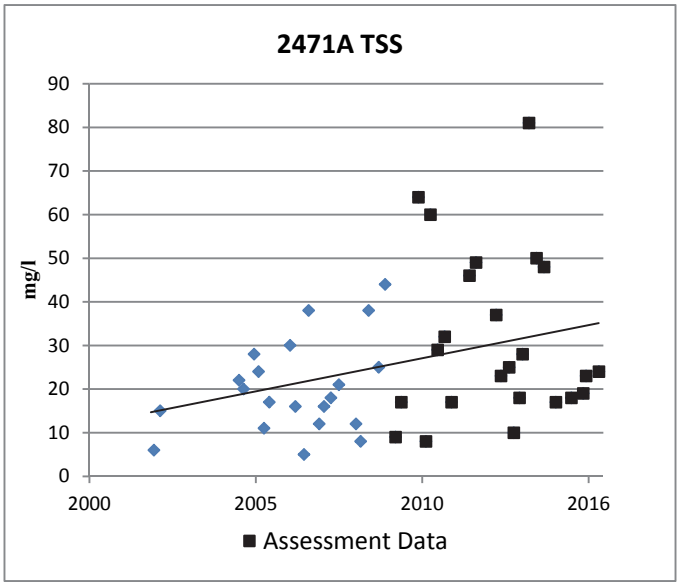
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	0.21	2.13	0.48
2471A		N/A	24	0.26	4.65	0.87

Trend analysis did not indicate any trends in TKN concentrations over time in either bay.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	19	<0.02	0.1	0.05	3	0
2471A		NC	23	0.06	0.24	0.13	0	1

Trend analysis did not indicate any trends in total phosphorus concentrations over time in either bay.

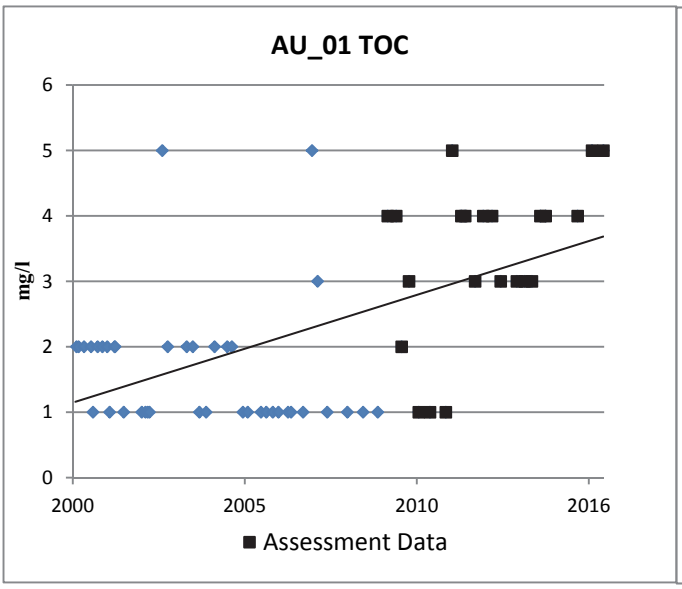
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	4	66	14
2471A		N/A	24	8	81	24.5

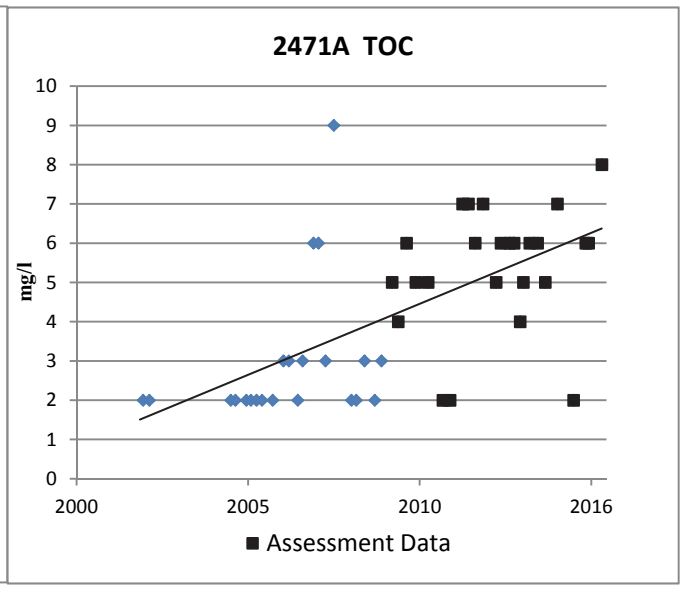


Trend analysis indicates an increasing trend in TSS concentrations in Little Bay (t = 2.27, p = 0.028) over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	1	5	4
2471A		N/A	25	2	8	6

Trend analysis indicates an increasing trend in TOC concentrations in Aransas Bay (t = 5.30, p = 0.000) and in Little Bay (t = 5.36, p = 0.000) over time.

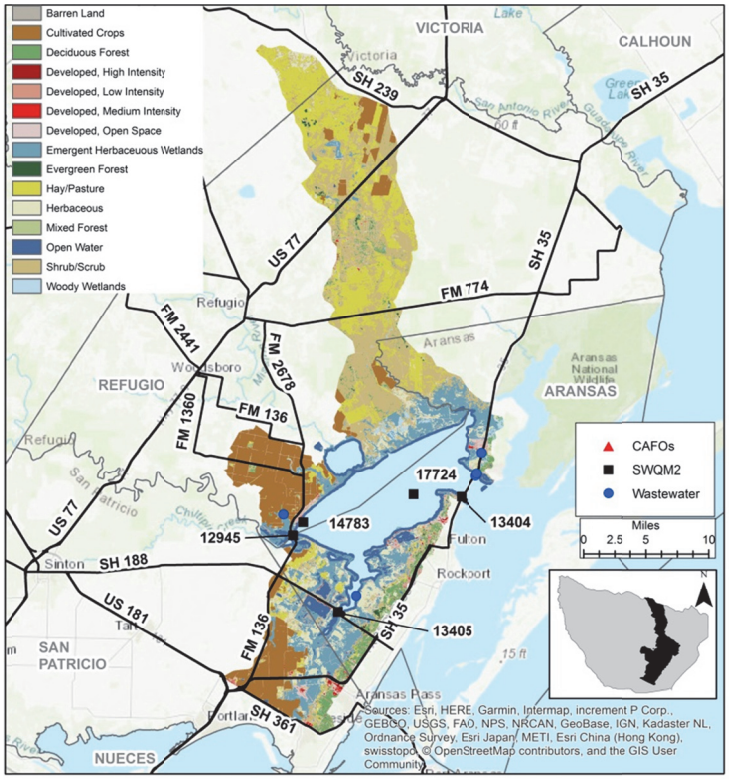




COPANO BAY – SEGMENT 2472 & PORT BAY

Segment 2472, Copano Bay, and Port Bay are located in Refugio and Aransas Counties. Its watershed is 249,235 acres. The south and east sides of the bay have a number of developments and small communities. The north and west sides are mostly farm and ranch lands. These bays, along with Mission Bay, are assessed together. Enough data exists in Port Bay to provide a separate analysis for this report.

The bay is included in the DSHS shellfish restrictions for bacteria in oyster waters as a concern.



Special Studies

A Copano Bay TMDL and Implementation Plan have been completed to address the bacteria in oyster water impairment in Copano Bay. BMPs to address the issue include improvements and upgrades to WWTPs and the development and implementation of conservation plans in priority areas of the watershed.

Water Quality Analysis

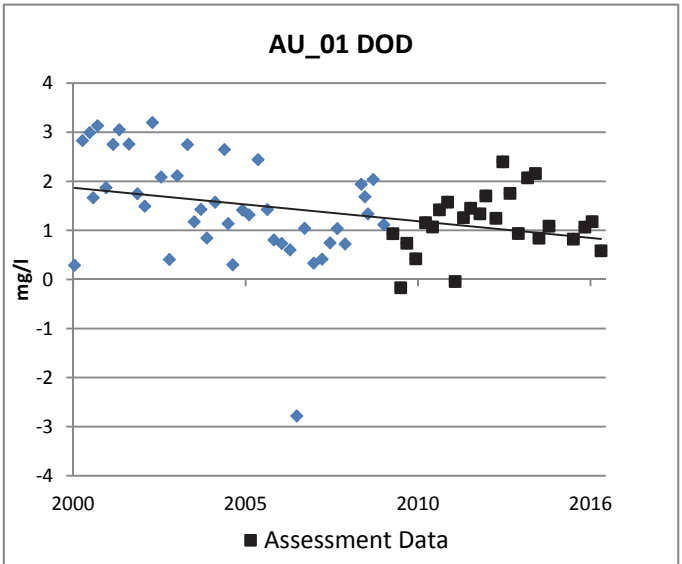
The analysis for Copano Bay based on data from **Station 13404** at SH 35 and **Station 17724** approximately 3.5 miles west of the south end of the Copano Fishing pier**.** The analysis for Port Bay is based on data from **Station 13405** at SH 188. There is insufficient data for TKN analysis for Port Bay.

Sampling location for Station 13404 at SH 35

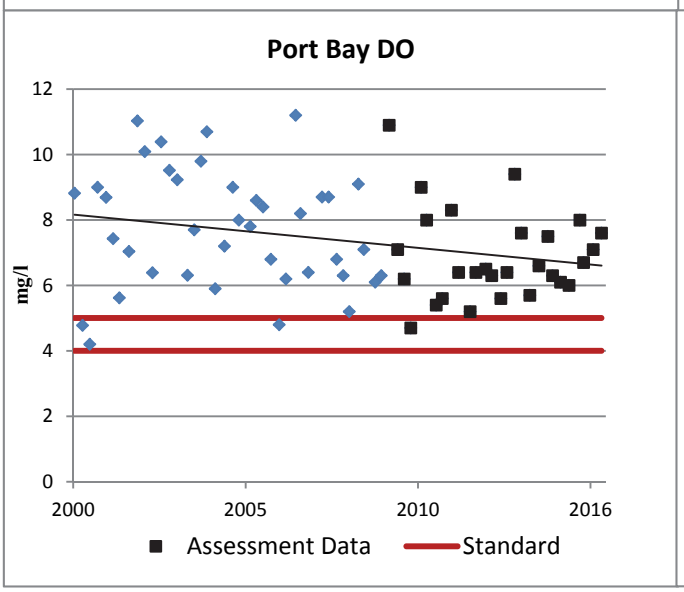
Sampling location for Station 13405 at SH 188

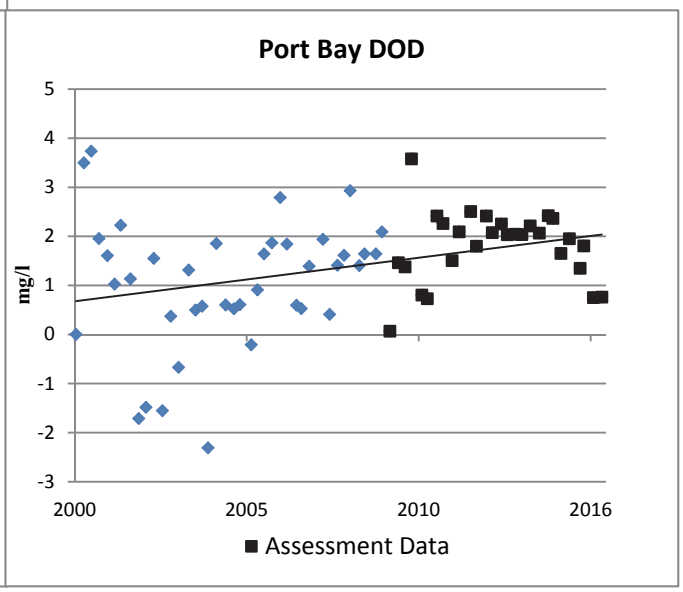
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	25	5.4	9.9	7.5	0	0
	Screening Level 5.0 mg/l	NC						
Port	Minimum 4.0 mg/l	FS	28	4.7	10.9	6.4	0	1
	Screening Level 5.0 mg/l	NC						



Trend analysis indicates a decreasing trend in DOD levels (t= -2.68, p = 0.009) in Copano Bay over time. Trend analysis indicates a decreasing trend in DO levels (t= -2.26, p = 0.027) and an increasing trend in DOD (t = 2.92, p = 0.005) in Port Bay over time.





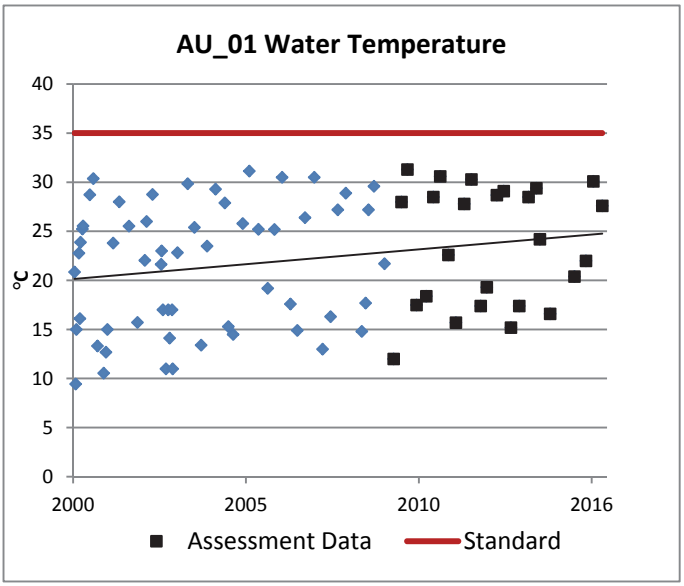
Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	19	<1	27	1.5	15	0
Port		FS	28	<1	>2400	13.4	8	3

Trend analysis did not indicate any trends in Enterococcus concentrations over time in either bay.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	25	12.0	31.3	24.2	0
Port		FS	28	15.1	32.4	25.3	6



Trend analysis indicates an increasing trend in water temperature in Copano Bay (t = 2.04, p = 0.044) over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	25	7.0	8.4	8.1	0	0
Port		FS	28	7.6	8.5	8.1	0	0

Trend analysis did not indicate any trends in pH levels over time in either bay.

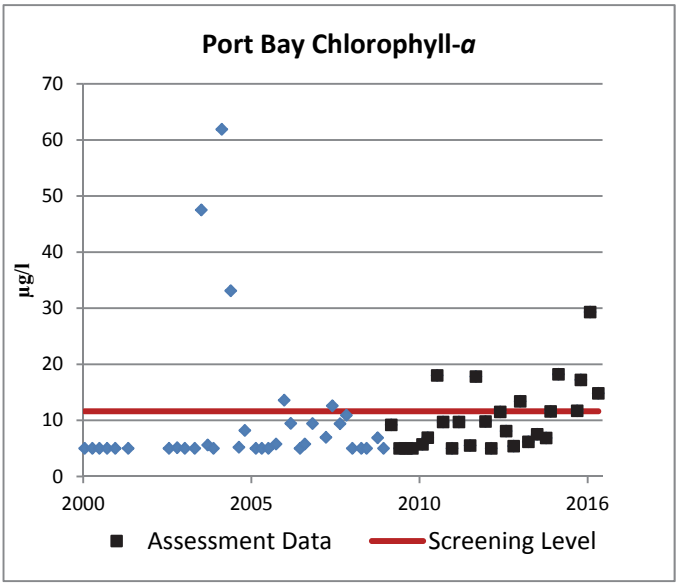
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	86	139	123
Port		N/A	28	55	156	133

Trend analysis did not indicate any trends in alkalinity over time in either bay.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	23	<0.02	0.11	0.02	21	1
Port		NC	28	<0.02	0.14	0.02	16	2

Trend analysis did not indicate any trends in ammonia concentrations over time in either bay.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	23	<3	10.3	1.3	8	0
Port		NC	27	<5	29.3	8.9	5	8



Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time in either bay. Currently, > 20% of the samples exceed the screening level in Port Bay.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	25	<0.01	0.32	0.01	24	1
Port		NC	28	<0.01	0.94	0.01	26	1

Trend analysis did not indicate any trends in nitrate concentrations over time in either bay.

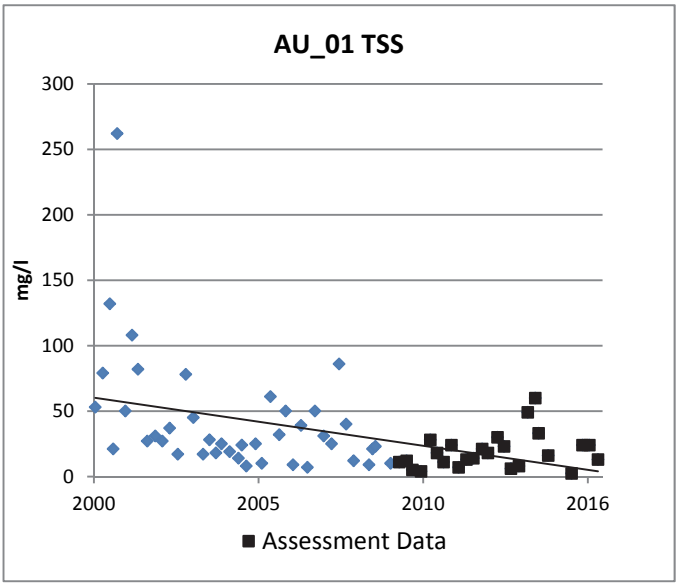
TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	0.5	1.91	0.61

Trend analysis did not indicate any trends in TKN concentrations over time in AU_01.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	22	<0.02	0.14	0.07	2	0
Port		NC	28	<0.01	0.18	0.01	15	0

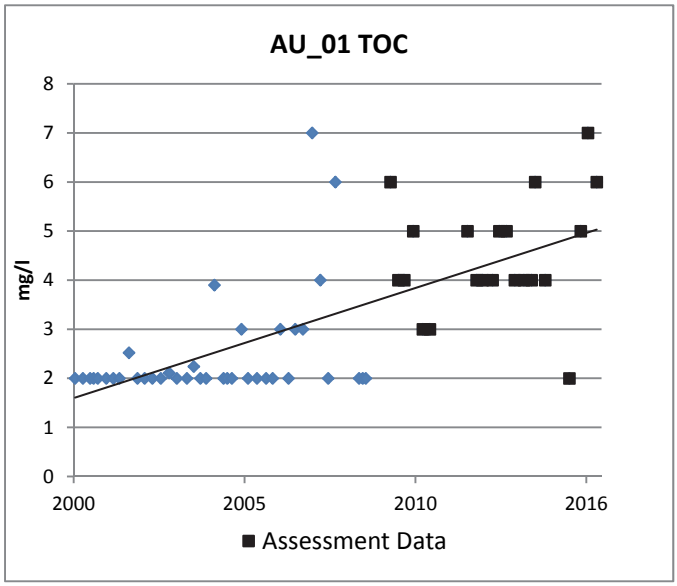
Trend analysis did not indicate any trends in total phosphorus concentrations over time in either bay.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	2.3	60	16
Port		N/A	28	6.4	279	39.6



Trend analysis indicates a decreasing trend in TSS concentrations in Copano Bay (t = -3.81, p = 0.000) over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	1	5	4
Port		N/A	28	0.93	10.4	2.72

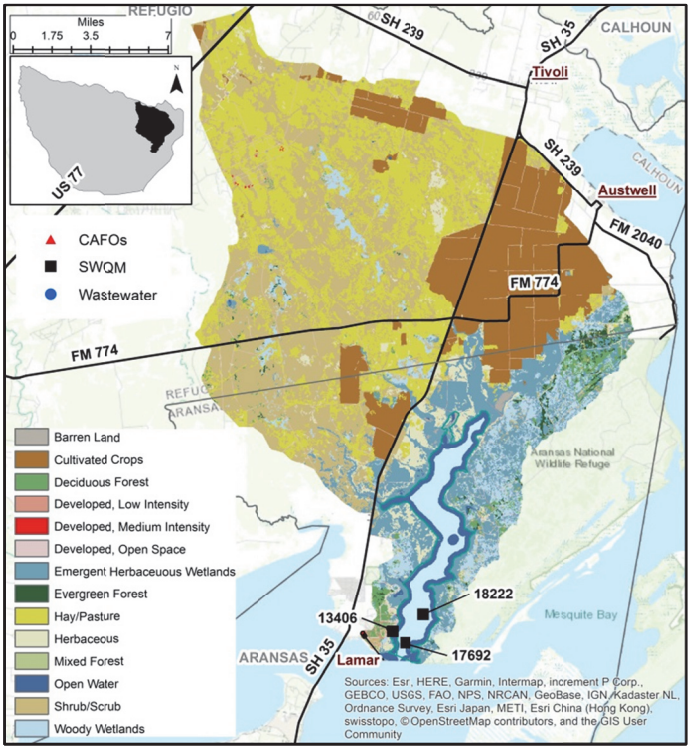


Trend analysis indicates an increasing trend in TOC concentrations in Copano Bay (t = 7.37, p = 0.000) over time.

ST. CHARLES BAY – SEGMENT 2473

Segment 2473, St. Charles Bay, is located in Aransas County. Its watershed is 162,401 acres. The bay is nearly surrounded by the Aransas Wildlife Refuge. The small community of Lamar is located on the southwest side adjacent to Aransas Bay.

The bay is included in the Department of State Health Service's (DSHS) shellfish restrictions for bacteria in oyster waters.

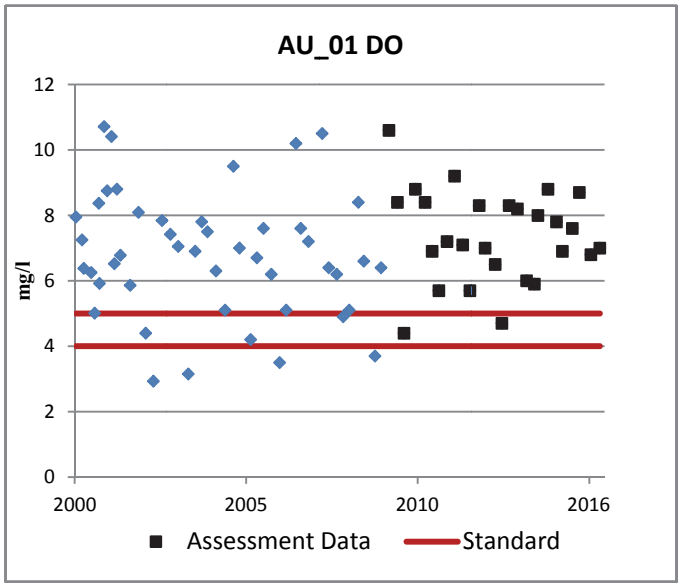


Water Quality Analysis

The analysis for this segment is based on data from **Station 13406** northeast of Goose Island State Park and **Station 17692** northeast of Hail Point. There is insufficient data for trend analysis for TKN.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	27	4.4	10.6	7.2	0	2
	Screening Level 5.0 mg/l	CS						



The bay has been assessed as having a concern for DO at the grab screening level. The more recent data indicates that the segment is meeting this screening level. The likely reason is that the sampling location was moved from Station 13406, located at a boat ramp, to the middle of the bay, which is more representative of the bay. Trend analysis did not indicate any trends in DO levels or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	20	<1	250	2.69	12	1

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	27	9.8	30.4	24.0	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	27	7.8	8.5	8.1	0	0

Trend analysis did not indicate any trends in pH levels over time.

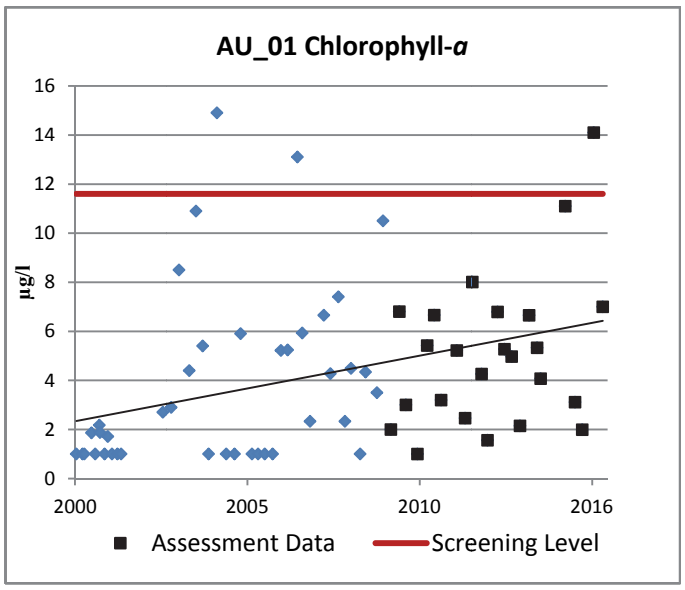
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	104	149	128

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	24	<0.02	0.14	0.02	20	1

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	24	<1	14.1	5.1	1	1



Trend analysis indicates an increasing trend in chlorophyll-*a* concentrations over time (t = 3.03, p = 0.004).

Sampling location for Station 13406

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	26	<0.01	0.09	0.01	23	0

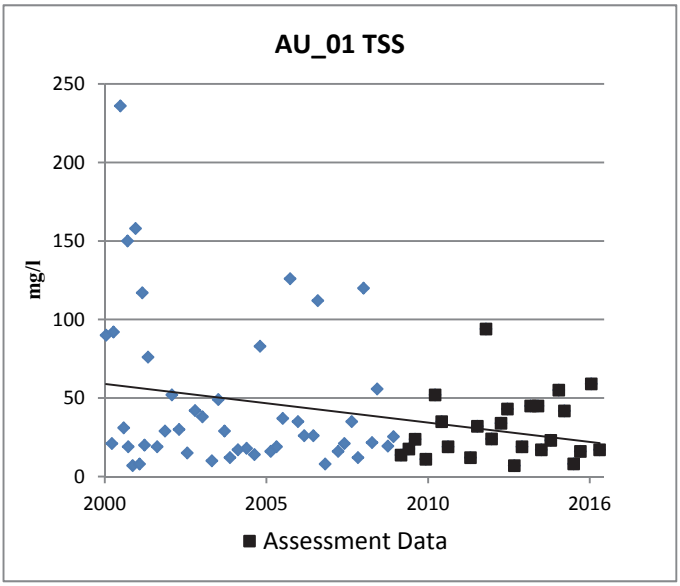
Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	0.38	1.69	0.62

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	23	<0.02	0.146	0.05	5	0

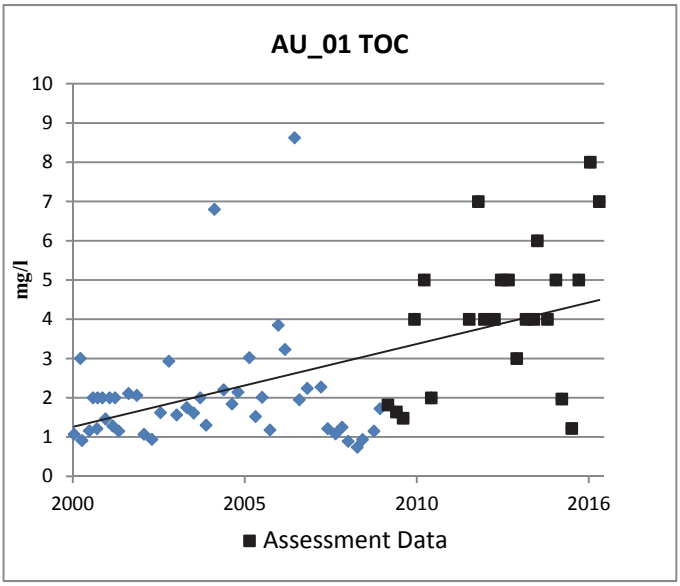
Trend analysis did not indicate any trends in total phosphorus concentrations over time.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	7	94	24



Trend analysis indicates a decreasing trend in TSS concentrations over time (t = -2.39, p = 0.020).

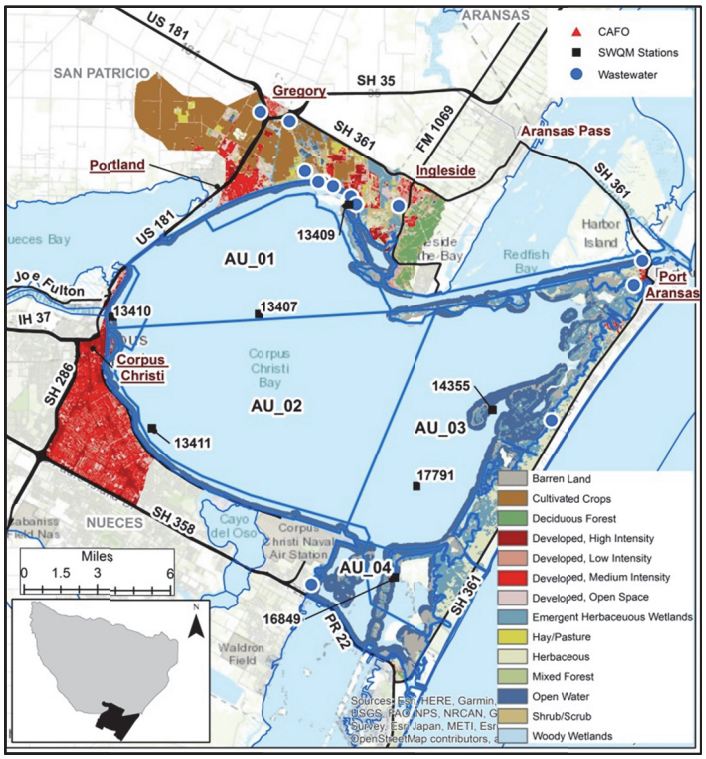
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	1.22	8	4



Trend analysis indicates an increasing trend (t = 5.25, p = 0.000) in TOC concentrations over time.

CORPUS CHRISTI BAY – SEGMENT 2481

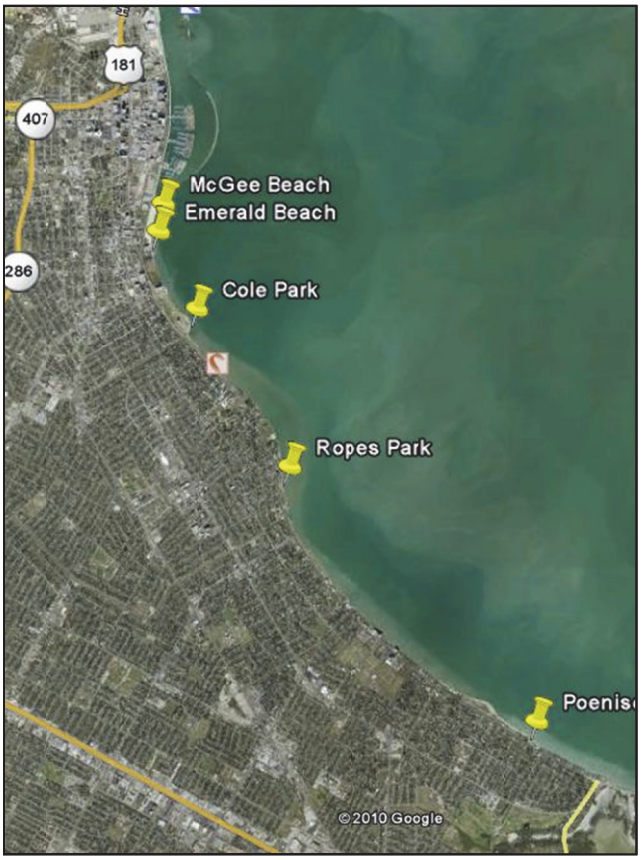
Segment 2481, Corpus Christi Bay, is located in Nueces County. It is split between the San Antonio – Nueces and Nueces – Rio Grande Coastal basins. The bay is divided into four AUs: **AU_01** is the north side of the bay from the Corpus Christi Ship Channel (CCSC) east to Pelican Island, including the La Quinta Channel and the CCSC adjacent to Redfish Bay. **AU_02** is from the CCSC east to Pelican Island, south to Demit Island including the area from the CCSC to Demit Island (Oso Bay and City of Corpus Christi area). **AU_03** is from Pelican Island south to Demit Island, to Mustang Island and the area along Mustang Island State Park to the CCSC. **AU_04** is from the JFK Causeway to a line from Demit Island across to Mustang Island State Park. Its watershed is 144,878 acres.



Beach Watch data have identified Cole Park, Ropes Park, and Poenish Park as having impairments for bacteria for primary contact recreation. These data are collected for the Texas General Land Office by Texas A&M University – Corpus Christi during and after high storm water runoff events at the beaches where it discharges into the bay where people are likely to get into the water. Therefore, the impairment is only considered to be at the beaches and not the entire bay.

Water Quality Analysis

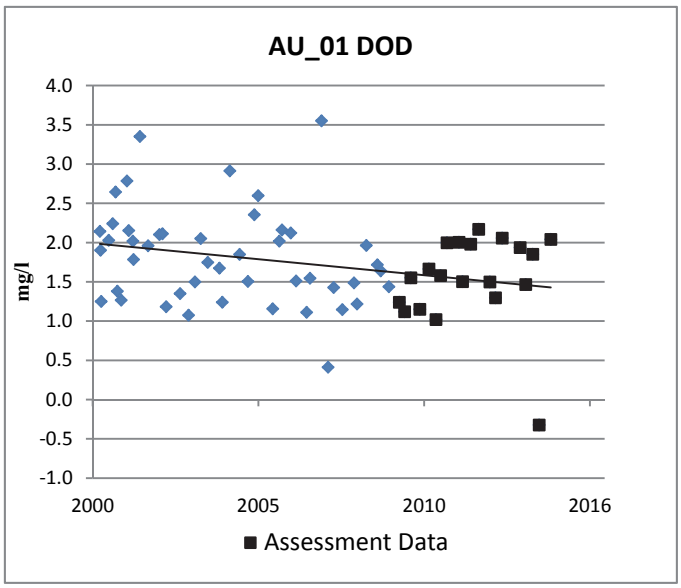
The analysis for AU_01 based on data from **Station 13407** at CM 62**.** The analysis for AU_02 is based on data from **Station 13411** northeast of Doddridge Road. The analysis for AU_03 is based on data from **Station 14355** at Shamrock Point. There are no sampling locations in AU_04.



Beach Watch Locations in Corpus Christi Bay

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	20	5.6	9.7	7.4	0	0
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 4.0 mg/l	FS	25	4.9	10.6	7.3	0	1
	Screening Level 5.0 mg/l	NC						
AU_03	Minimum 4.0 mg/l	FS	24	5.6	9.9	7.0	0	0
	Screening Level 5.0 mg/l	NC						



Trend analysis indicates a decreasing trend in DOD in AU_01 (t = -2.30, p = 0.025) over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	17	<10	<10	10	16	0
AU_02		FS	21	<10	41	10.7	15	1
AU_03		FS	20	<10	280	12.2	17	1

Trend analysis did not indicate any trends in Enterococcus concentrations in any of the AUs over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	21	9.1	30.3	23.0	0
AU_02		FS	25	9.9	30.7	23.6	0
AU_03		FS	24	10.9	30.6	24.7	0

Trend analysis did not indicate any trends in water temperature in any of the AUs over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	20	7.9	8.2	8.0	0	0
AU_02		FS	25	7.9	8.4	8.1	0	0
AU_03		FS	24	8.0	8.4	8.2	0	0

Trend analysis did not indicate any trends in pH levels in any of the AUs over time.

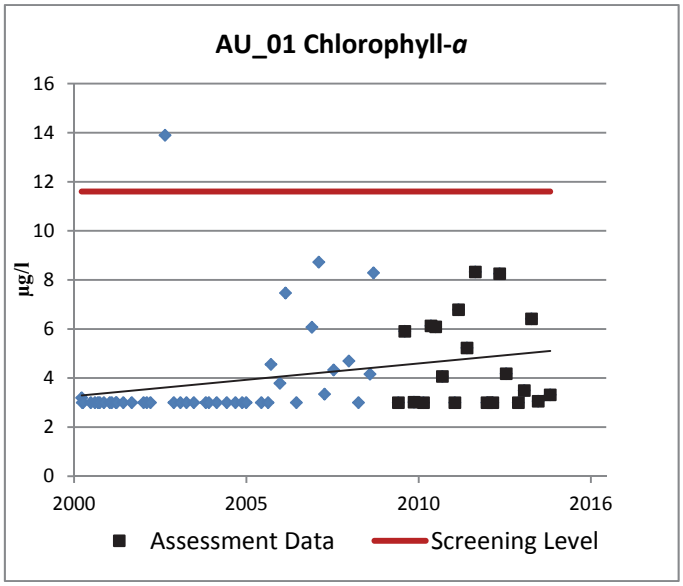
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	21	109	144	128
AU_02		N/A	25	102	147	128
AU_03		N/A	24	111	152	128

Trend analysis did not indicate any trends in alkalinity in any of the AUs over time.

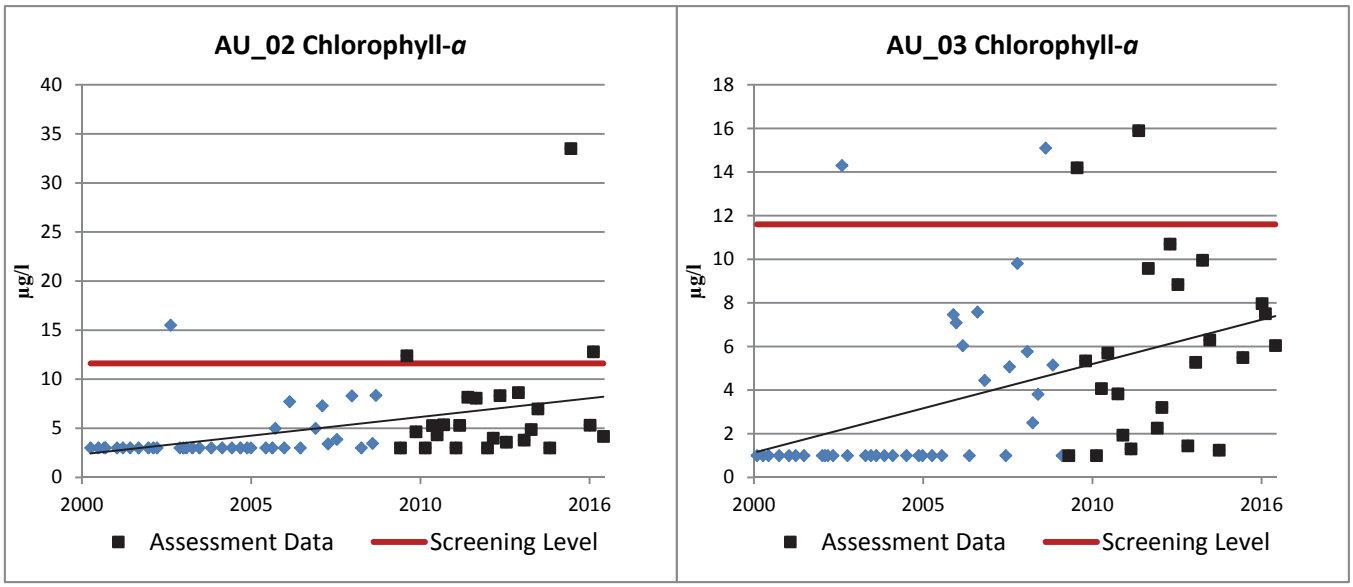
Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	20	<0.02	0.09	0.02	19	0
AU_02		NC	23	<0.02	0.07	0.02	20	0
AU_03		NC	23	<0.02	<0.02	0.02	23	0

Trend analysis did not indicate any trends in ammonia concentrations in any of the AUs over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	20	<3	8.33	3.8	6	0
AU_02		NC	24	<3	33.5	5.1	5	3
AU_03		NC	24	<1	15.9	5.4	1	2



Trend analysis indicates increasing trends in chlorophyll-*a* concentrations in AU_01 (t = 2.18, p = 0.033), in AU_02 (t = 3.10, p = 0.003) and in AU_03 (t= 3.82, p = 0.000) over time.

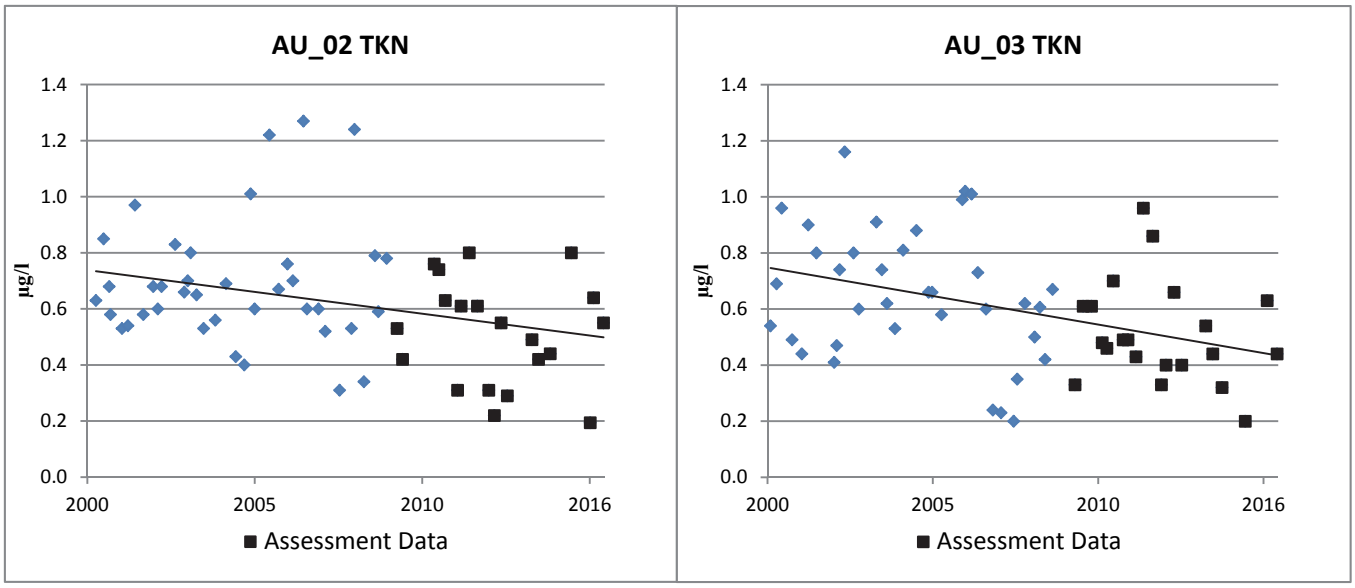


Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	20	<0.04	<0.04	0.04	20	0
AU_02		NC	24	<0.04	0.17	0.04	5	0
AU_03		NC	24	<0.04	<0.04	0.04	24	0

Trend analysis did not indicate any trends in nitrate concentrations in any of the AUs over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	16	0.5	0.83	0.5
AU_02		N/A	20	0.19	0.8	0.54
AU_03		N/A	21	0.2	0.96	0.48

Trend analysis indicates decreasing trends in TKN concentrations in AU_02 (t = -2.50, p = 0.015) and in AU_03 (t = -3.10, p = 0.003) over time.



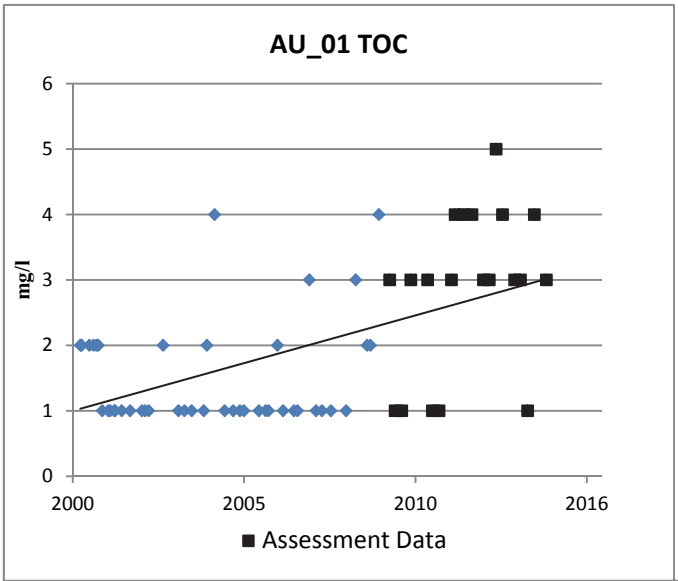
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	19	<0.05	0.52	0.05	10	1
AU_02		NC	23	<0.02	0.17	0.04	5	0
AU_03		NC	22	<0.02	0.09	0.04	6	0

Trend analysis did not indicate any trends in total phosphorus concentrations in any of the AUs over time.

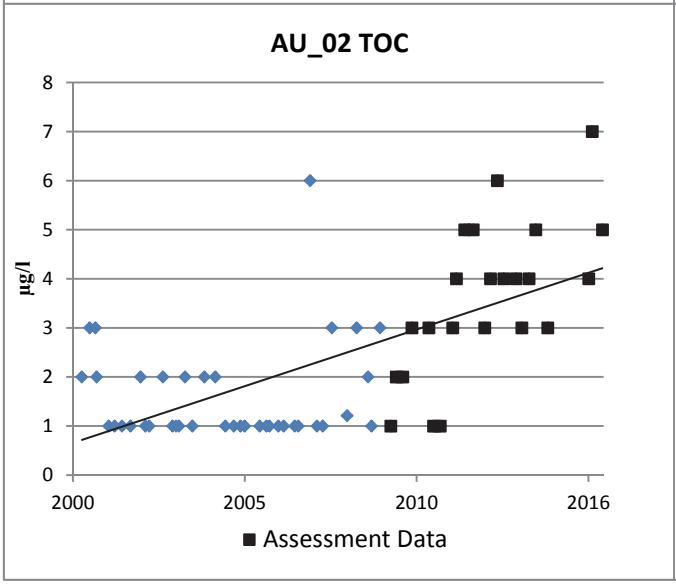
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	5	26	14
AU_02		N/A	25	6	46	16
AU_03		N/A	23	5	75	20

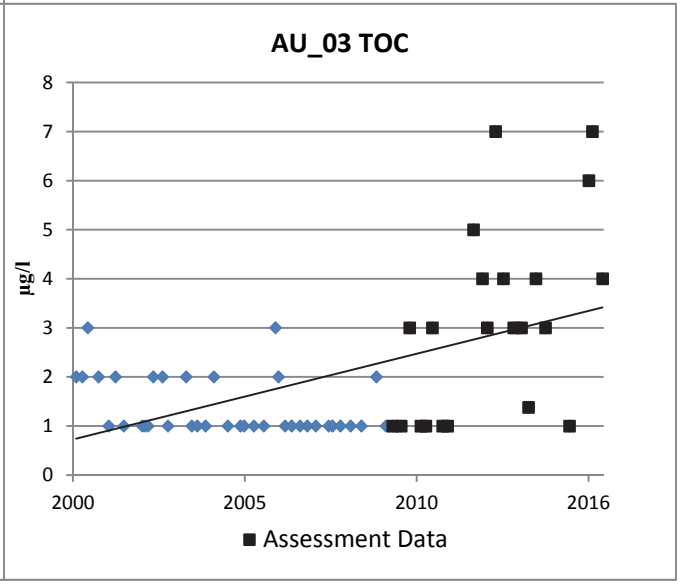
Trend analysis did not indicate any trends in TSS concentrations in any of the AUs over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	19	6	43	18
AU_02		N/A	23	1	7	4
AU_03		N/A	22	1	7	3



Trend analysis indicates increasing trends in TOC concentrations in AU_01 (t = 5.14, p = 0.000), in AU_02 (t = 6.59, p = 0.000), and in AU_03 (t= 4.60, p = 0.000) over time.

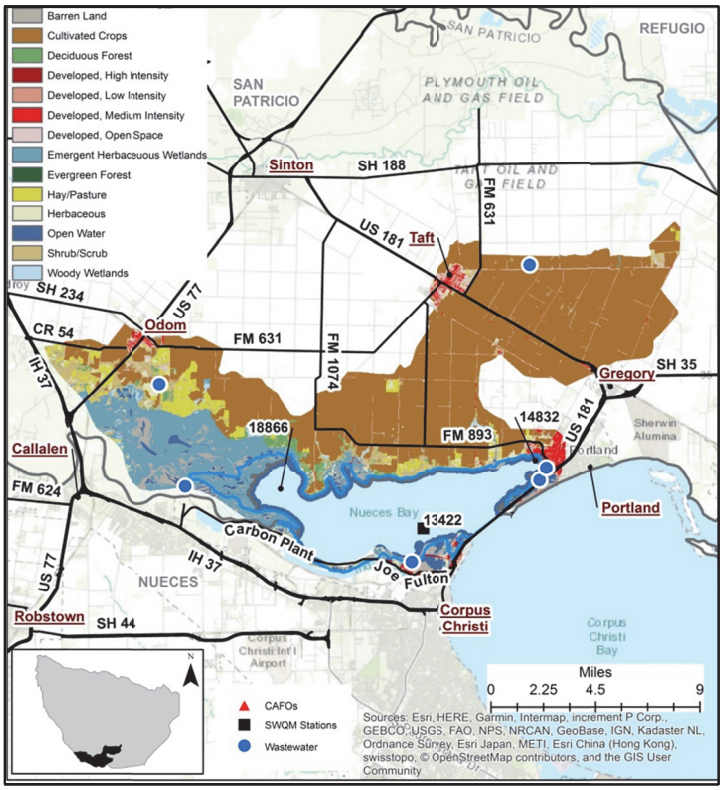




NUECES BAY – SEGMENT 2482

Segment 2482, Nueces Bay, is located in Nueces County. It is split between the San Antonio – Nueces and Nueces – Rio Grande Coastal Basins. Its watershed is 92,834 acres. The bay is bordered on the south by the City of Corpus Christi where there are many industries associated with the CCSC. A large portion of the Nueces Delta has been bought and designated as a preserve. The area north of the bay is primarily farm and ranch lands.

There is a concern for copper in water based on limited data. The DSHS shellfish restrictions for zinc in edible tissue continue.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13422** near the south shore.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 4.0 mg/l	FS	27	5.7	11.2	6.8	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	21	<1	690	5.2	13	3

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	27	9.4	30.9	24.0	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	27	7.8	8.4	8.1	0	0

Trend analysis did not indicate any trends in pH levels over time.

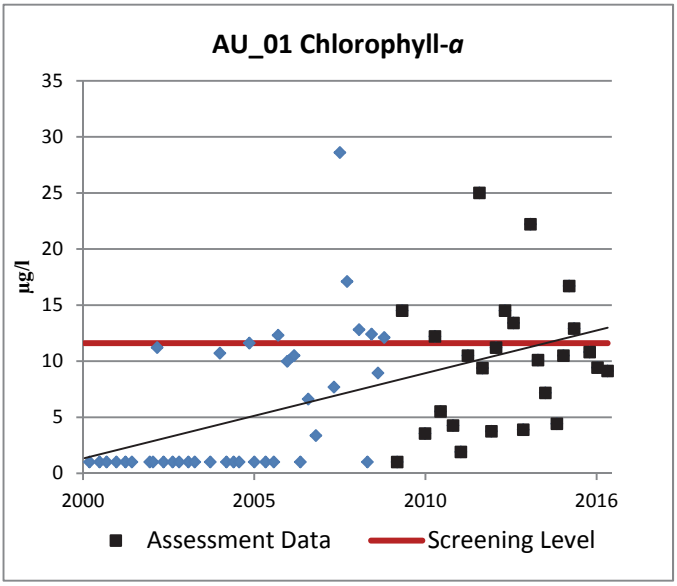
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	104	156	127

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	27	<0.02	0.14	0.02	22	2

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	CS	25	<1	25	10.1	1	8



Chlorophyll-*a* has been assessed as being a concern in the bay. Trend analysis indicates an increasing trend over time (t = 4.70, p = 0.000). The source of this large increase is unknown.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	27	<0.04	0.13	0.04	21	0

Trend analysis did not indicate any trends in nitrate concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	0.36	2.62	0.7

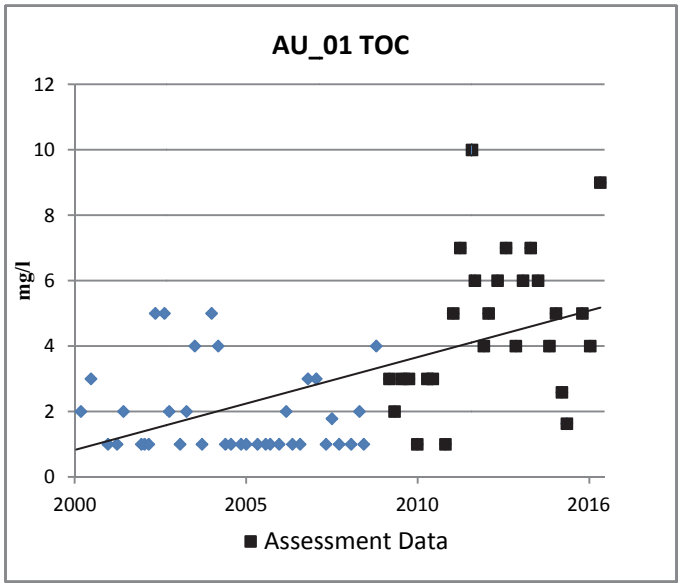
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	24	<0.02	0.22	0.11	2	1

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	7	135	24

Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	1.22	8	4



Trend analysis indicates an increasing trend (t = 5.34, p = 0.000) in TOC concentrations over time.

Google Earth View of Nueces Bay and Station 13422 location.

RED FISH BAY – SEGMENT 2483 & CONN BROWN HARBOR – SEGMENT 2483A

Segment 2483, Red Fish Bay, is in Nueces County. The 45,936 acre watershed spans three counties, the northeast end is in Aransas County and the southwest end is in San Patricio County. There is very little undeveloped land on the western shore of the bay. The main cities are Ingleside and Aransas Pass, with numerous small communities all the way to Rockport. Port Aransas encompasses most of the eastern shoreline. Segment 2483A, Conn Brown Harbor, is within the City of Aransas Pass. There are concerns for copper in water in both segments.

Water Quality Analysis

The analysis for Aransas Bay based on data from **Station 13426** at SH 361**.** The analysis for Conn Brown Harbor is based on data from **Station 18848** mid-harbor northeast of the intersection of Huff Street and East Maddox Avenue**.**

There is insufficient data for TKN trend or statistical analysis in both segments.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4 / <3	<5 / <4
AU_01	Minimum 4.0 mg/l	FS	29	5.1	11.1	6.9	0	0
	Screening Level 5.0 mg/l	NC						
2483A	Minimum 3.0 mg/l	FS	28	4.4	11.0	7.4	0	0
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time in either segment.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	28	<1	>2400	6.2	9	4
2483A		FS	28	<1	>2400	12.1	8	9

Trend analysis did not indicate any trends in Enterococcus concentrations over time in either segment.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	29	9.2	30.7	24.3	0
2483A		FS	28	9.6	31.1	25.5	0

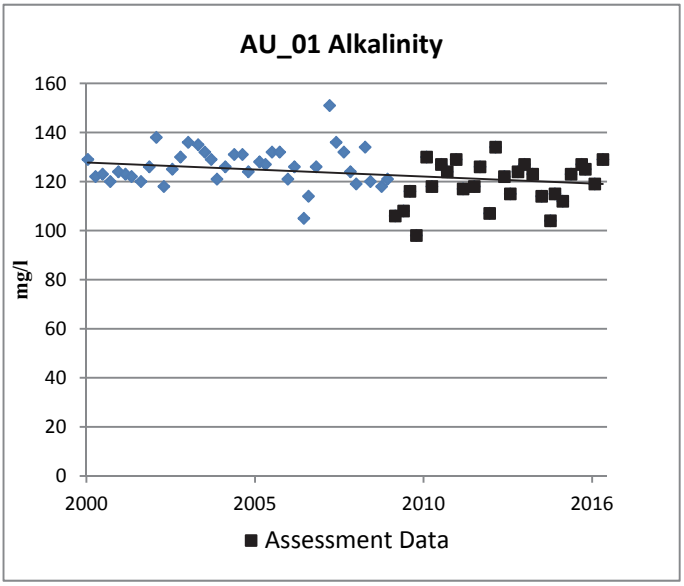
Trend analysis did not indicate any trends in water temperature over time in either segment.

pH	Status	# samples	Min	Max	Median	<6.5	>9.0

AU_01	6.5 – 9.0 su	FS	29	7.8	8.5	8.2	0	0
2483A		FS	28	7.8	8.5	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time in either segment.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	98	134	120.5
2483A		N/A	28	87	137	122.5



Trend analysis indicates a decreasing trend in alkalinity over time in Red Fish Bay (t = -2.46, p = 0017).

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	28	<0.02	0.076	0.02	20	0
2483A		NC	28	<0.02	0.14	0.02	12	1

Trend analysis did not indicate any trends in ammonia concentrations over time in either segment.

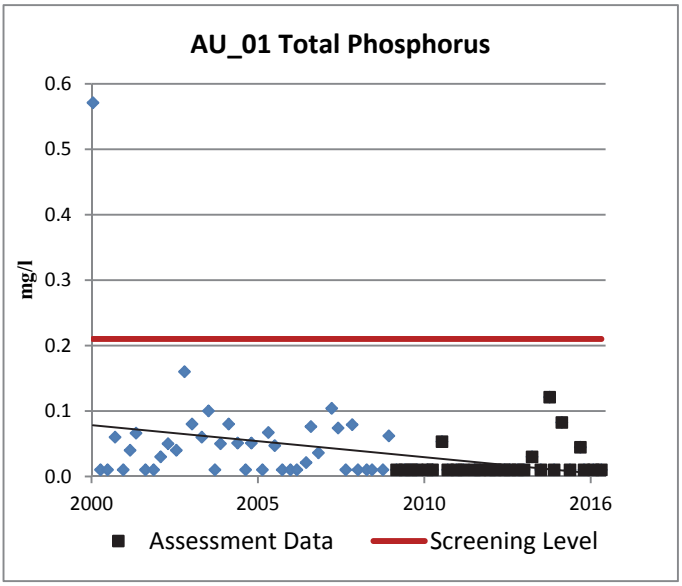
Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	27	<2	11.9	3.9	1	1
2483A		NC	27	2.3	19.8	5.1	0	3

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time in either segment.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	28	<0.01	1.31	0.01	25	2
2483A		NC	28	<0.02	0.5	0.02	27	1

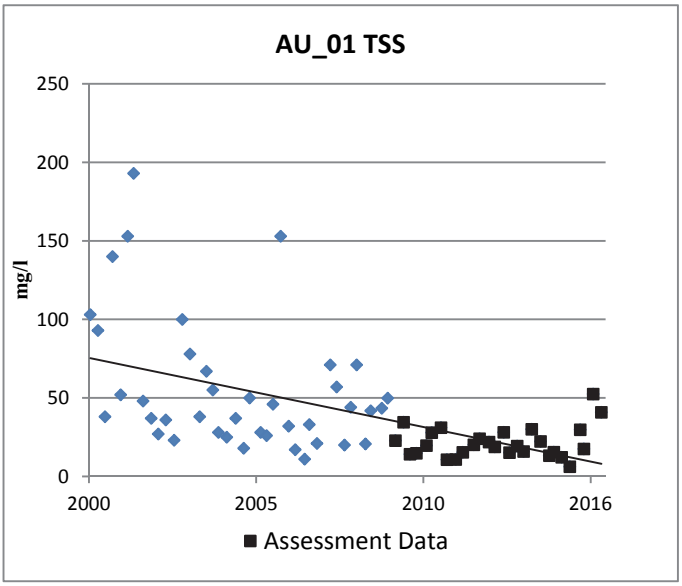
Trend analysis did not indicate any trends in nitrate concentrations over time in either segment.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	28	<0.01	0.121	0.01	23	0
2483A		NC	28	<0.05	0.102	0.05	27	0



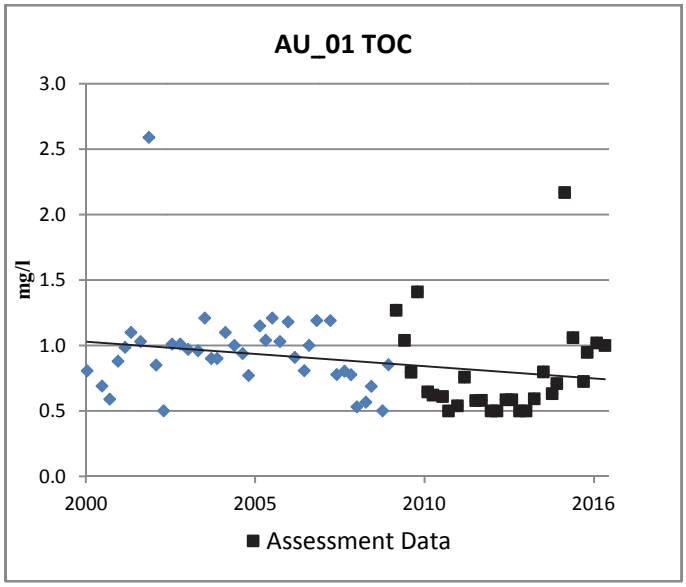
Trend analysis indicates a decreasing trend in total phosphorus concentrations over time in Red Fish Bay (t = -2.10, p = 0.040).

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	6.24	52.5	20.0
2483A		N/A	28	4.3	24.5	8.05



Trend analysis indicates a decreasing trend in TSS concentrations over time in Red Fish Bay (t = -5.20, p = 0.000).

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	<0.5	2.17	0.64
2483A		N/A	28	0.5	2.56	0.77



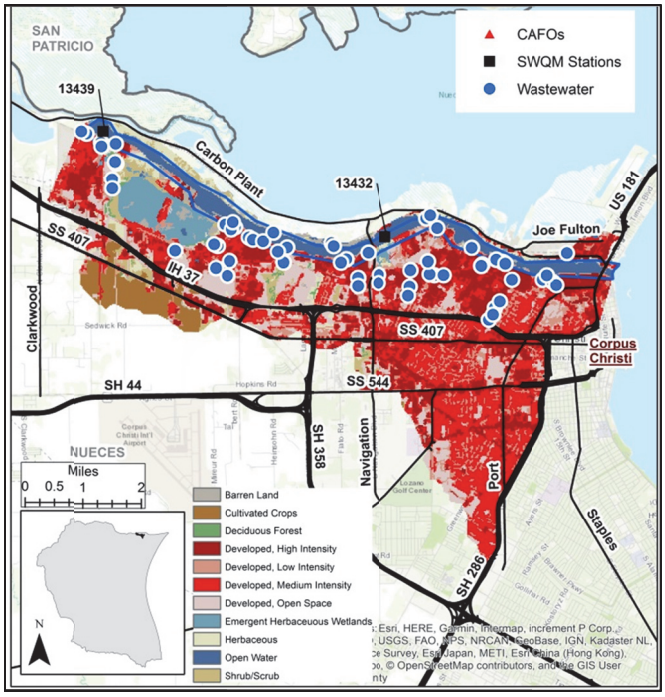
Trend analysis indicates a decreasing trend in TSS concentrations over time in Red Fish Bay (t = -2.08, p = 0.041).

Sampling location for Station 13426

Sampling location for Station 18848

CORPUS CHRISTI INNER HARBOR – SEGMENT 2484

Segment 2484, the Corpus Christi Inner Harbor (CCIH), is located in the City of Corpus Christi in Nueces County. Its watershed is 13,360 acres. CCIH is home to the Port of Corpus Christi, the second deepest port in the State of Texas. Many refineries and other industries are located all along the harbor. There are also numerous permitted wastewater outfalls, many of which are for storm water.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13432** near the old Navigation Blvd. bridge.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<2	<3
AU_01	Minimum 2.0 mg/l	FS	37	4.3	9.8	6.4	0	0
	Screening Level 3.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	18	<10	430	15.8	10	2

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	37	12.8	31.5	24.3	0

Trend analysis did not indicate any trends in water temperature over time.

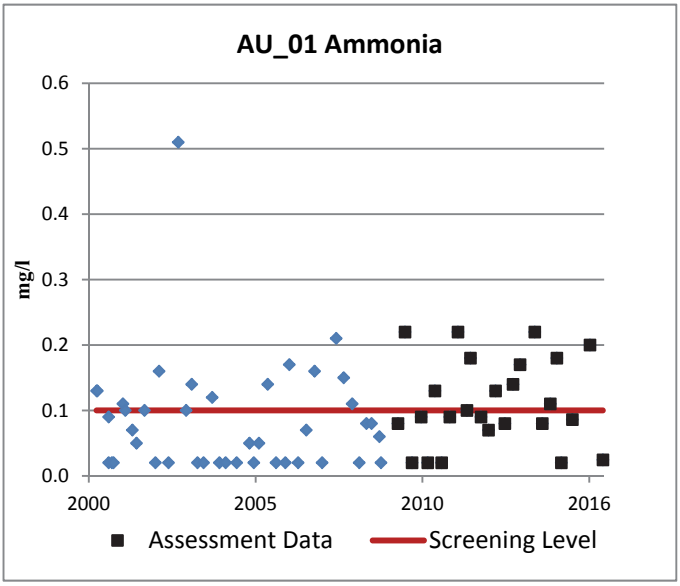
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	37	7.8	8.2	8.0	0	0

Trend analysis did not indicate any trends in pH levels over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	108	143	128.5

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	CS	25	<0.02	0.22	0.09	4	11

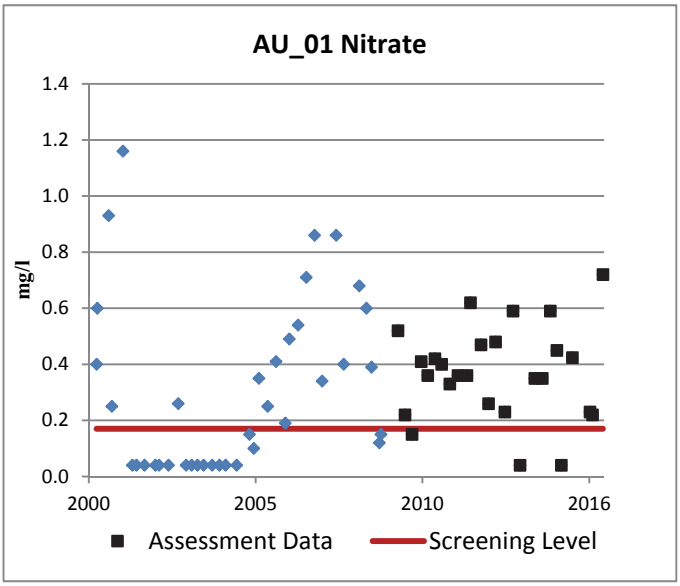


The segment has been assessed as having a concern for ammonia. Trend analysis did not indicate any trends over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	NC	25	<1	19.3	4.36	1	3

Trend analysis did not indicate any trends in chlorophyll-*a* concentrations over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	CS	26	<0.04	0.72	0.36	2	23



The segment has been assessed as having a concern for nitrate. Trend analysis did not indicate any trends over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	0.4	1.07	0.66

Trend analysis did not indicate any trends in TKN concentrations over time.

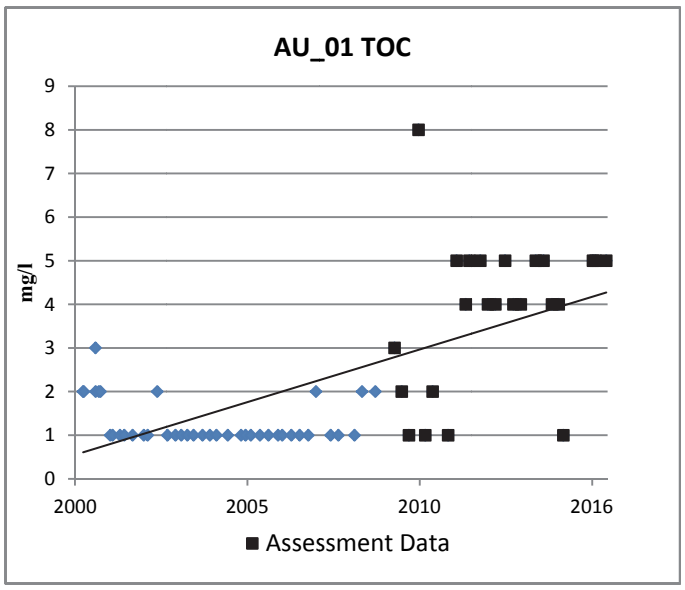
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	20	0.06	0.14	0.1	0	0

Trend analysis did not indicate any trends in total phosphorus concentrations over time.

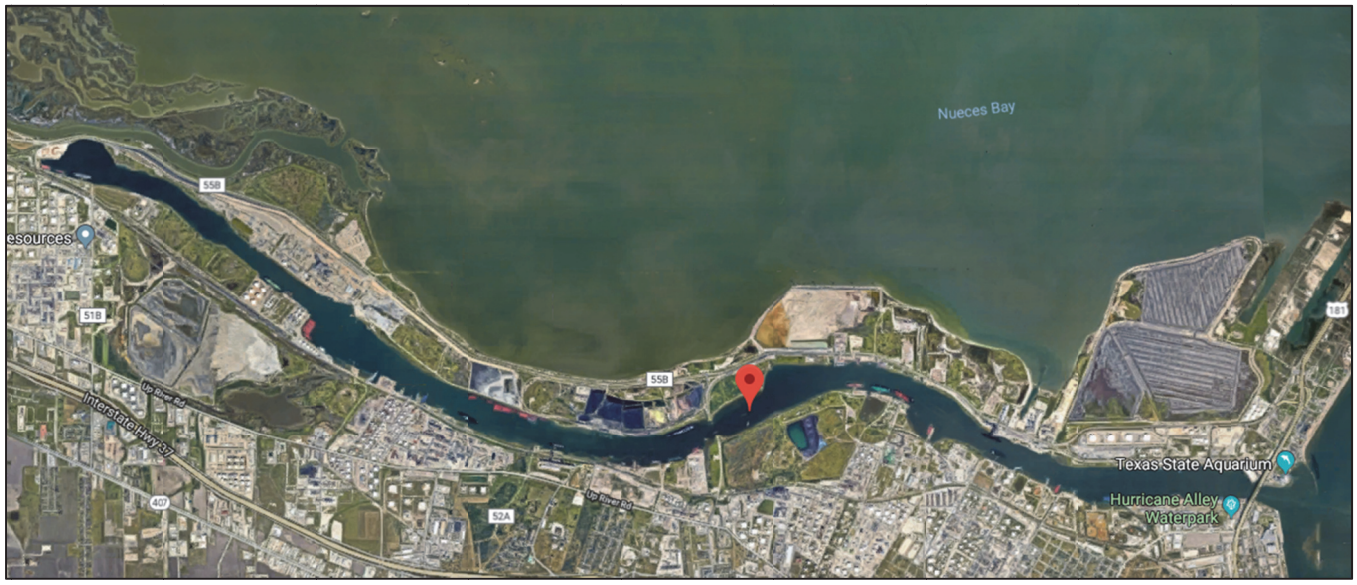
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	33	3.5	53.6	15

Trend analysis did not indicate any trends in TSS concentrations over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	<1	8	4



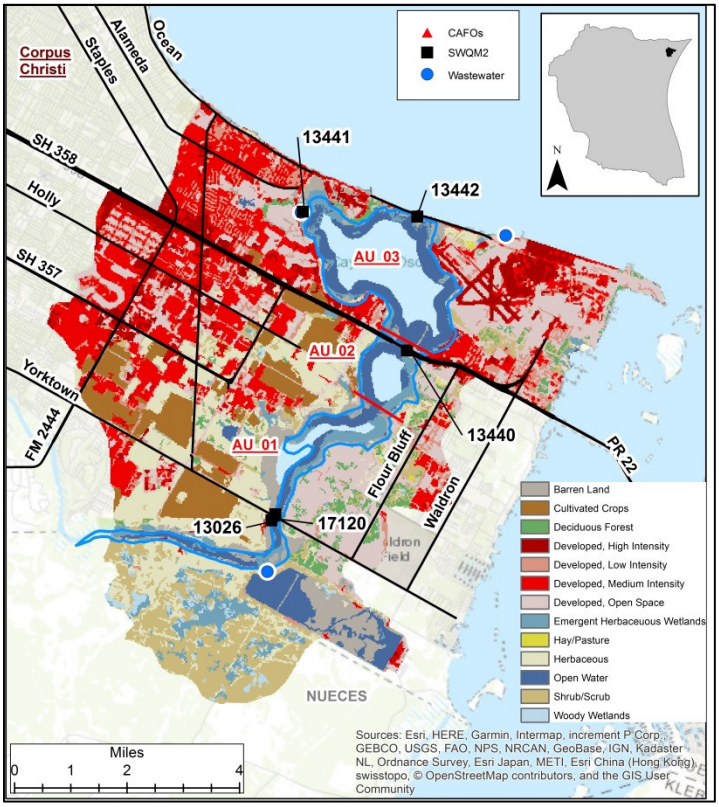
Trend analysis indicates an increasing trend (t = 6.97, p = 0.000) in TOC concentrations over time. The cause of this increase is unknown.



Google Earth View of Nueces Bay and Station 13432 location

OSO BAY – SEGMENT 2485

Segment 2485, Oso Bay, is located in the City of Corpus Christi in Nueces County. The bay is divided into three AUs. **AU_01** is the upper bay from Holly Road to CR 24. **AU_02** is the middle bay from SH 358 to Holly Road. **AU_03** is from Ocean Drive to SH 358. Its watershed is 29,661 acres. The northwest portion of the bay between Ward Island and Ennis Joslin Road in AU_03 is known as the Blind Oso.



Oso Bay receives much of the storm water runoff from the City of Corpus Christi as well as the cooling water from the Barney Davis Power Plant. The housing developments around the bay range from large, multi-acre tracts, to neighborhoods with many houses per acre, to apartment complexes.

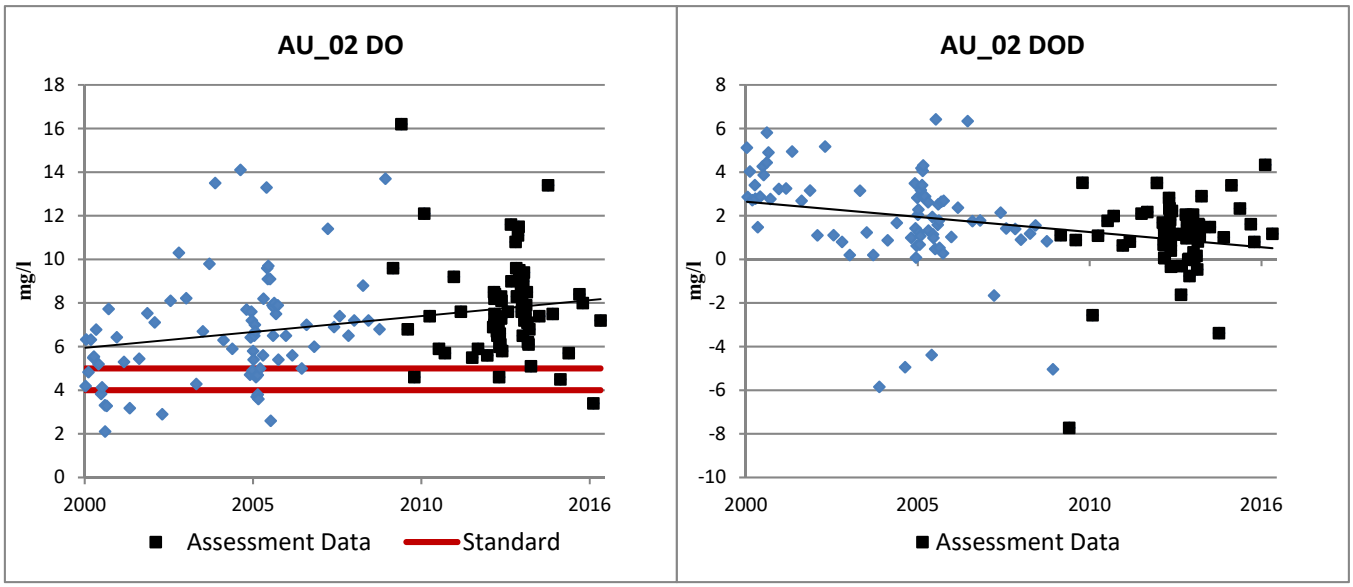
Water Quality Analysis

The analysis for AU_01 based on data from **Station 13026** at the Yorktown Blvd. bridge and **Station 17120** northeast of Yorktown Blvd. The analysis for AU_02 is based on data from **Station 13440** at SH 358. The analysis for AU_03 is based on data from **Station 13442** at Ocean Drive. For AU_01 and AU_03, the date range for the parameters alkalinity, ammonia, chlorophyll-*a*, nitrate, TKN, total phosphorus, TSS, and TOC is from 2000 through 2005. Therefore, there is insufficient data for trend analysis and no data within the statistical analysis data range. The DO, temperature, pH, enterococcus data in AU_01 and AU_03 are grouped into three clusters, collected during special studies, in 2000, 2003 – 2006, and 2013 – 2014, which is not a good temporal range for a valid trend analysis. While this report includes statistical analysis on the available data for AU_01 and AU_03, the concerns discussed below are based on older data that are being carried forward for previous assessments. Due to budget constraints, AU_02 is the only AU of the bay which is currently being monitored on a routine basis.

Aquatic Life Use Assessment

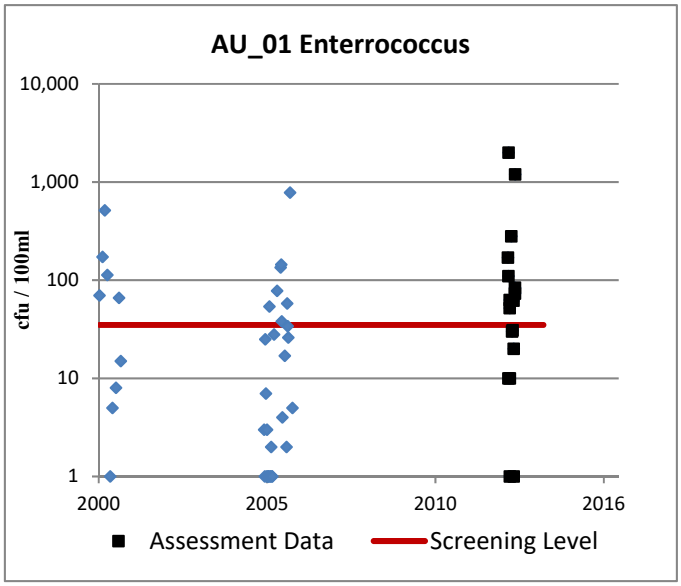
DO		Status	# samples	Min	Max	Median	<4	<5
AU_01	Minimum 3.0 mg/l	N/A	47	4.9	12.0	7.8	0	1
	Screening Level 4.0 mg/l	N/A						
AU_02	Minimum 3.0 mg/l	FS	73	3.4	16.2	7.3	1	4
	Screening Level 4.0 mg/l	NC						
AU_03	Minimum 3.0 mg/l	N/A	47	5.7	15.7	7.8	0	0
	Screening Level 4.0 mg/l	N/A						

Trend analysis indicates an increasing trend in DO levels ($t = 3.57$, $p = 0.000$) and a decreasing trend in DOD ($t = -2.35$, $p = 0.021$) in AU_02 over time.

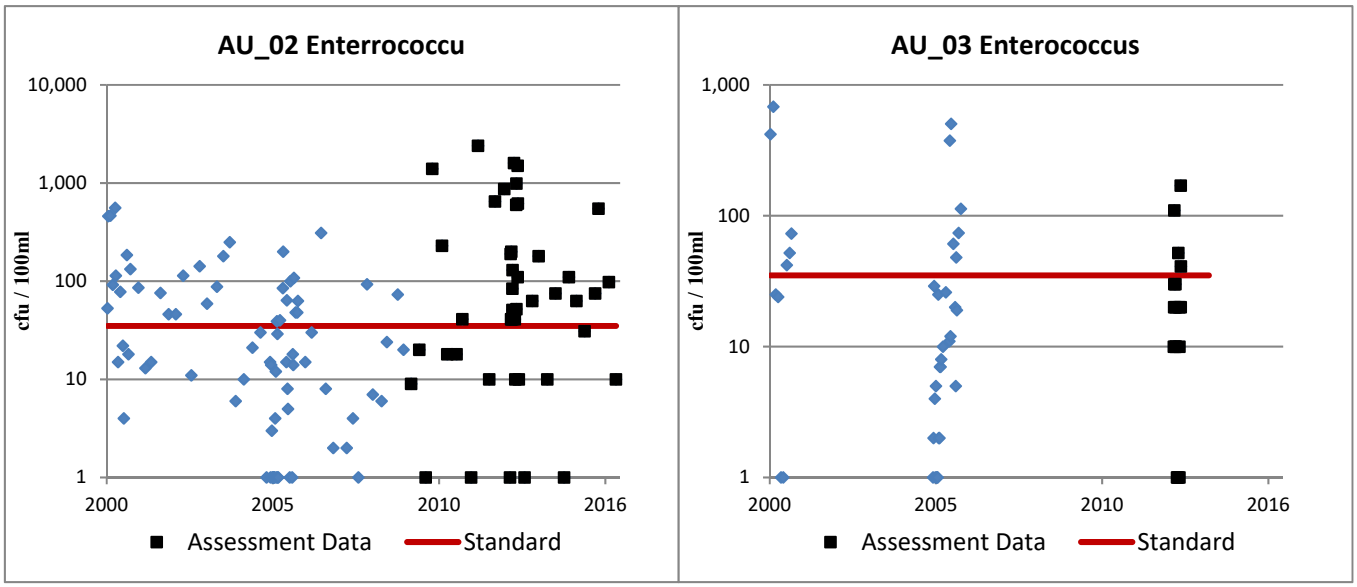


Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	N/A	17	<1	2000	47.2	2	10
AU_02		FS	44	<1	>2400	60.6	5	30
AU_03		NS	17	<1	170	14.5	3	4



AU_01 has not been assessed for enterococcus, but the more recent data indicates that the standard is not being met, but the short date range of the data, all collected in 2013, may not be truly representative of the bacteria levels. AU_02 is not currently listed as being impaired for bacteria, but the more recent data indicates that the standard is not being met. AU_03 is listed as being impaired for bacteria. Although the geomean of the more recent data meets the standard, the short date range of the data, all collected in 2013, may not be truly representative of the bacteria levels. Trend analysis did not indicate any trends in Enterococci concentrations in AU_02 over time.



General Use

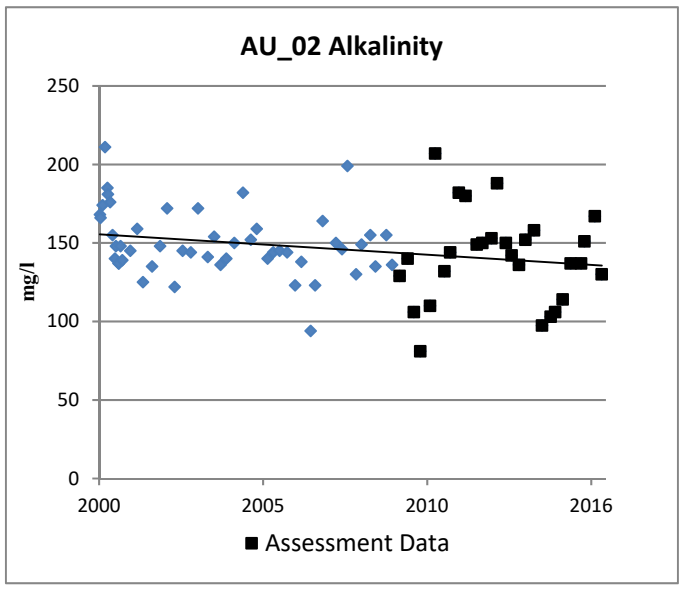
Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	47	8.5	31.7	25.0	0
AU_02		FS	73	3.9	32.4	24.7	0
AU_03		FS	47	8.1	30.3	24.5	0

Trend analysis did not indicate any trends in water temperature in AU_02 over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	47	7.4	8.6	8.1	0	0
AU_02		FS	73	7.6	8.7	8.2	0	0
AU_03		FS	47	7.4	8.2	8.0	0	0

Trend analysis did not indicate any trends in pH levels in AU_02 over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	28	81	207	141

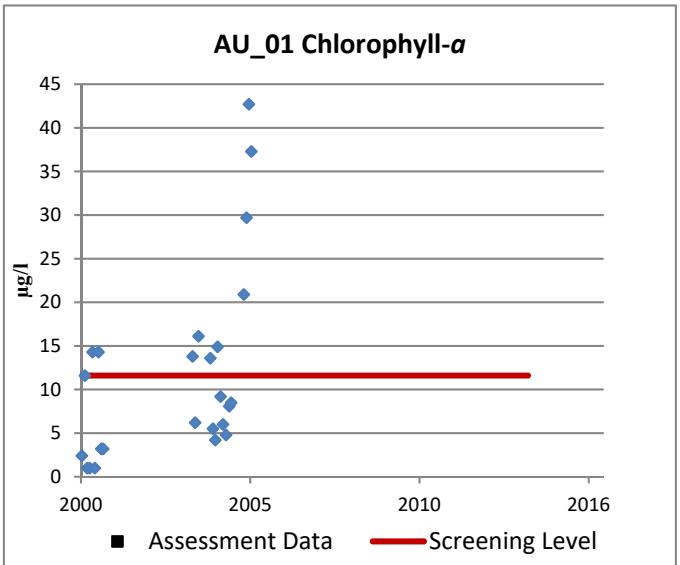


Trend analysis indicates a decreasing trend in alkalinity in AU_02 (t = -2.35, p = 0.021) over time.

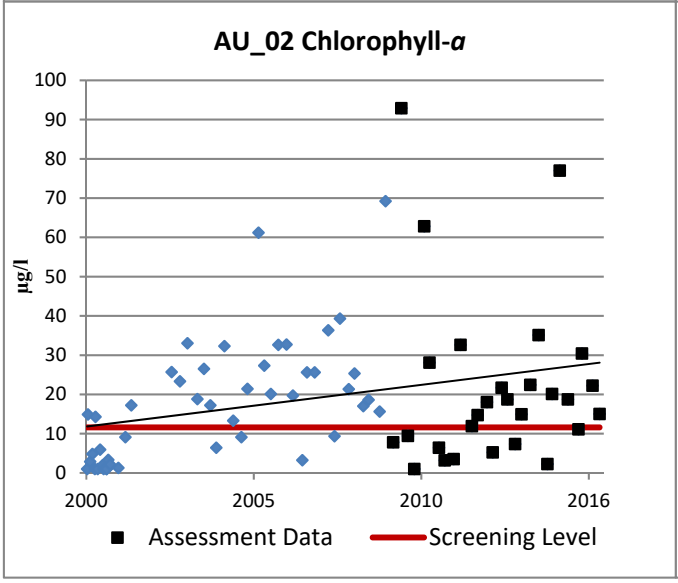
Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_02	0.1 mg/l	NC	28	<0.02	0.29	0.02	11	3

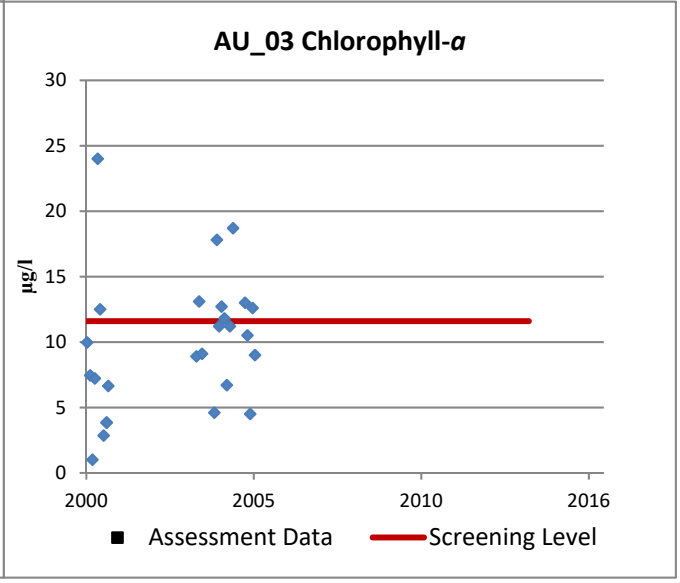
Trend analysis did not indicate any trends in ammonia concentrations in AU_02 over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_02	11.6µg/l	CS	27	<1	92.9	18	1	18



All AUs have been assessed as having a concern for chlorophyll-*a*. The concerns in AU_01 and AU_03 are based on older data since no chlorophyll-*a* samples have been taken since 2005. Trend analysis indicates an increasing trend in AU_02 (t = 2.53, p = 0.014) over time.





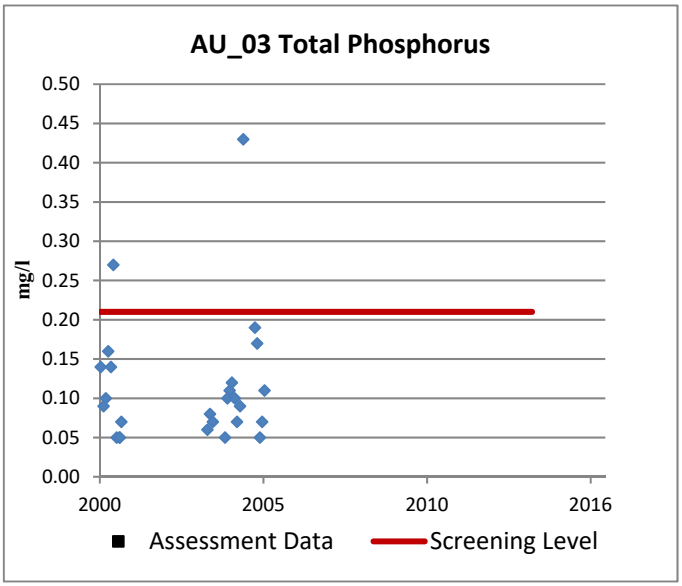
Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_02	0.17 mg/l	NC	28	<0.01	0.14	0.01	26	0

Trend analysis did not indicate any trends in nitrate concentrations in AU_02 over time.

TKN		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	21	<0.5	3.89	1.79

Trend analysis did not indicate any trends in TKN concentrations in AU_02 over time.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_02	0.21 mg/l	NC	28	<0.05	0.55	0.11	7	7

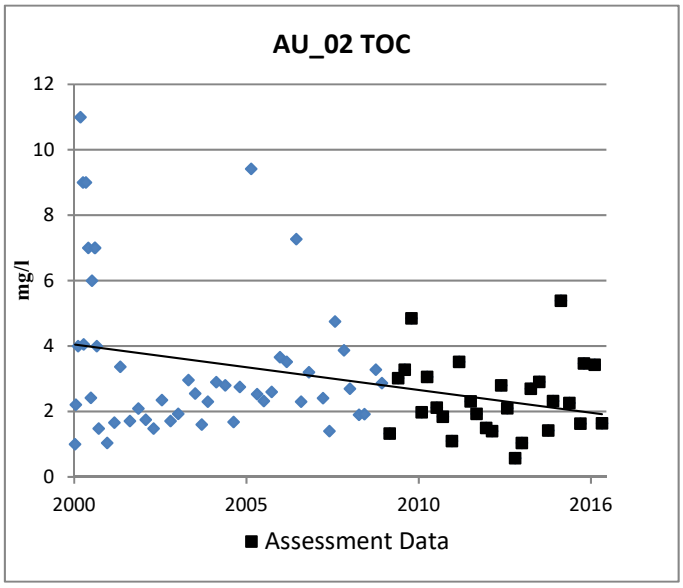


AU_03 has been assessed as having a concern for total phosphorus. The concern is based on older data since no total phosphorus samples have been taken since 2005. Trend analysis did not indicate any trends in total phosphorus concentrations in AU_02 over time.

TSS		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	28	13.2	624	81.75

Trend analysis did not indicate any trends in TSS concentrations in AU_02 over time.

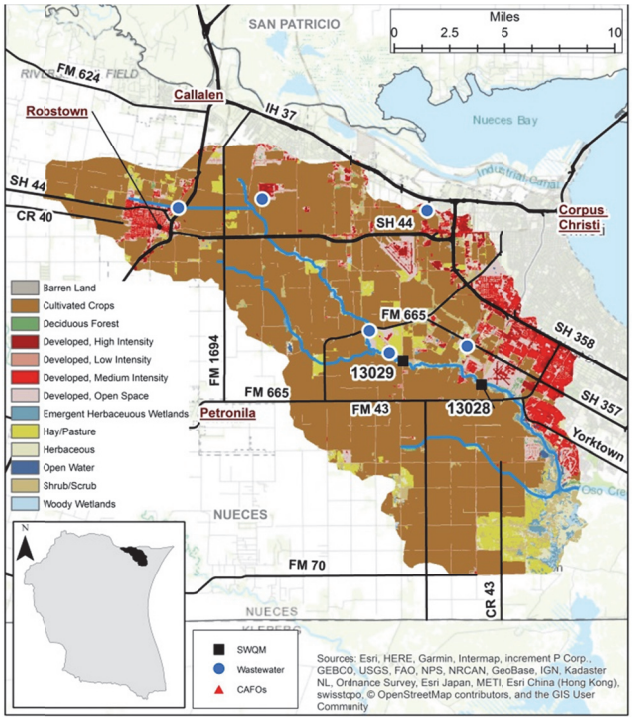
TOC		Status	# samples	Min	Max	Median
AU_02	mg/l	N/A	28	0.58	5.39	2.19



Trend analysis indicates a decreasing trend in TOC concentrations in AU_02 ($t = -3.00$, $p = 0.004$) over time.

OSO CREEK – SEGMENT 2485A

Segment 2485A, Oso Creek, flows 29.5 miles from a point 3 miles upstream of SH 44 west of Corpus Christi to the confluence with Oso Bay in Nueces County. Its watershed is 118,380 acres. The southeastern end of the creek flows through highly developed areas of Corpus Christi. The northwestern end is primarily rural, but development is rapidly encroaching.



Special Studies

The Center for Water Supply Studies at Texas A&M University – Corpus Christi (TAMUCC) is developing an I-Plan to address the bacteria impairment in the creek. The draft is expected to be completed during the summer of 2018.

Water Quality Analysis

The analysis for this segment is based on data from **Station 13028** at SH 286**.**

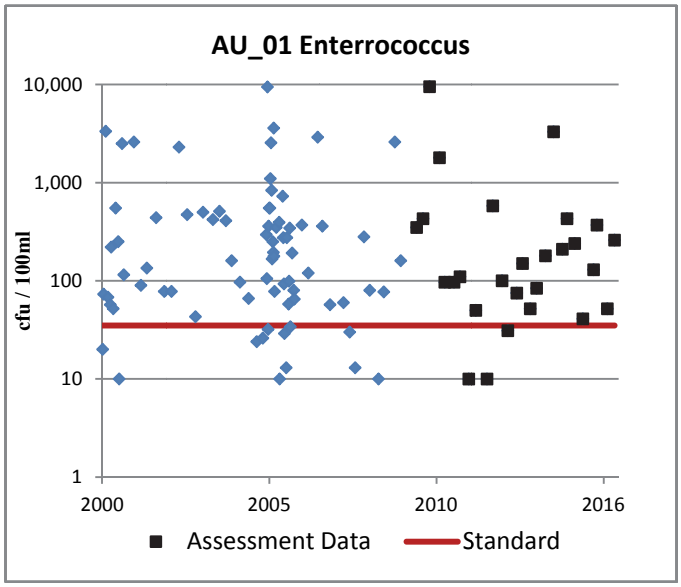
Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	28	2.5	17.4	7.5	1	2
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO concentrations or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	NS	27	<10	9500	161	1	24



The creek has been listed impaired for bacteria for contact recreation since 2002. There have been numerous studies conducted, and the most likely cause is from wildlife and avian contributions. Standing water after heavy rains attracts the laughing gulls, and hundreds of sandhill cranes can be seen on the fields during migratory seasons. Trend analysis did not indicate any trends in Enterococci concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	28	11.2	30.7	24.6	0

Trend analysis did not indicate any trends in water temperature over time.

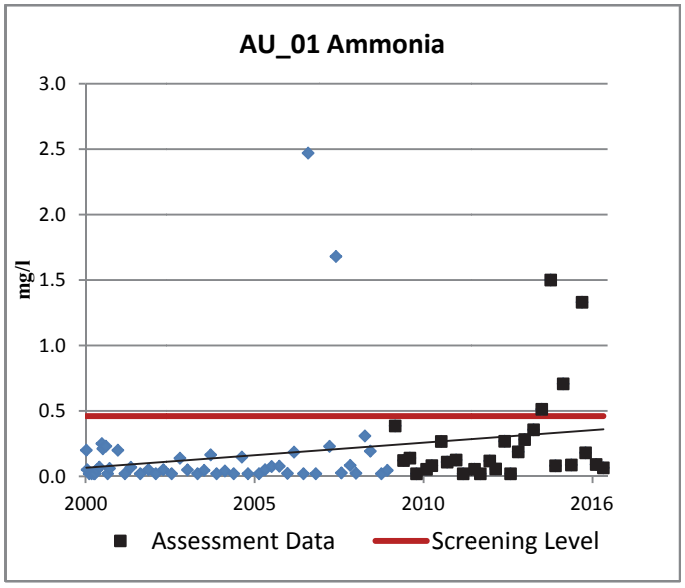
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	28	6.9	8.7	7.8	0	1

Trend analysis did not indicate any trends in pH levels over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	91	220	135.5

Trend analysis did not indicate any trends in alkalinity over time.

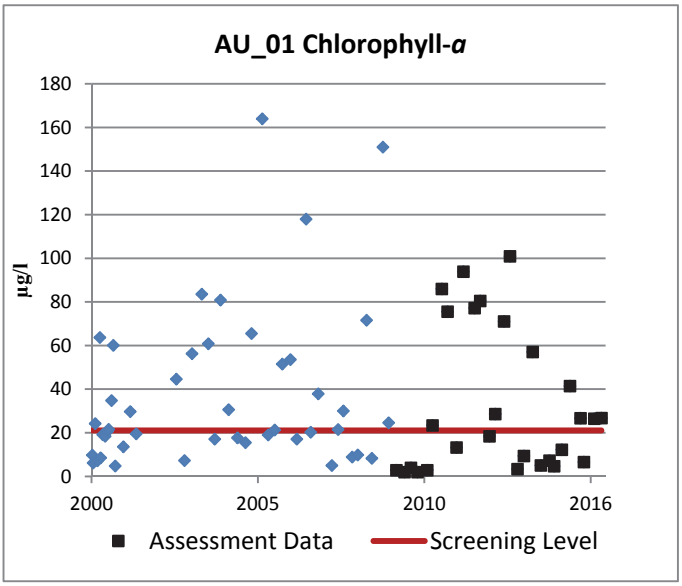
Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	28	<0.02	1.5	0.12	4	4



Trend analysis indicates an increasing trend (t = 2.17, p = 0.033) in ammonia concentrations over time. Some of the more recent data have exceeded the screening level. The cause of this increase is unknown.

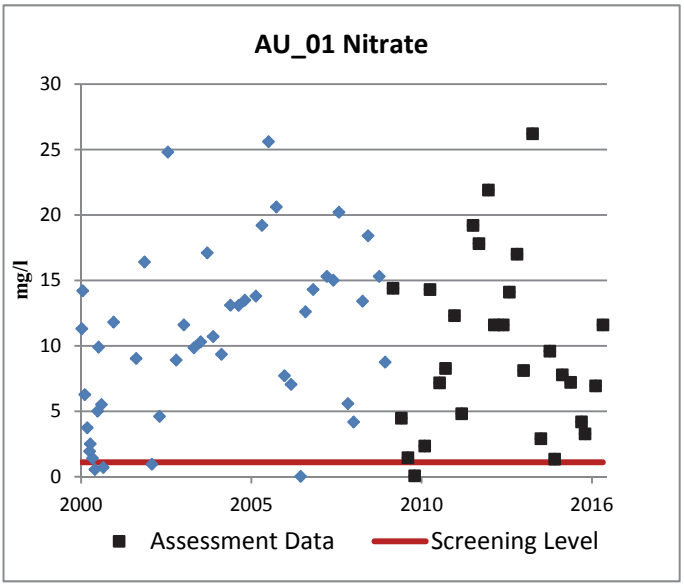
Sampling location for Station 13028

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21µg/l	CS	28	<2	101	20.9	2	14



The segment is assessed as having a concern for chlorophyll-*a*. Trend analysis did not indicate any trends over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.10
AU_01	1.10 mg/l	CS	28	0.062	26.2	8.19	0	27

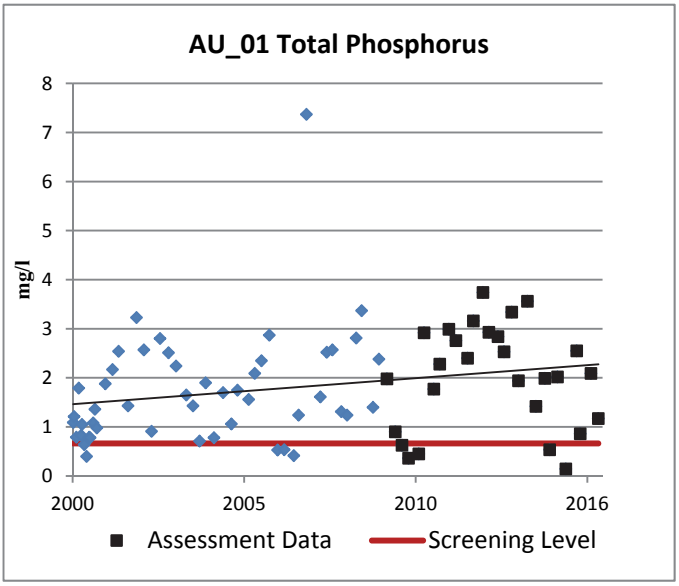


The segment is assessed as having a concern for nitrate. Trend analysis did not indicate any trends concentrations over time.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	22	0.76	3.56	1.55

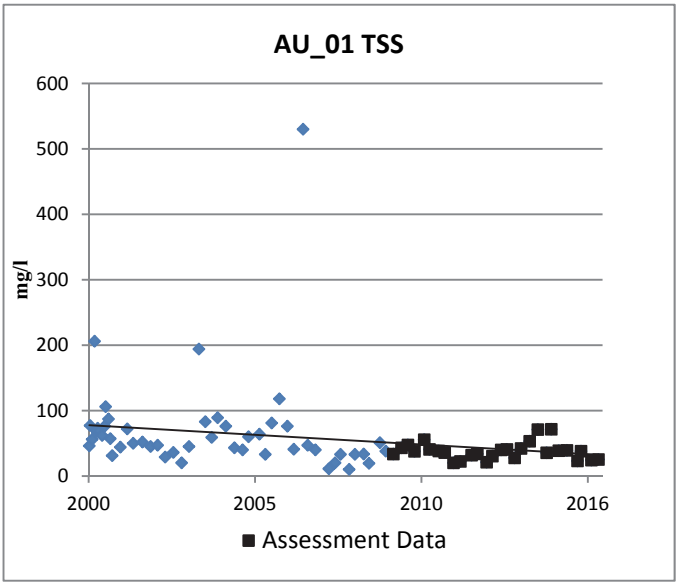
Trend analysis was not conducted on this parameter due to a 2001 – 2011 data gap.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	CS	28	0.144	3.74	2.06	0	23



The segment has been assessed as having a concern for total phosphorus. Trend analysis indicates an increasing trend (t = 2.02, p = 0.046) over time. The cause of the increase is unknown.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	20	71.5	37.75



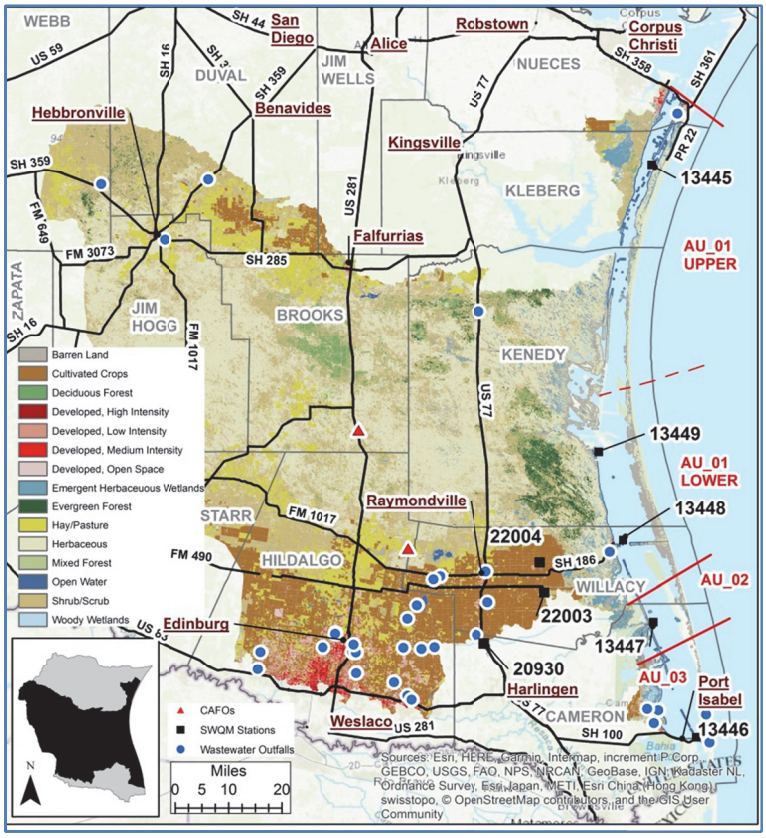
Trend analysis indicates a decreasing trend in TSS concentrations (t = -2.02, p = 0.047) over time.

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	4.53	17	9.5

Trend analysis did not indicate any trends in TOC concentrations over time.

LAGUNA MADRE – SEGMENT 2491

Segment 2491, Laguna Madre, runs along the Texas coast from Corpus Christi Bay in Nueces County to the Brownsville Ship Channel in Cameron County. It is divided into three AUs. **AU_01** is the upper portion north of the Arroyo Colorado confluence. Because of the hydrological differences above and below the land cut, the area north of the land cut is proposed to be separated into its own segment, **2490**. To better represent the water quality over the entire Laguna Madre, this report includes analysis for AU_01 Upper and AU_01 Lower, assuming the same water quality standards and screening levels as for AU_01. **AU_02** is the area adjacent to the Arroyo Colorado confluence. **AU_03** is the lower portion south of the Arroyo Colorado confluence. Its watershed is 4,222,224 acres.



The Laguna Madre is a very unique body of water. The only development is at the very northern and very southern ends: Corpus Christi and Port Isabel, respectively. Padre Island National Seashore encompasses most of the barrier island to the east. The land to the west is predominantly large ranches such as the King Ranch.

There is little water exchange directly from the Gulf of Mexico. The Laguna is connected to Corpus Christi Bay and there are two channels through the island at Port Mansfield and Port Isabel. Additional channels open periodically with tropical storms and hurricanes.

There are numerous WWTPs permitted to discharge to the Laguna Madre via the North Floodway, Segment 2491B, some of which are as far west as McAllen. The sampling location for the North Floodway, Station 20930, is also shown on this map.

Special Studies

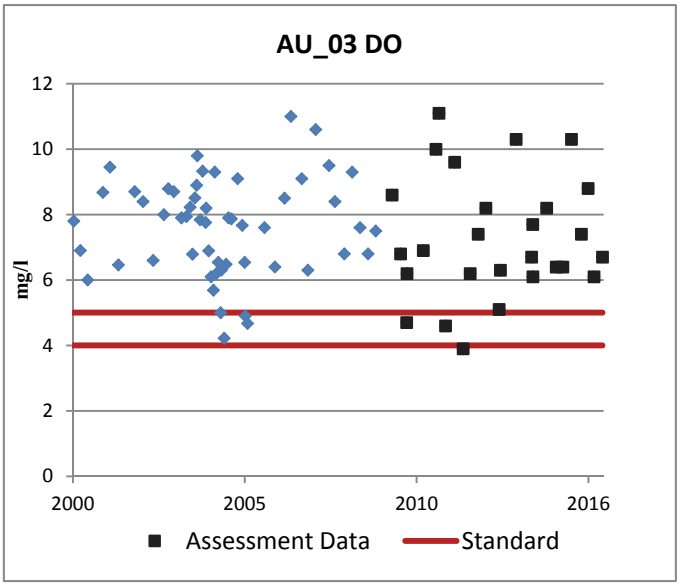
A TMDL was conducted to address a low DO impairment listed in 1999. The proposed separation of AU_01 Upper into its own segment is a result of this study.

Water Quality Analysis

The analysis for AU_01 Upper is based on data from **Station 13445** southwest of South Bird Island**.** The analysis for AU_01 Lower is based on data from **Station 13448** at the intersection of the Intracoastal Waterway (ICWW) and Port Mansfield Channel**.** The analysis for AU_02 is based on data from **Station 13447** at the intersection of the ICWW and. Arroyo Colorado. The analysis for AU_03 is based on data from **Station 13446** at ICWW CM 129 east of Port Isabel.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_01 Upper	Minimum 4.0 mg/l	FS	27	5.0	9.6	7.3	0	0
	Screening Level 5.0 mg/l	NC						
AU_01 Lower	Minimum 4.0 mg/l	FS	23	5.3	9.6	6.8	0	0
	Screening Level 5.0 mg/l	NC						
AU_02	Minimum 4.0 mg/l	FS	25	1.5	9.8	6.8	2	2
	Screening Level 5.0 mg/l	NC						
AU_03	Minimum 4.0 mg/l	FS	27	3.9	11.1	6.8	1	3
	Screening Level 5.0 mg/l	CS						



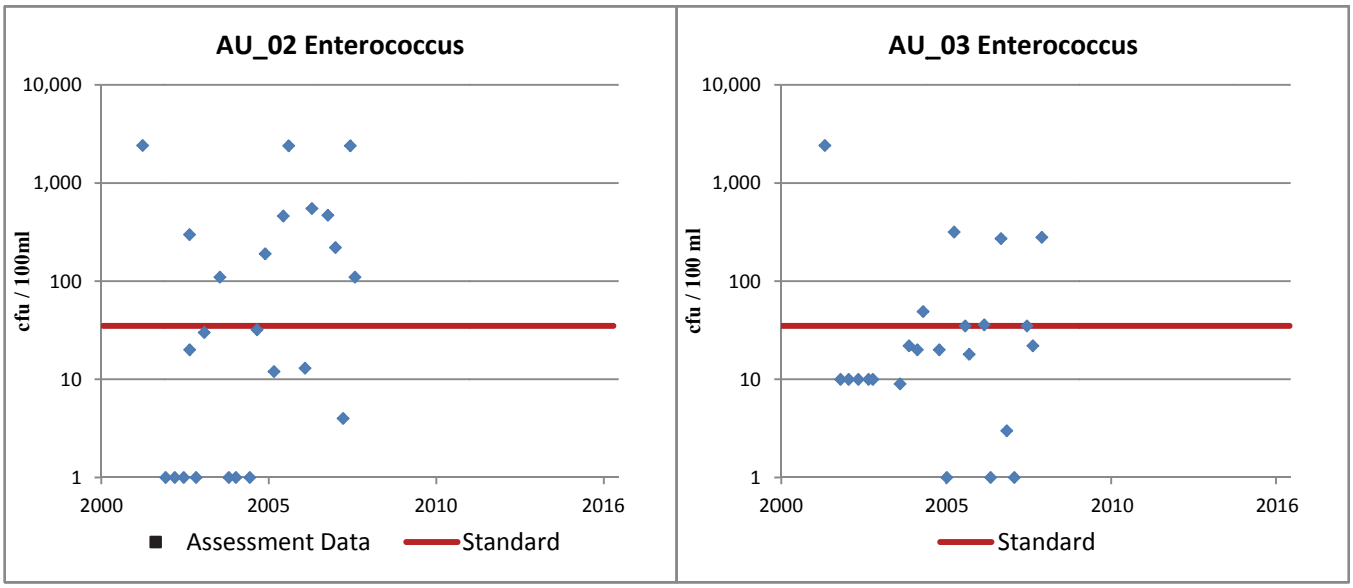
Based on data collected for the TMDL, a revision to the DO criteria is being proposed: The TCEQ recommends changing the 24-Hr average criteria from 5.0 mg/l to 4.5 mg/l, but local stakeholders have requested that they consider 4.0 mg/l. The recommended change for the 24-Hr minimum criteria is from 4.0 mg/l to 2.0 mg/l. AU_01 and AU_02 do not meet the current 24-Hr minimum. The revisions are under review by the EPA. The bay is currently meeting the new proposed DO standards in all AUs. AU_03 is currently the only AU that is currently assessed as having a concern at the grab screening level.

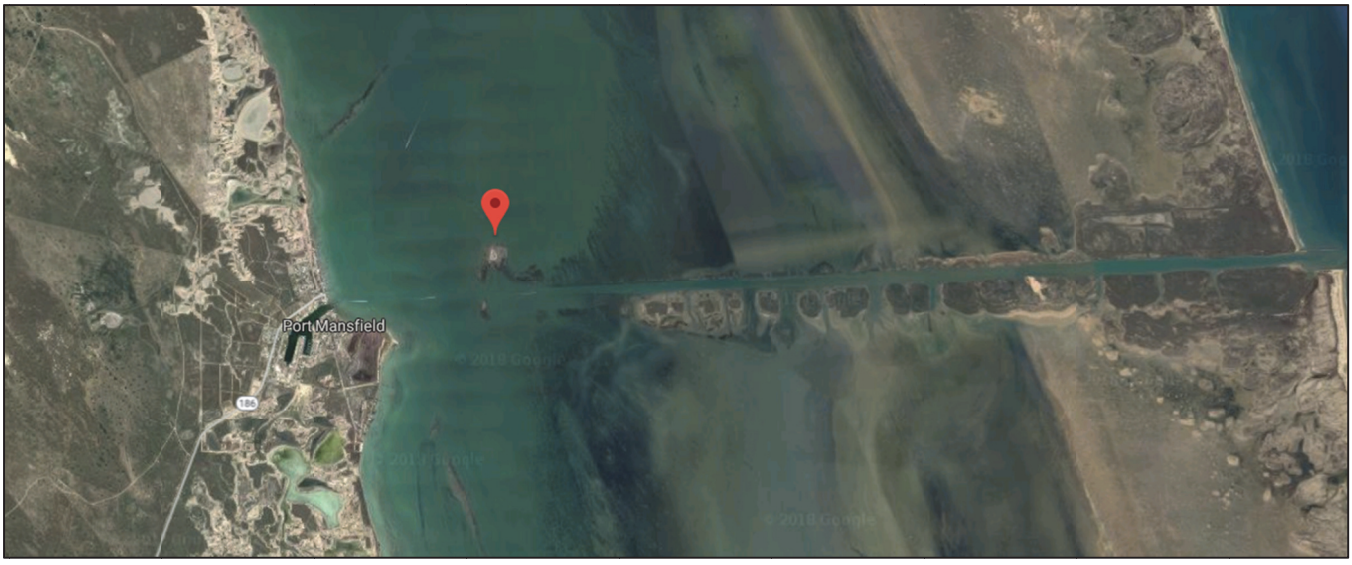
Trend analysis did not indicate any trends in any of the AUs over time

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01 Upper	Geomean 35 cfu/100 ml	FS	20	<10	1600	14.4	16	2

AU_02 is listed as being impaired and AU_03 has been assessed as having a concern for bacteria for contact recreation based on older data. The absence of a local accredited lab for bacteria analysis has prevented recent water quality samples from being collected for bacteria because holding times cannot be met. Only AU_01 Upper had bacteria samples collected after 2008, so there was insufficient data for trend analysis in AU_01 Lower, AU_02, or AU_03. Trend analysis did not indicate any trends in Enterococcus concentrations in AU_01 Upper over time.

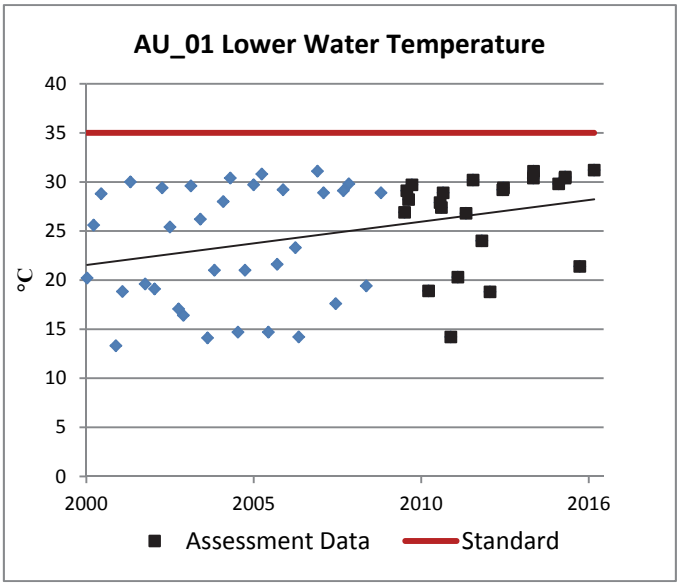




Google Earth view of sampling location for Station 13448

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01 Upper	35.0 °C	FS	27	12.9	31.4	26.4	0
AU_01 Lower		FS	23	14.2	31.2	28.9	0
AU_02		FS	26	12.3	30.9	26.2	0
AU_03		FS	29	2.9	29.0	23.1	0



Trend analysis indicates an increasing trend in water temperature in AU_01 Lower (t = 2.68, p = 0.010) over time.

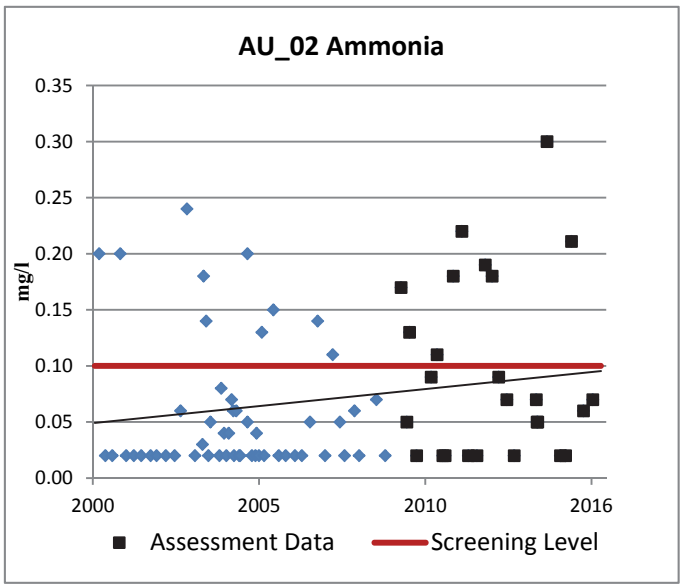
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01 Upper	6.5 – 9.0 su	FS	27	7.9	9.0	8.2	0	0
AU_01 Lower		FS	23	7.9	8.3	8.1	0	0
AU_02		FS	26	7.6	8.5	8.1	0	0
AU_03		FS	29	7.5	8.4	8.0	0	0

Trend analysis did not indicate any trends in pH levels in any of the AUs over time.

Alkalinity		Status	# samples	Min	Max	Median
AU_01 Upper	mg/l	N/A	26	113	188	146.5
AU_01 Lower		N/A	19	118	163	133
AU_02		N/A	28	124	238	153
AU_03		N/A	26	114	160	123

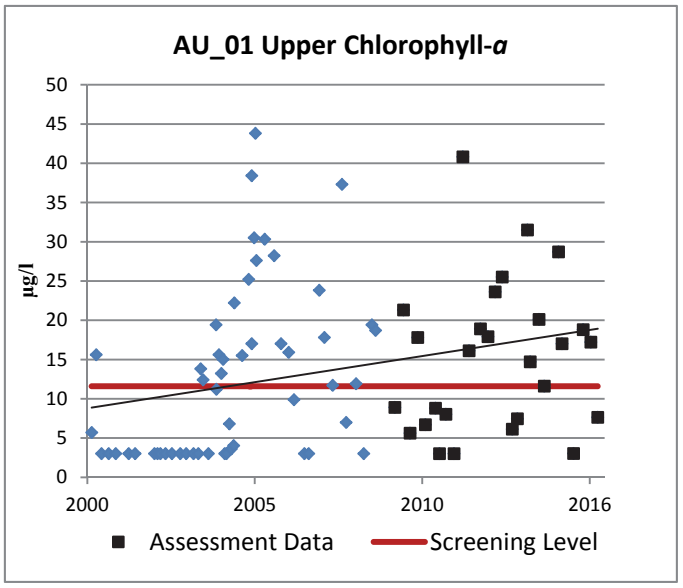
Trend analysis did not indicate any trends in alkalinity in any of the AUs over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01 Upper	0.1 mg/l	NC	26	<0.02	0.06	0.02	25	0
AU_01 Lower		NC	20	<0.05	0.107	0.05	12	1
AU_02		NC	26	<0.02	0.3	0.07	8	9
AU_03		NC	26	<0.02	0.12	0.02	24	1

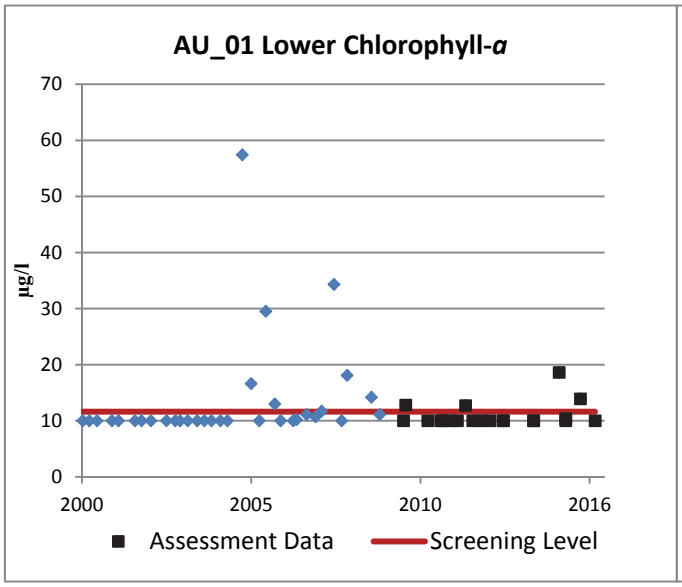


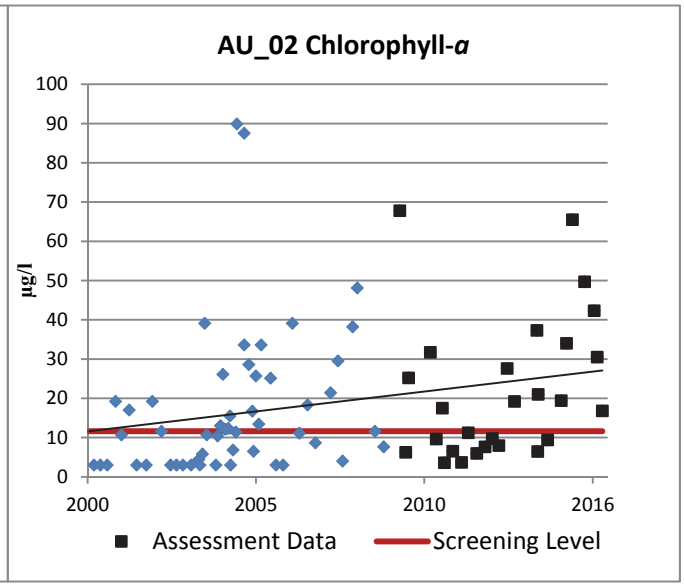
Trend analysis indicates an increasing trend in AU_02 (t = 2.18, p = 0.032) over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01 Upper	11.6µg/l	CS	27	0.99	40.8	16.1	0	15
AU_01 Lower		CS	19	<10	18.6	10	15	4
AU_02		CS	26	3.61	63.5	17.15	0	14
AU_03		NC	26	<3	44.8	2.66	1	2

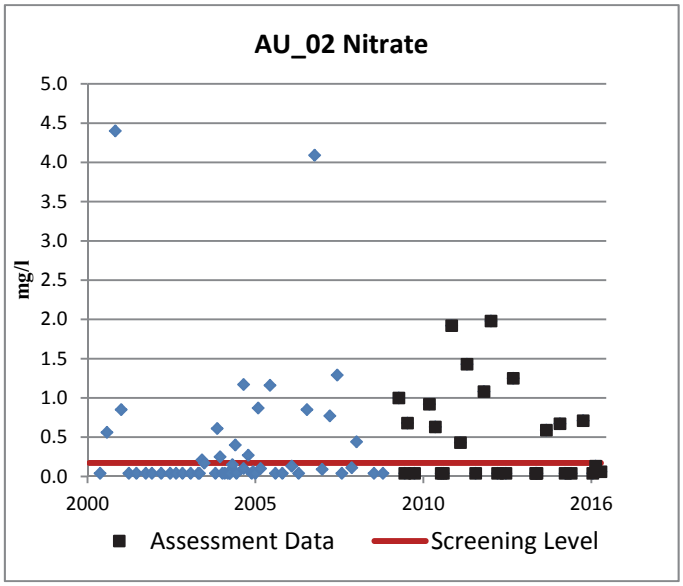


AU_01 Upper, AU_01 Lower, and AU_02 have been assessed as having a concern for chlorophyll-*a*. Based on the more recent data, AU_01 Lower is meeting the screening level. Trend analysis indicates increasing trends in AU_01 Upper (t = 2.50, p = 0.014) and in AU_02 (t = 2.17, p = 0.033) over time.



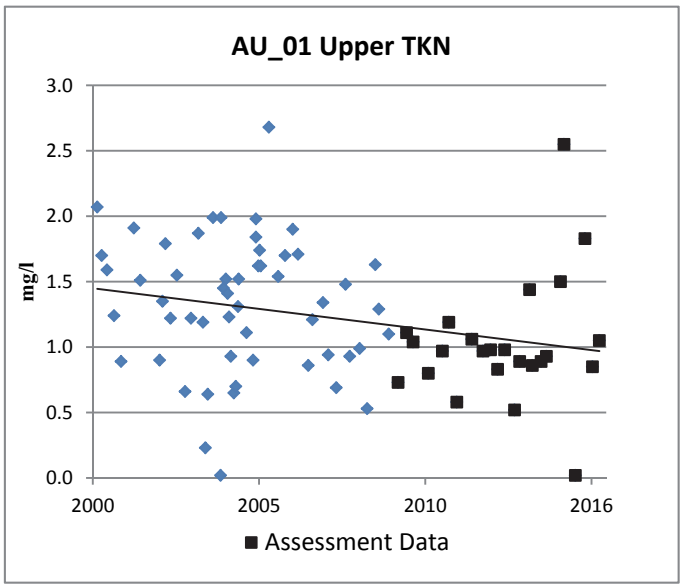


Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01 Upper	0.17 mg/l	NC	26	<0.02	<0.02	0.02	26	0
AU_01 Lower		NC	21	<0.04	0.14	0.04	19	0
AU_02		CS	28	<0.04	1.98	0.10	13	13
AU_03		NC	28	<0.04	0.06	0.04	26	0



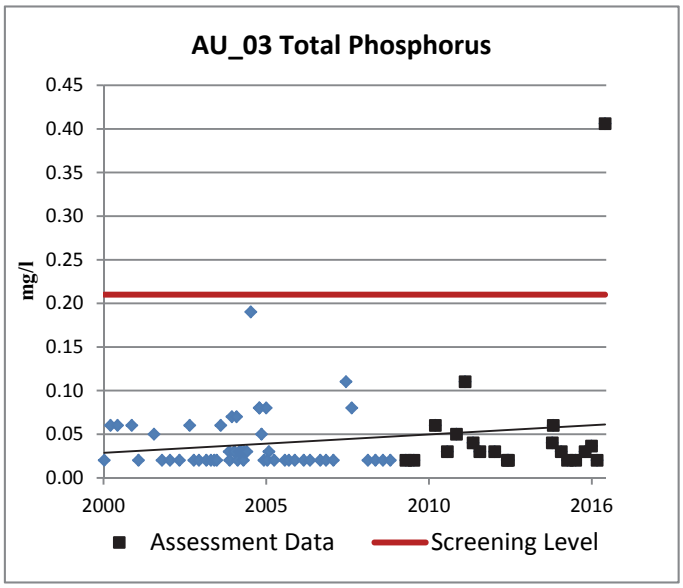
AU_02 has been assessed as having a concern for nitrate. Trend analysis did not indicate any trends in any of the AUs over time.

TKN		Status	# samples	Min	Max	Median
AU_01 Upper	mg/l	N/A	24	<0.02	2.55	0.97
AU_01 Lower		N/A	20	<2	<2	2
AU_02		N/A	23	0.56	3.78	0.88
AU_03		N/A	21	0.02	0.78	0.4



Trend analysis indicates a decreasing trend in TKN concentrations in AU_01 Upper (t = -2.41, p = 0.018) over time.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01 Upper	0.21 mg/l	NC	23	<0.02	0.07	0.05	7	0
AU_01 Lower		NC	17	<0.02	0.11	0.05	5	0
AU_02		NC	21	<0.02	0.5	0.14	1	5
AU_03		NC	20	<0.02	0.406	0.03	7	1



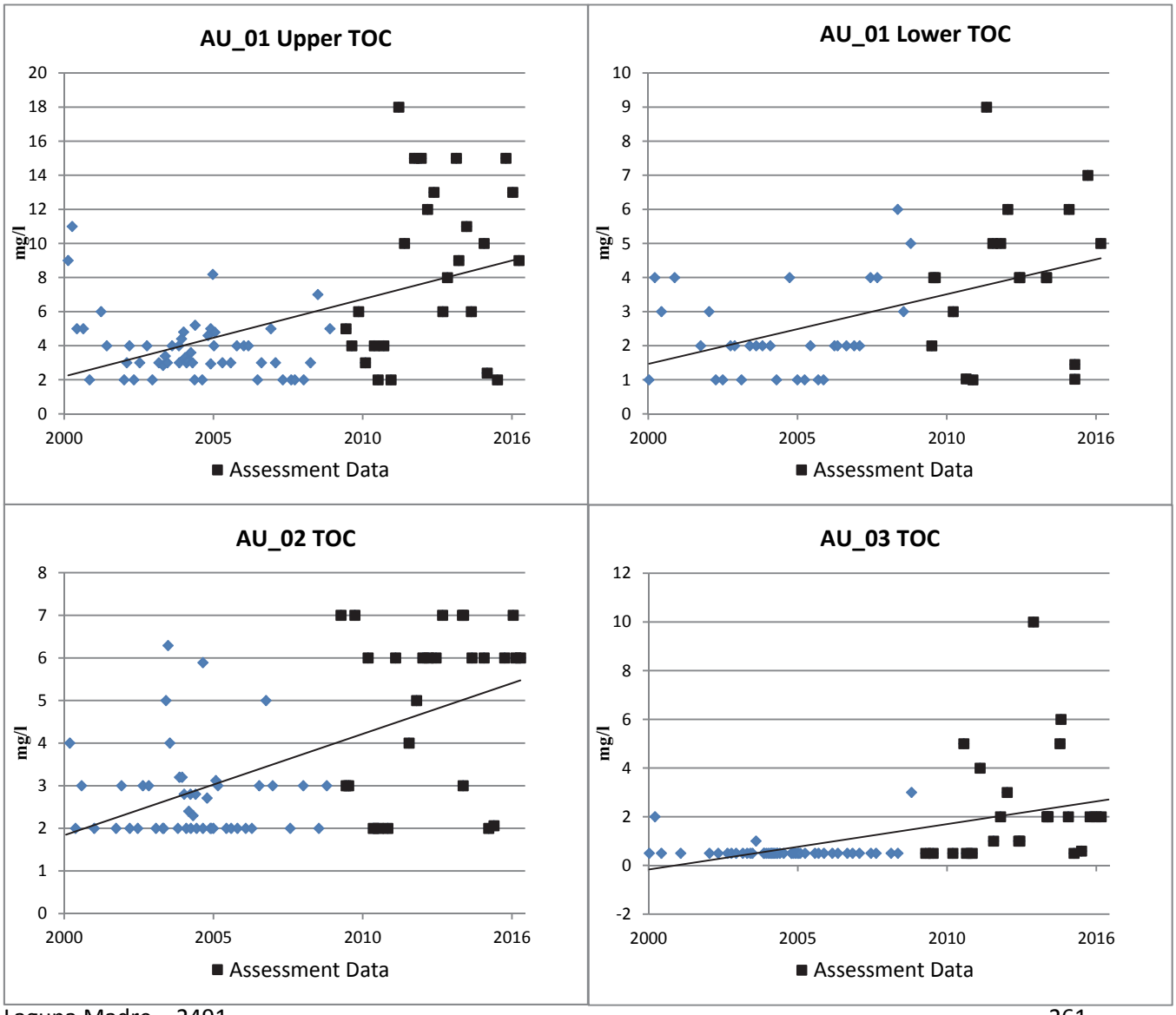
Trend analysis indicates an increasing trend in total phosphorus concentrations in AU_03 (t = 2.4, p = 0.008) over time.

TSS		Status	# samples	Min	Max	Median
AU_01 Upper	mg/l	N/A	26	5	72	21.5
AU_01 Lower		N/A	19	7	43	22
AU_02		N/A	28	10	369	24.5
AU_03		N/A	27	4.88	104	19

Trend analysis did not indicate any trends in TSS concentrations in any of the AUs over time.

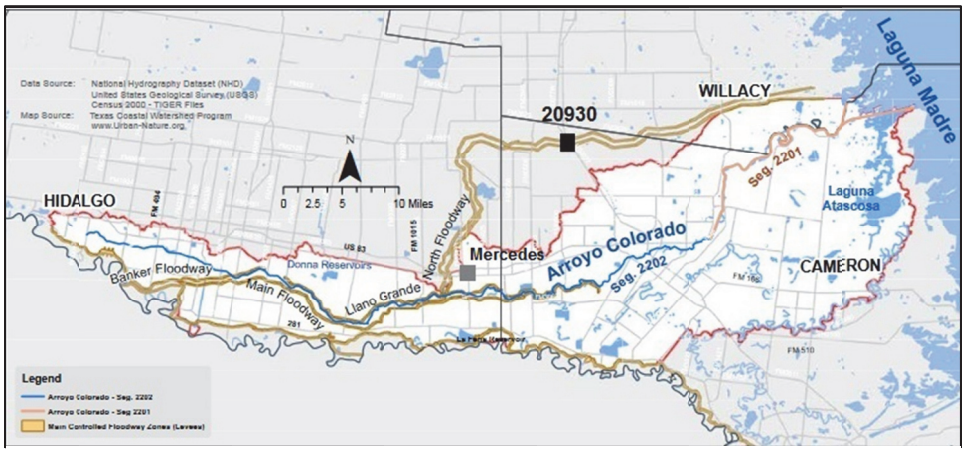
TOC		Status	# samples	Min	Max	Median
AU_01 Upper	mg/l	N/A	26	2	18	8.5
AU_01 Lower		N/A	19	1	9	4
AU_02		N/A	26	2	7	6
AU_03		N/A	24	0.5	10	2

Trend analysis indicates increasing trends in TOC concentrations in AU_01 Upper (t = 5.14, p = 0.014), in AU_01 Lower (t = 3.88, p = 0.000), in AU_02 (t = 5.94, p = 0.000), and in AU_03 (t= 4.92, p = 0.000) over time.



NORTH FLOODWAY – SEGMENT 2491B

Segment 2491B, North Floodway, is a flood control channel for the Arroyo Colorado. It diverts north from the Arroyo Colorado Above Tidal about two miles southwest of Mercedes and flows to the Laguna Madre near the Willacy / Cameron county line.



Water Quality Analysis

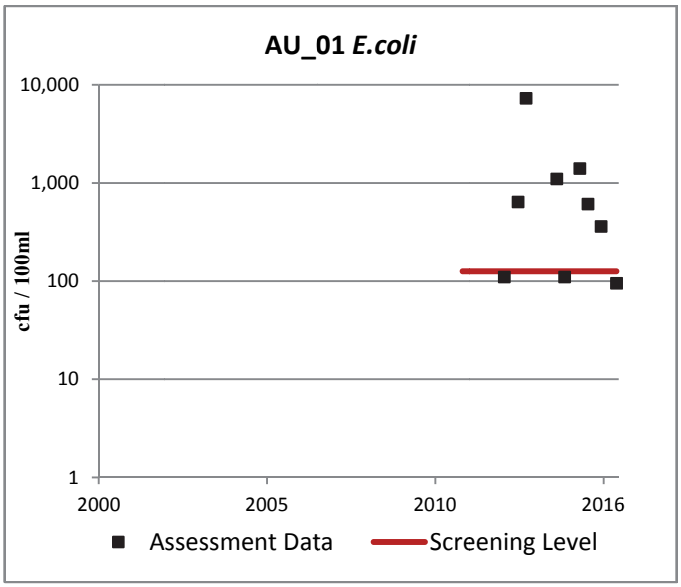
The analysis is based on data from **Station 20930** at US 77. TPWD requested a site on the floodway to better understand its influence on the Laguna Madre. Data collection began at this site in November 2011, so there is insufficient data for trend analysis. For the parameters that were not assessed for the Draft 2016 Integrated Report, the standards and screening levels for Arroyo Colorado Above Tidal, Segment 2202, were assumed because it is diverted from this segment.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<2	<3
AU_01	Minimum 2.0 mg/l	FS	19	6.8	17.0	6.1	0	0
	Screening Level 3.0 mg/l	NC						

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	N/A	9	95	7300	496	0	6



E. coli was not assessed in the Draft 2016 Integrated report due to insufficient data. The data that has been collected are exceeding the contact recreation standard for *E. coli* bacteria.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	N/A	19	12.0	39.0	23.7	1

Water temperature was not assessed in the Draft 2016 Integrated report, but the assumed temperature standard is being met.

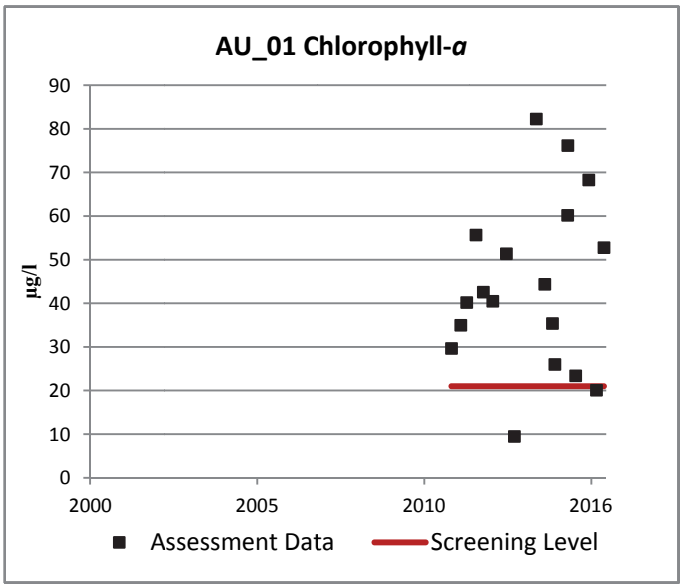
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	N/A	19	7.0	8.5	8.0	0	0

pH was not assessed in the Draft 2016 Integrated report, but the state-wide standard is being met.

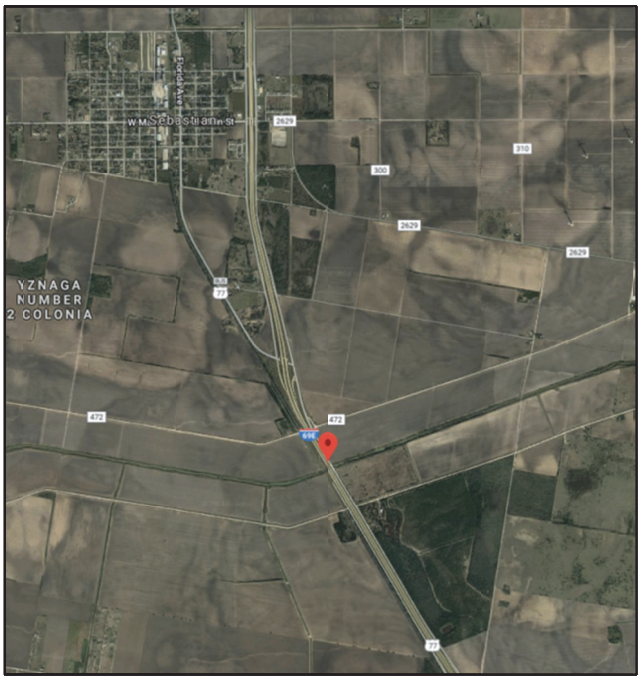
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	17	176	340	248

Ammonia		Status	# samples	Min	Max	Median	ND	>0.46
AU_01	0.46 mg/l	NC	17	<0.05	0.25	0.12	1	0

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>21
AU_01	21 µg/l	CS	18	9.5	82.3	41.6	0	11

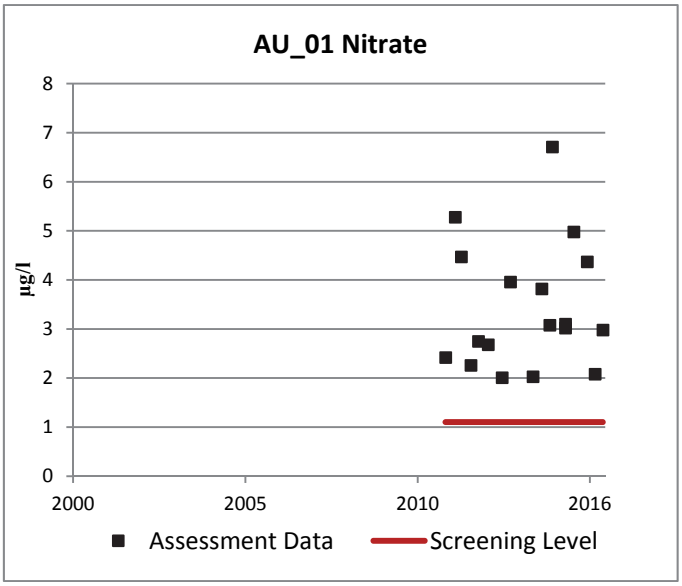


The segment has been assessed as having a concern for chlorophyll-*a*.



Google Earth view of sampling location for Station 20930

Nitrate		Status	# samples	Min	Max	Median	ND	>1.1
AU_01	1.1 mg/l	CS	18	2.01	6.71	3.05	0	18



The segment has been assessed as having a concern for nitrate.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	17	0.68	3.19	1.5

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.66
AU_01	0.66 mg/l	NC	15	0.21	0.59	0.29	0	0

Chloride		Status	# samples	Min	Max	Average	ND	>1200
AU_01	1200 mg/l	N/A	18	381	1160	587	0	0

Chloride was not assessed in the Draft 2016 Integrated report, but the assumed chloride standard is being met.

Sulfate		Status	# samples	Min	Max	Average	ND	>1000
AU_01	1000 mg/l	N/A	18	440	1200	686	0	1

Sulfate was not assessed in the Draft 2016 Integrated report, but the assumed sulfate standard is being met.

TDS		Status	# samples	Min	Max	Average	ND	>4000
AU_01	4000 mg/l	N/A	18	1540	3822	2351	0	0

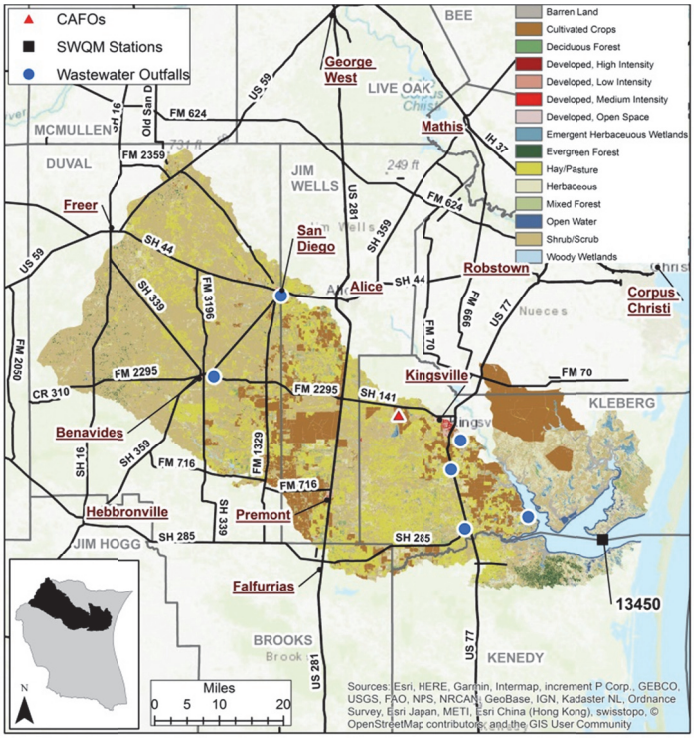
TDS was not assessed in the Draft 2016 Integrated report, but the assumed TDS standard is being met.

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	17	40.4	156	96.5

TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	16	4.7	9	7

BAFFIN BAY – SEGMENT 2492

Segment 2482, Baffin Bay is located in Kleberg and Kenedy Counties. Alazan Bay is the northeastern arm in Kleberg County, Cayo del Grullo is the northwestern arm in Kleberg County, and Laguna Salado is the western arm in Kleberg and Kenedy Counties. Its watershed is 1,376,310 acres. The City of Kingsville is the only large city in the watershed. Most of the bay is surrounded by large ranches such as the King Ranch. There are only a few public access points.



Special Studies

Local stakeholders, primarily fishermen, have expressed concerns of the water quality in the bay. Scientists at TAMUCC have been working with them to collect additional water quality samples, and the analysis indicates an excess of organic nitrogen. The stakeholder group, TAMUCC, Texas AgriLife, CBBEP, and NRA are working together to identify projects, and apply for funding to implement those projects, to better understand the loading and eventually intend to develop a WPP for the bay.

Water Quality Analysis

The analysis for this segment is based on data from **Station 13450** at CM 14.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<3	<4
AU_01	Minimum 3.0 mg/l	FS	27	5.6	10.1	6.9	0	0
	Screening Level 4.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_01	Geomean 35 cfu/100 ml	FS	20	<10	89	12.8	13	2

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35.0 °C	FS	27	13.3	31.2	25.5	0

Trend analysis did not indicate any trends in water temperature over time.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	FS	27	8.0	8.8	8.2	0	0

Trend analysis did not indicate any trends in pH levels over time.

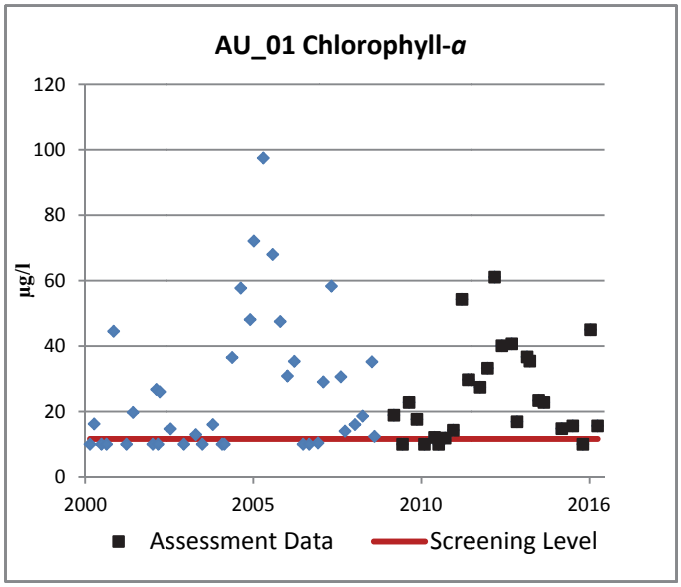
Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	26	76.7	210	166

Trend analysis did not indicate any trends in alkalinity over time.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
AU_01	0.1 mg/l	NC	25	<0.05	0.223	0.05	22	2

Trend analysis did not indicate any trends in ammonia concentrations over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
AU_01	11.6µg/l	CS	24	<1	14.1	5.1	1	1



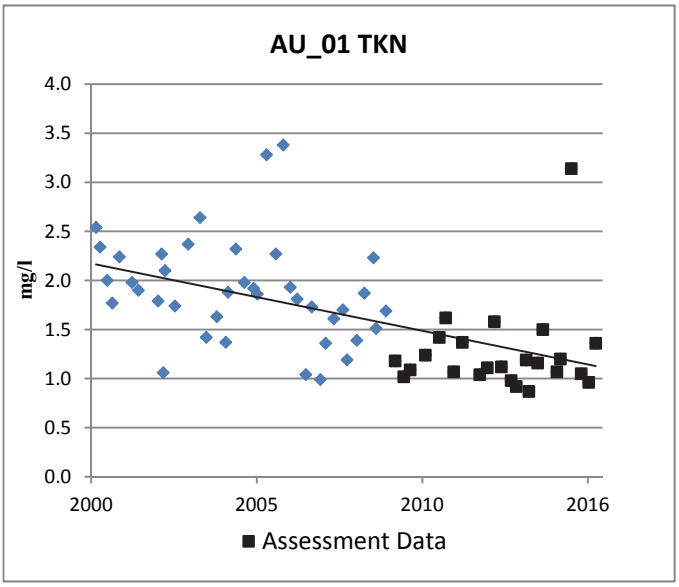
The bay has been assessed as having a concern for chlorophyll-*a*. Trend analysis did not indicate any trends over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
AU_01	0.17 mg/l	NC	26	<0.04	<0.04	0.04	26	0

Trend analysis did not indicate any trends in nitrate concentrations over time.

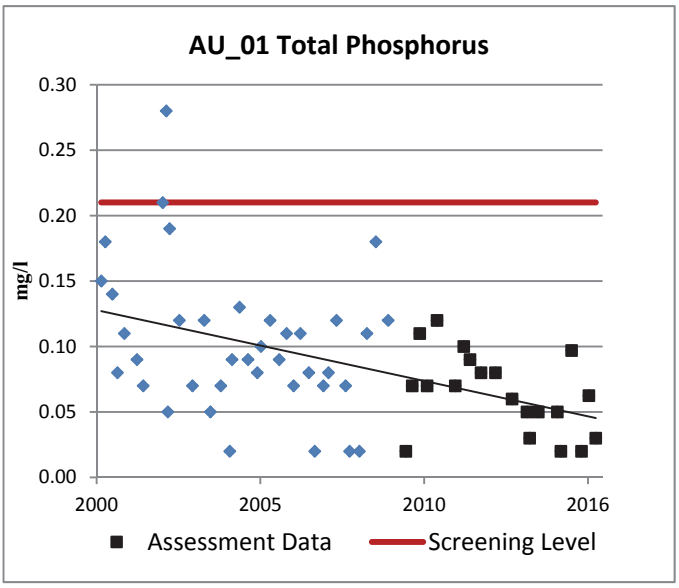
Google Earth view of Station 13450 sampling location

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	24	0.87	3.14	1.14



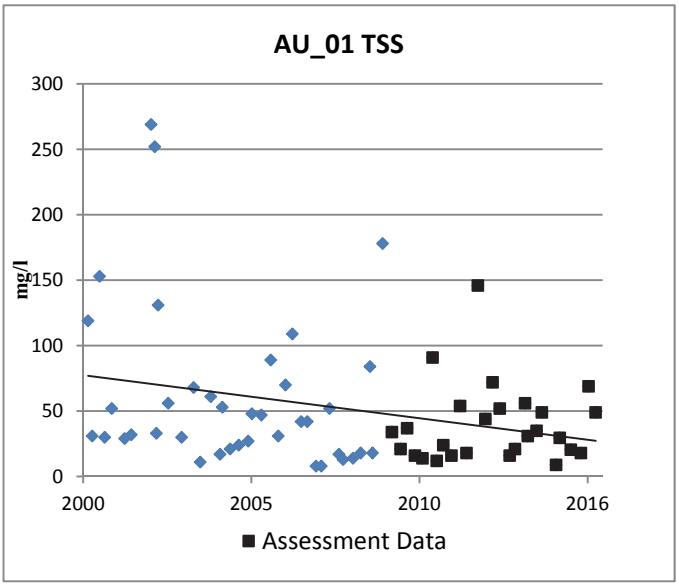
Trend analysis indicates a decreasing trend in TKN concentrations over time (t = -4.80, p = 0.000).

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
AU_01	0.21 mg/l	NC	23	<0.02	0.146	0.05	5	0



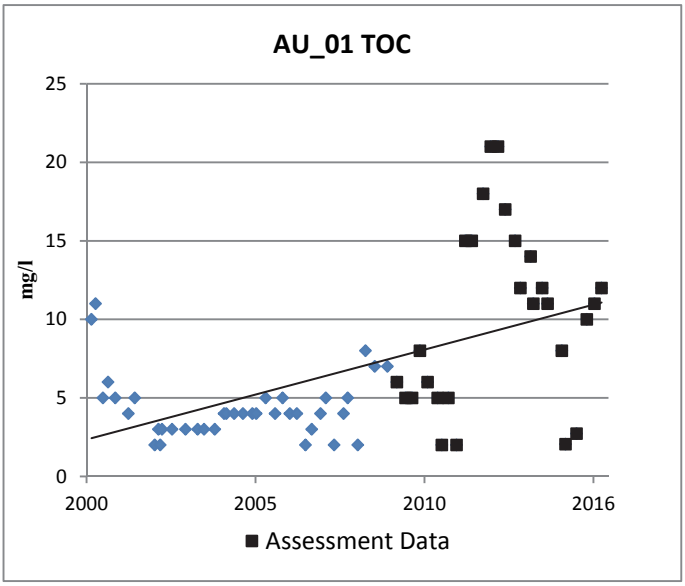
Trend analysis indicates a decreasing trend in total phosphorus concentrations over time (t = -3.00, p = 0.004).

TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	25	7	94	24



Trend analysis indicates a decreasing trend in TSS concentrations over time (t = -2.32, p = 0.023).

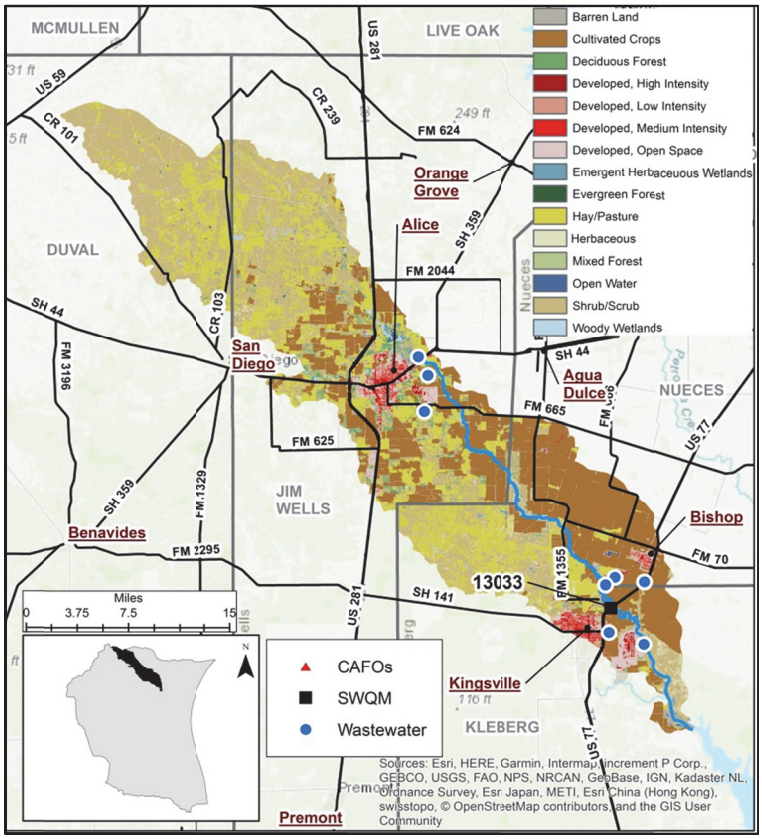
TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	23	1.22	8	4



Trend analysis indicates an increasing trend (t = 2.33, p = 0.023) in TOC concentrations over time.

SAN FERNANDO CREEK – SEGMENT 2492A

Segment 2492A, San Fernando Creek, flows 45.6 miles from a point just east of the Nueces and Jim Wells county line to the confluence of the Cayo del Grullo arm of Baffin Bay in Kleberg County. Its watershed is 288,572 acres. While primarily rural, the creek flows through the City of Alice and the City of Kingsville.



Water Quality Analysis

The analysis for this segment is based on data from **Station 13033** at US 77. Being a 2400-numbered segment, the creek has previously been assessed as a tidal stream. However, at the sampling location, the flow is always downstream. The creek is now being assessed as a freshwater stream. The same impairment and concerns are identified with both the tidal and freshwater standards and screening levels. Water temperature, pH chloride, sulfate, and TDS were not assessed in the Draft 2016 Integrated Report. For these parameters, the analysis for this report assumes the same standards and screening levels as for Segment 2204, Petronila Creek above Tidal. This is the closest, most similar, above tidal stream.

Aquatic Life Use Assessment

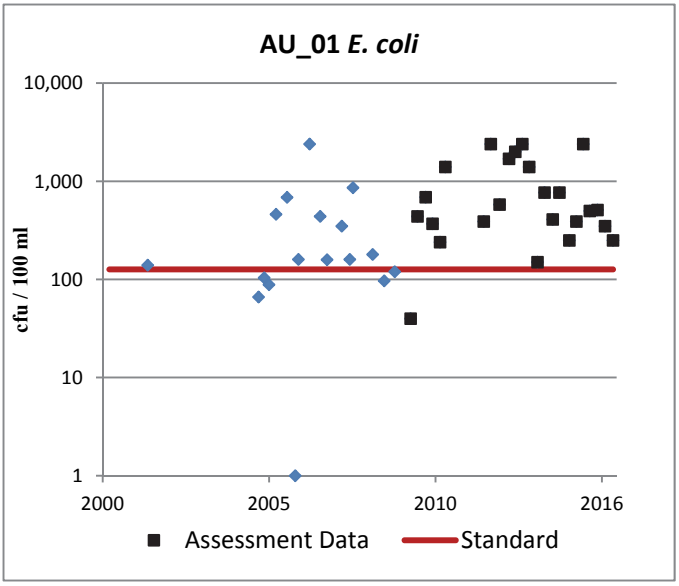
DO		Status	# samples	Min	Max	Median	<3	<5
AU_01	Minimum 3.0 mg/l	FS	37	5.5	16.0	9.2	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends DO levels or DOD over time or with respect to flow.

Sampling location for Station 13033

Recreation Use

E. coli		Status	# samples	Min	Max	Geomean	ND	>126
AU_01	Geomean 126 cfu/100 ml	NS	24	40	>2400	576	0	23



The segment is listed as being impaired for bacteria for contact recreation. Trend analysis indicates an increasing trend (t = 2.94, p = 0.005) over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_01	35°C	N/A	38	12.4	33	23.8	0

Water temperature has not been assessed in this segment, but the data are currently meeting the assumed standard. Trend analysis did not indicate any trends over time or with respect to flow.

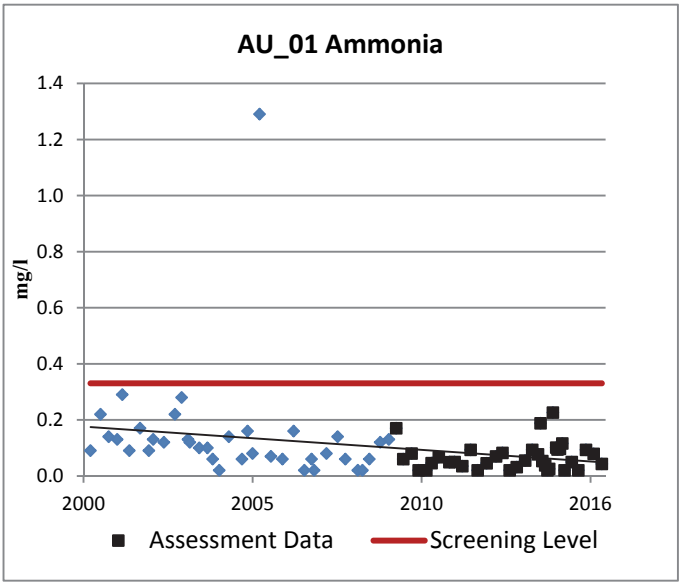
pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_01	6.5 – 9.0 su	N/A	37	7.6	8.6	8.3	0	0

pH has not been assessed in this segment, but the data are currently meeting the assumed standard. Trend analysis did not indicate any trends over time or with respect to flow.

Alkalinity		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	28	22	203	57.6

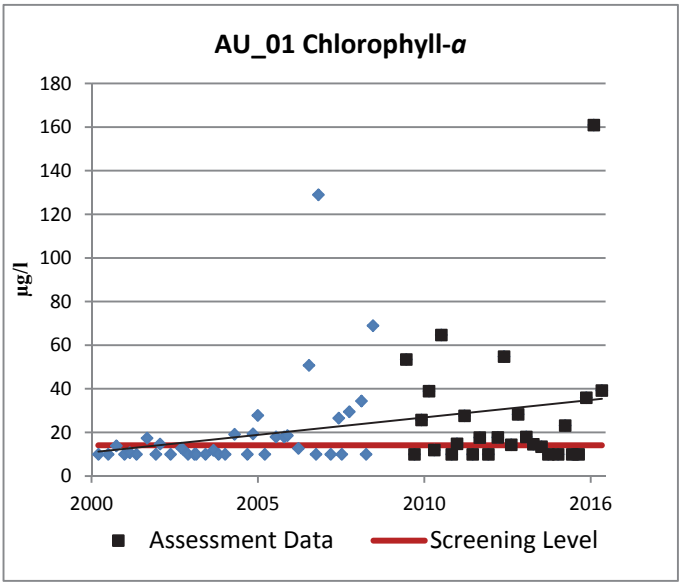
Trend analysis did not indicate any trends in alkalinity over time or with respect to flow.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.33
AU_01	0.33 mg/l	NC	36	<0.02	0.226	0.05	7	0



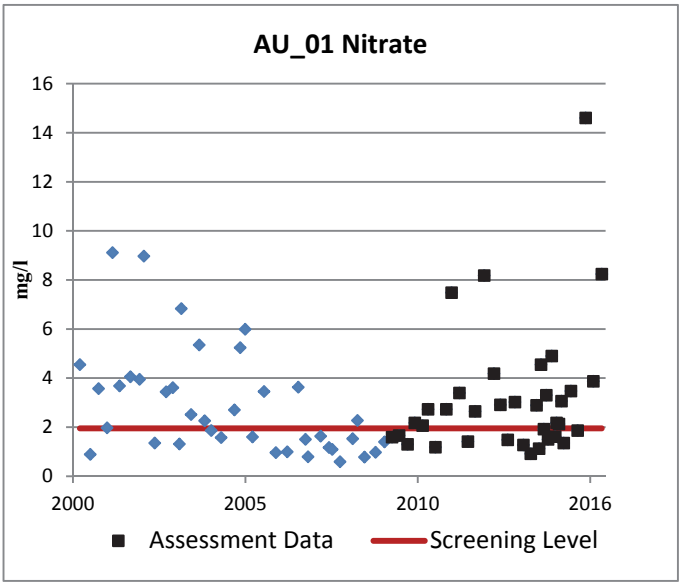
Trend analysis indicates a decreasing trend in ammonia concentrations (t = -2.11, p = 0.038) over time.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>14.1
AU_01	14.1 µg/l	CS	27	<10	161	17.7	7	17



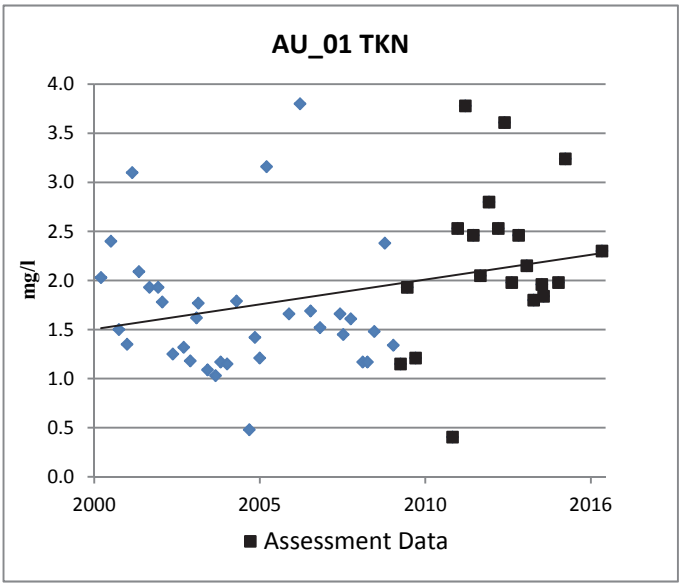
The segment has been assessed as having a concern for chlorophyll-*a*. Trend analysis indicates an increasing trend (t = 2.26, p = 0.027) over time.

Nitrate		Status	# samples	Min	Max	Median	ND	>1.95
AU_01	1.95 mg/l	CS	36	0.912	14.6	2.41	0	22



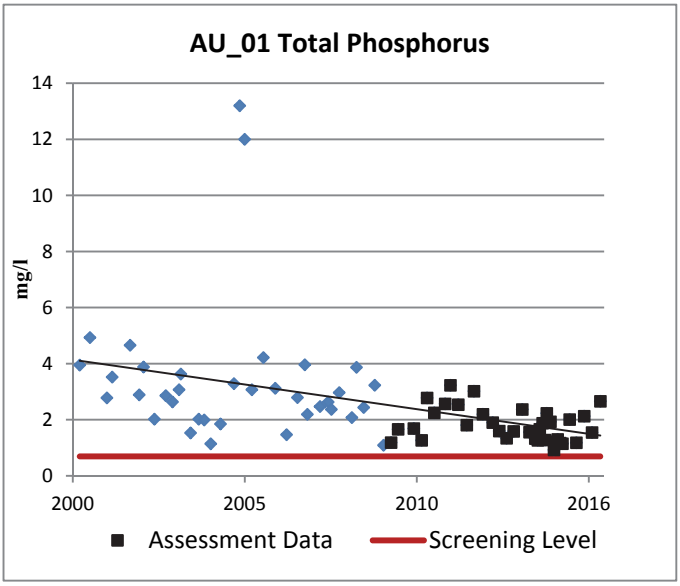
The segment has been assessed as having a concern for nitrate. Trend analysis did not indicate any trends over time or with respect to flow.

TKN		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	20	0.405	3.78	2.1



Trend analysis indicates an increasing trend (t = 2.34, p = 0.023) in TKN concentrations over time.

Total Phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_01	0.69 mg/l	CS	35	0.925	3.23	1.66	0	35



The segment has been assessed as having a concern for total phosphorus. Trend analysis indicates a decreasing trend (t = -3.74, p = 0.000) over time. The concentrations are approaching, but are still exceeding, the screening level.

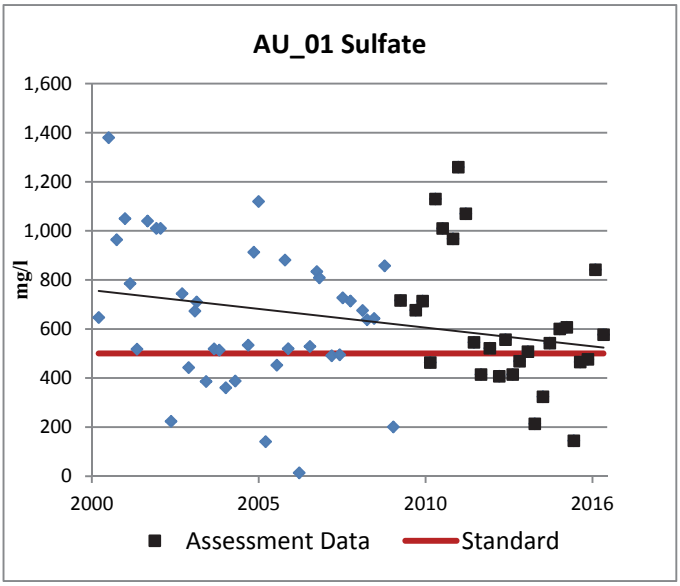
TSS		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	88	22	203	57.65

Trend analysis did not indicate any trends in TSS concentrations over time or with respect to flow.

Chloride		Status	# samples	Min	Max	Average	ND	>1500
AU_01	1500 mg/l	N/A	27	181	1050	631	0	0

Chloride has not been assessed in this segment, but the data are currently meeting the assumed standard. Trend analysis did not indicate any trends in over time or with respect to flow.

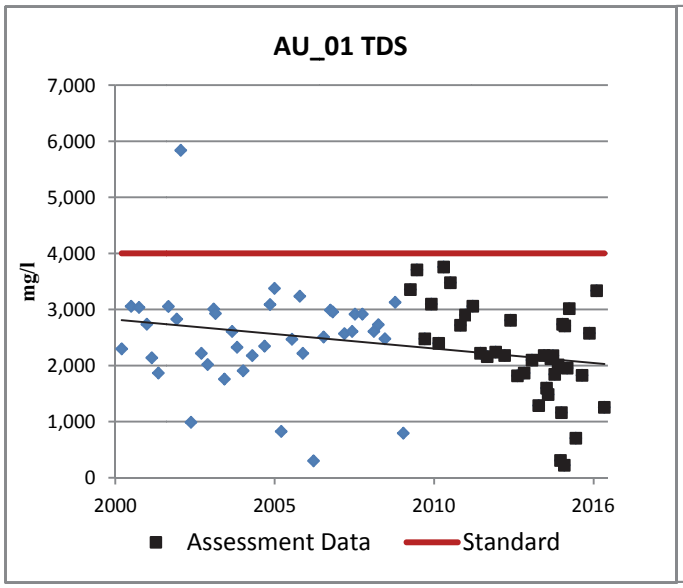
Sulfate		Status	# samples	Min	Max	Average	ND	>500
AU_01	500 mg/l	N/A	27	145	1260	616	0	17

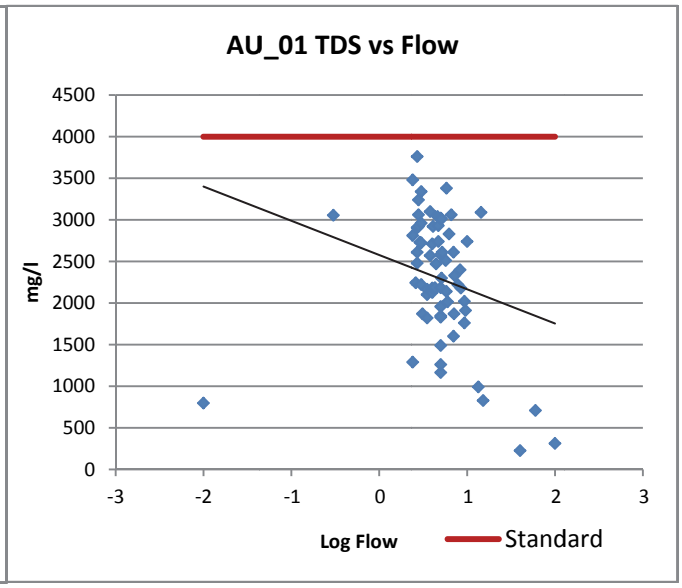


Sulfate has not been assessed in this segment, but the data are not currently meeting the assumed standard. Trend analysis indicates a decreasing trend (t = -2.00, p = 0.049) over time. This decreasing trend, as well as the ones seen for total phosphorus and TDS may be related to improvements at some of the WWTPs in the watershed.

TDS		Status	# samples	Min	Max	Average	ND	>4000
AU_01	4000 mg/l	N/A	19	356	702	541	0	1

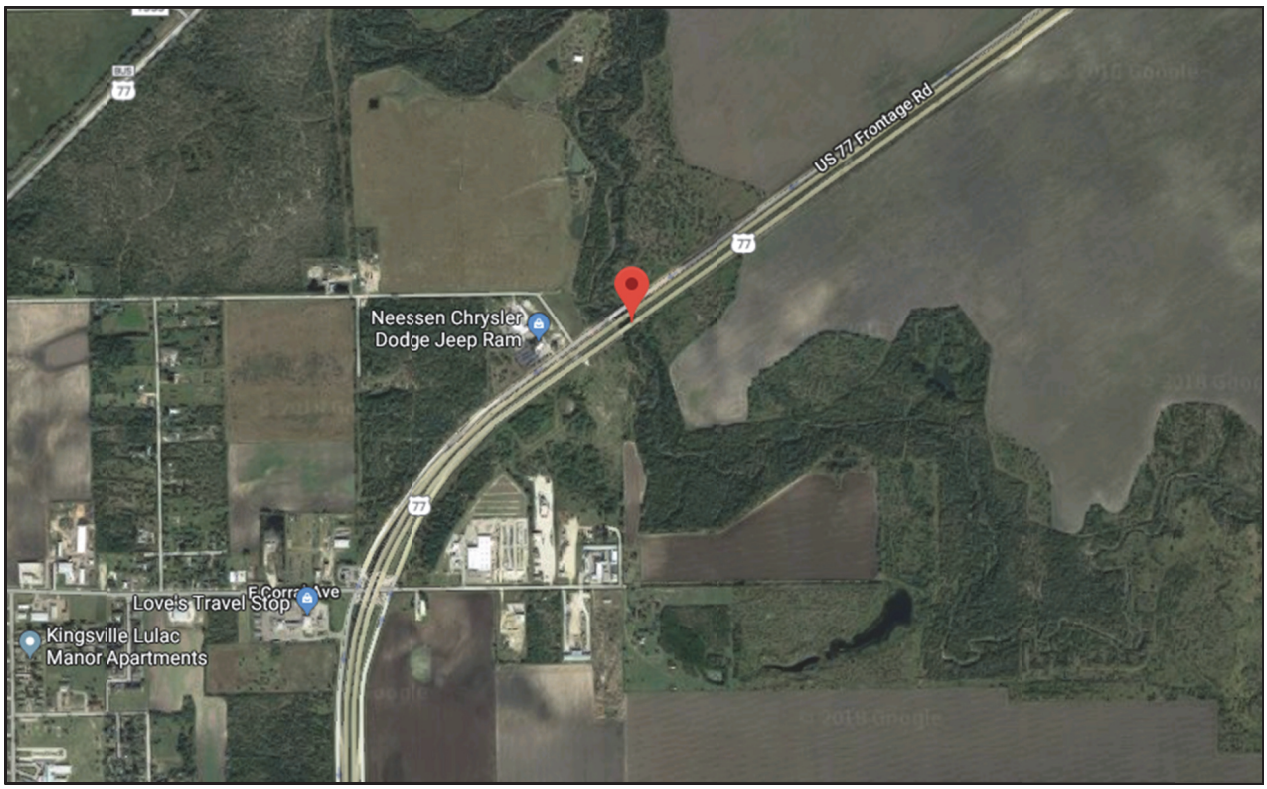
TDS has not been assessed in this segment, but the data are currently meeting the assumed standard. Trend analysis indicates decreasing trends over time (t = -2.44, p = 0.017) and with respect to flow (t = -2.15, p = 0.035).





TOC		Status	# samples	Min	Max	Median
AU_01	mg/l	N/A	18	1	5	2

Trend analysis did not indicate any trends in TOC concentrations over time or with respect to flow.



Google Earth view of Station 13033 sampling location

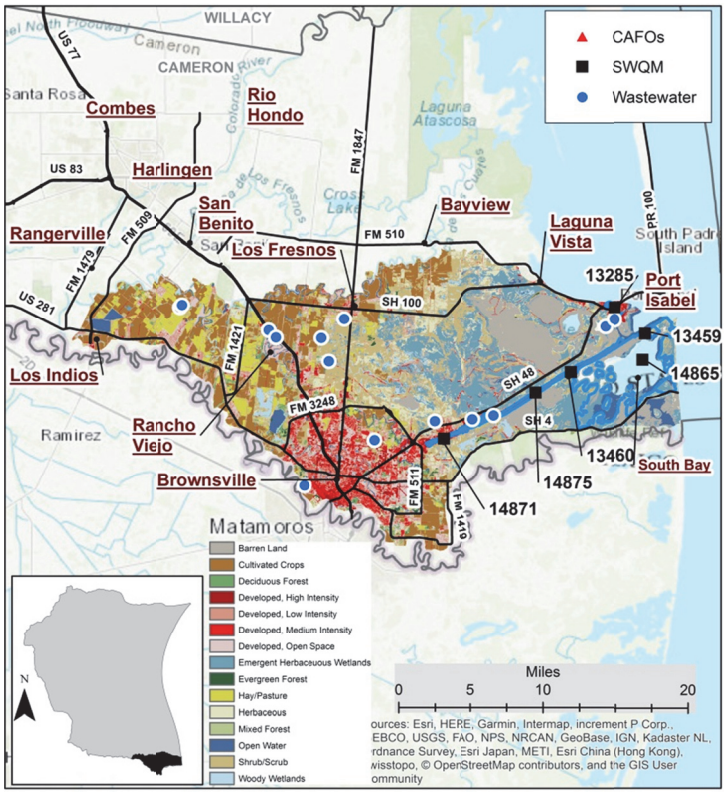
SOUTH BAY – SEGMENT 2493, BROWNSVILLE SHIP CHANNEL – SEGMENT 2494, & PORT ISABEL FISHING HARBOR – SEGMENT 2494A

Segment 2483, South Bay is located south of the Brownsville Ship Channel in Cameron County. It is the southernmost bay in Texas, and is part of the South Bay Coastal Preserve. It supports the largest concentration of oysters in the Lower Laguna Madre and is relatively inaccessible except by boat.

Segment 2494, Brownsville Ship Channel, extends from the Port of Brownsville to the Laguna Madre. The ship channel is part of the Port of Brownsville, a major center of industrial development with over 230 companies doing business there.

Segment 2494A, Port Isabel Fishing Harbor, harbor is located within the City of Port Isabel in Cameron County. The properties along the canals are a combination of businesses and residential properties.

The combined watershed of these three segments is 225,554 acres.



Water Quality Analysis

The analysis for Segment 2493 is based on data from **Station 13459** near Clark Island. The analysis for Segment 2494 is based on data from **Station 13460** at CM 35. The analysis for Segment 2494A is based on data from **Station 13285** at SH 100. Water temperature and pH were not assessed in Segment 2494A in the Draft 2016 Integrated Report. For those parameters, the analysis for this report assumes the same standards and screening levels as for Segment 2494.

Aquatic Life Use Assessment

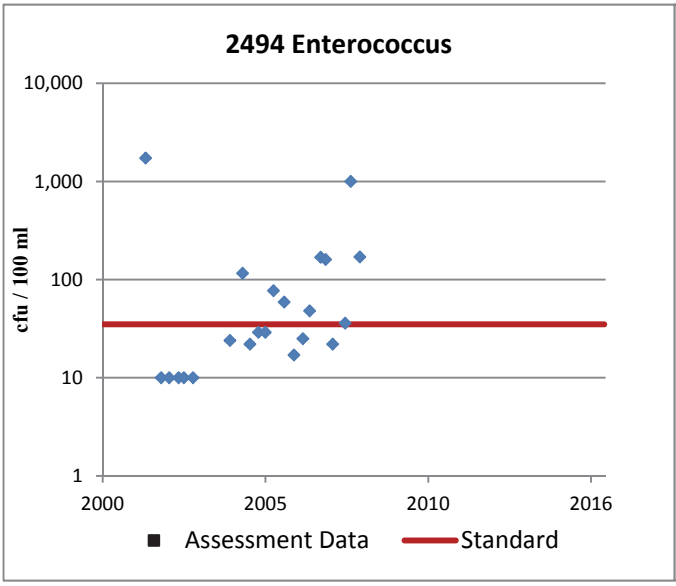
DO		Status	# samples	Min	Max	Median	<4 / <3	<5 / <4
2493	Minimum 4.0 mg/l	FS	27	4.9	14.2	7.8	0	1
	Screening Level 5.0 mg/l	NC						
2494	Minimum 4.0 mg/l	FS	28	1.2	12.2	7.2	1	2
	Screening Level 5.0 mg/l	CS						
2494A	Minimum 3.0 mg/l	FS	27	2.1	10.4	6.7	1	1
	Screening Level 4.0 mg/l	NC						

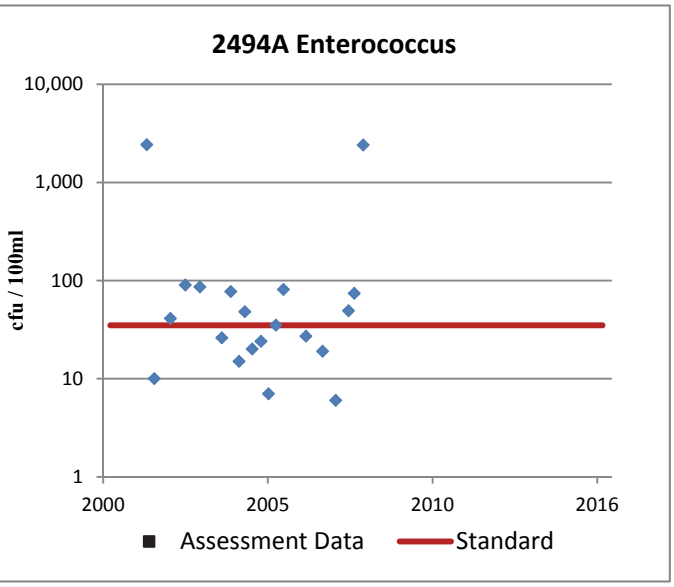
Segment 2494 has been assessed as having a concern for low DO at the grab screening level. However, analysis for this report was conducted using data from the station with the longest data record of the three monitoring sites on the ship channel. This individual site meets the screening level.

Trend analysis did not indicate any trends in DO levels or DOD over time in any of the segments.

Recreation Use

There is insufficient Enterococcus data for either trend or statistical analysis in any of the segments. Based on limited data from 2001 through 2008 in all segments, Segment 2493 was not assessed for bacteria, but Segments 2494 and 2494A are listed as being impaired for bacteria for contact recreation.





General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
2493	35.0 °C	FS	29	11.7	28.5	25.5	0
2494		FS	29	13.4	30.3	26.7	0
2494A		N/A	29	15.0	30.6	27.8	0

Trend analysis did not indicate any trends in water temperature over time in any of the segments.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
2493	6.5 – 9.0 su	FS	28	7.5	8.6	8.0	0	0
2494		FS	29	7.4	8.5	8.0	0	0
2494A		N/A	28	7.6	8.3	8.0	0	0

Trend analysis did not indicate any trends in pH levels over time in any of the segments.

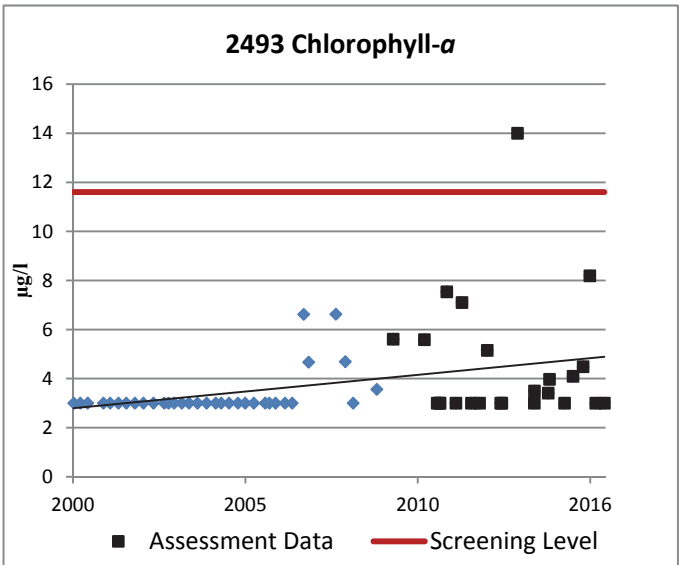
Alkalinity		Status	# samples	Min	Max	Median
2493	mg/l	N/A	25	115	133	123
2494		N/A	23	120	134	126
2494A		N/A	27	118	136	126

Trend analysis did not indicate any trends in alkalinity over time in any of the segments.

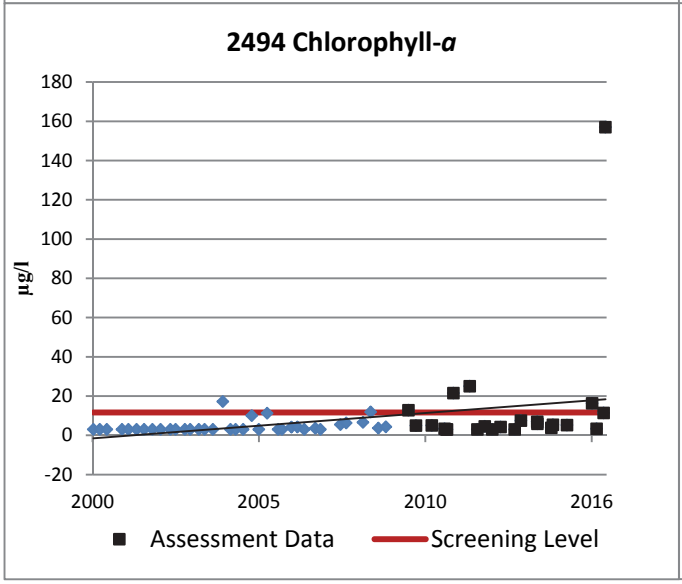
Ammonia		Status	# samples	Min	Max	Median	ND	>0.1
2493	0.1 mg/l	NC	26	<0.02	0.13	0.02	22	1
2494		NC	26	<0.05	0.22	0.05	22	1
2494A		NC	28	<0.02	0.269	0.02	22	2

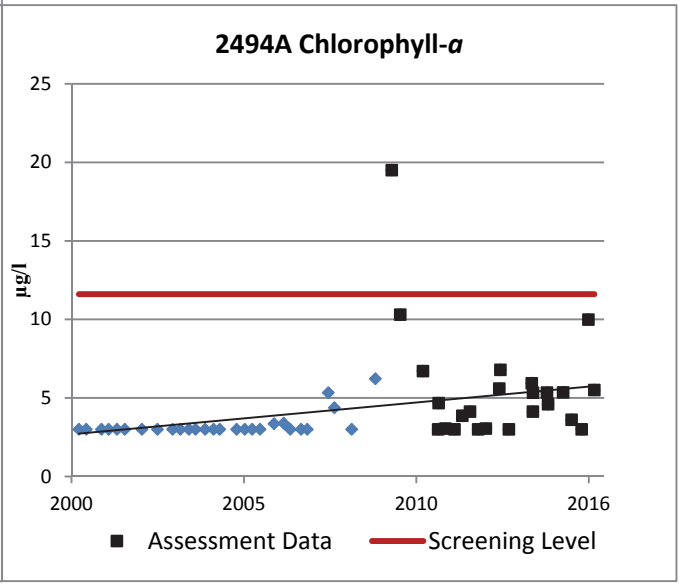
Trend analysis did not indicate any trends in ammonia concentrations over time in any of the segments.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>11.6
2493	11.6µg/l	NC	24	<3	14	3.2	12	1
2494		NC	22	<3	25	5.0	5	5
2494A		NC	24	<3	19.5	4.6	5	1



Trend analysis indicates increasing trends in chlorophyll-a concentrations in Segment 2493 (t = 2.74, p = 0.006), in Segment 2494 (t = 2.33, p = 0.023), and in Segment 2494A (t = 2.60, p =0.012) over time. However, in all segments, the non-detect levels in 2000 through 2005, was higher (<10 and <5) than for the later data, so that trend is most likely the result of the analysis methodology of converting all non-detects to the lowest non-detect value.





Nitrate		Status	# samples	Min	Max	Median	ND	>0.17
2493	0.17 mg/l	NC	27	<0.04	<0.04	0.04	27	0
2494		NC	27	<0.04	0.08	0.04	24	0
2494A		NC	28	<0.04	<0.04	0.04	28	0

Trend analysis did not indicate any trends in nitrate concentrations over in any of the segments.

TKN		Status	# samples	Min	Max	Median
2493	mg/l	N/A	22	0.1	1.55	0.325
2494		N/A	21	0.2	1.18	0.38
2494A		N/A	22	<0.1	1.41	0.34

Trend analysis did not indicate any trends in TKN concentrations over in any of the segments.

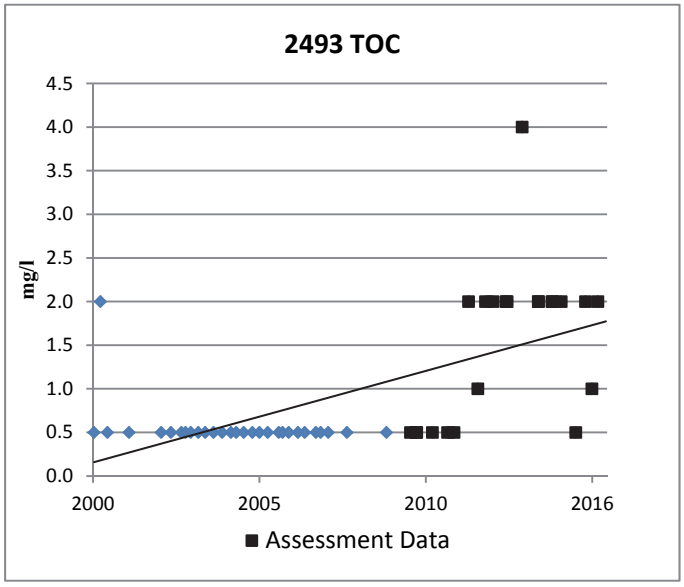
Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.21
2493	0.21 mg/l	NC	20	<0.02	0.956	0.03	6	1
2494		NC	20	<0.02	2.32	0.04	5	1
2494A		NC	28	<0.04	0.04	0.04	27	0

Trend analysis did not indicate any trends in total phosphorus concentrations over in any of the segments.

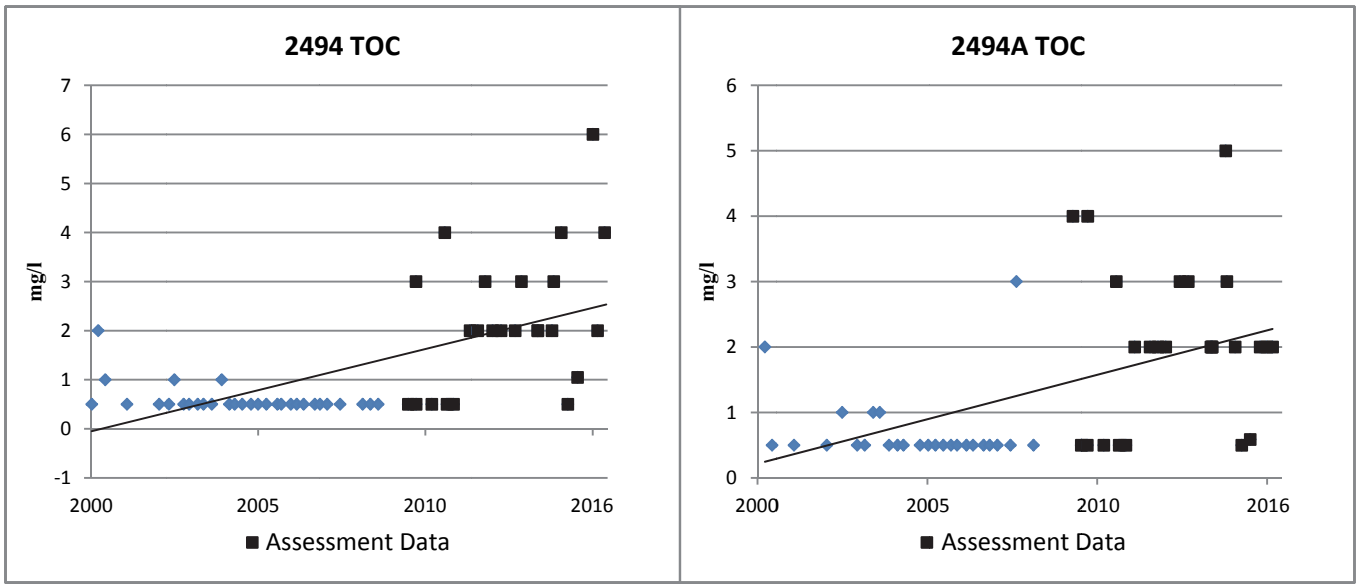
TSS		Status	# samples	Min	Max	Median
2493	mg/l	N/A	25	3.55	56	17
2494		N/A	24	6	74	17.5
2494A		N/A	27	12	55	26

Trend analysis did not indicate any trends in TSS concentrations over in any of the segments.

TOC		Status	# samples	Min	Max	Median
2493	mg/l	N/A	23	1.22	8	4
2494		N/A	24	<0.5	6	2
2494A		N/A	26	<0.5	5	2



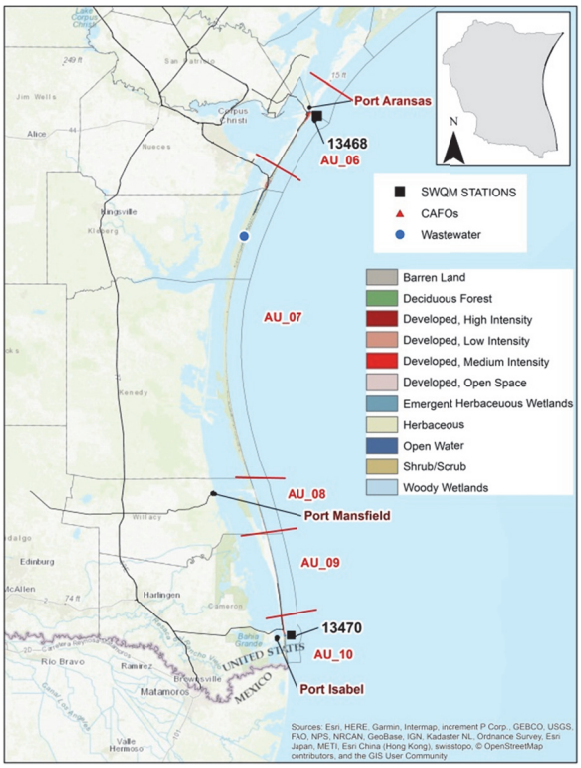
Trend analysis indicates increasing trends in TOC concentrations in Segment 2493 (t = 5.38, p = 0.000), in Segment 2494 (t = 5.71, p = 0.000), and in Segment 2494A (t = 4.71, p =0.000) over time.



Google Earth view of Stations 13285, 13459, and 13460 sampling locations

GULF OF MEXICO – SEGMENT 2501

The portion of Segment 2501, Gulf of Mexico, that NRA includes in its reporting extends approximately 150 miles from Port Aransas to Port Isabel. The Gulf is divided into 10 AUs, with AU_06 through AU_10 being the southern AUs adjacent to NRA's CRP area of responsibility. **AU_06** is the Port Aransas area. **AU_07** is the area between Port Aransas and Port Mansfield. **AU_08** is the Port Mansfield area. **AU_09** is the area between Port Mansfield and Port Isabel. **AU_10** is the Port Isabel area.



Water Quality Analysis

The analysis for AU_06 is based on data from **Station 13468** at Port Aransas. The analysis for AU_10 is based on data from **Station 13470** at Port Isabel. There are no sampling locations in AU_07 through AU_09. There is insufficient Enterococcus data for either trend or statistical analysis in AU_10.

This entire section of the coast has been listed by the DSHS as being impaired for mercury in edible fish tissue (King Mackerel > 43") since 1998.

Aquatic Life Use Assessment

DO		Status	# samples	Min	Max	Median	<4	<5
AU_06	Minimum 4.0 mg/l	FS	25	5.7	9.6	7.1	0	0
	Screening Level 5.0 mg/l	NC						
AU_10	Minimum 4.0 mg/l	FS	27	5.0	11.1	7.8	0	0
	Screening Level 5.0 mg/l	NC						

Trend analysis did not indicate any trends in DO levels or DOD over time in either AU.

Recreation Use

Enterococcus		Status	# samples	Min	Max	Geomean	ND	>35
AU_06	Geomean 35 cfu/100 ml	NC	18	<1	190	3.6	11	3

Trend analysis did not indicate any trends in Enterococcus concentrations over time.

General Use

Water Temperature		Status	# samples	Min	Max	Median	>35
AU_06	35.0 °C	FS	25	10.1	30.6	22.2	0
AU_10		FS	29	12.5	27.7	23.9	0

Trend analysis did not indicate any trends in water temperature over time in either AU.

pH		Status	# samples	Min	Max	Median	<6.5	>9.0
AU_06	6.5 – 9.0 su	FS	25	8.0	8.2	8.1	0	0
AU_10		FS	29	7.4	8.3	8.0	0	0

Trend analysis did not indicate any trends in pH levels over time in either AU.

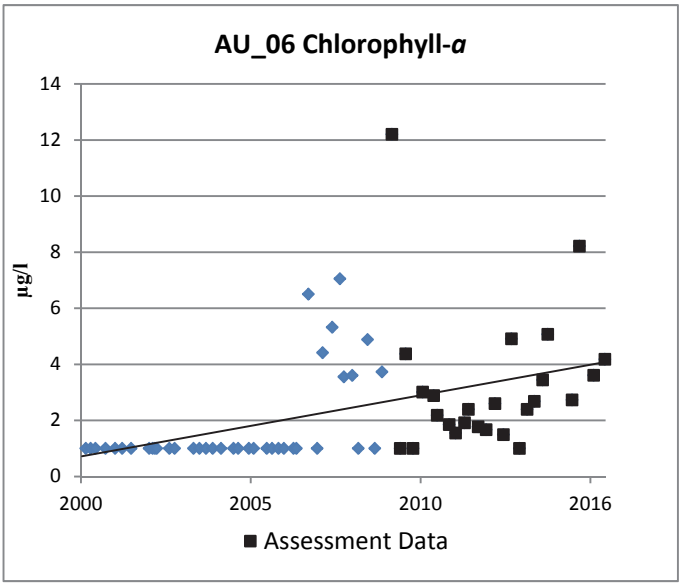
Alkalinity		Status	# samples	Min	Max	Median
AU_06	mg/l	N/A	24	108	128	120
AU_10		N/A	27	116	130	122

Trend analysis did not indicate any trends in alkalinity over time in either AU.

Ammonia		Status	# samples	Min	Max	Median	ND	>0.11
AU_06	0.11 mg/l	NC	23	<0.02	<0.02	0.02	23	0
AU_10		NC	28	<0.02	0.11	0.02	2	0

Trend analysis did not indicate any trends in ammonia concentrations over time in either AU.

Chlorophyll-*a*		Status	# samples	Min	Max	Median	ND	>26.7
AU_06	26.7µg/l	NC	25	<1	12.2	2.6	3	0
AU_10		NC	24	<3	6.69	3	14	0



Trend analysis indicates an increasing trend in chlorophyll-*a* concentrations in Segment AU_06 (t = 3.98, p = 0.000) over time. However, the values are well below the screening level.

Nitrate		Status	# samples	Min	Max	Median	ND	>0.37
AU_06	0.37 mg/l	NC	25	<0.04	0.05	0.04	24	0
AU_10		NC	27	<0.04	0.08	0.04	24	0

Trend analysis did not indicate any trends in nitrate concentrations over in either AU.

TKN		Status	# samples	Min	Max	Median
AU_06	mg/l	N/A	24	<0.2	0.836	0.305
AU_10		N/A	21	0.2	1.18	0.38

Trend analysis did not indicate any trends in TKN concentrations over in either AU.

Total phosphorus		Status	# samples	Min	Max	Median	ND	>0.69
AU_06	0.69 mg/l	NC	19	<0.02	0.07	0.03	8	0
AU_10		NC	20	<0.02	2.32	0.04	5	1

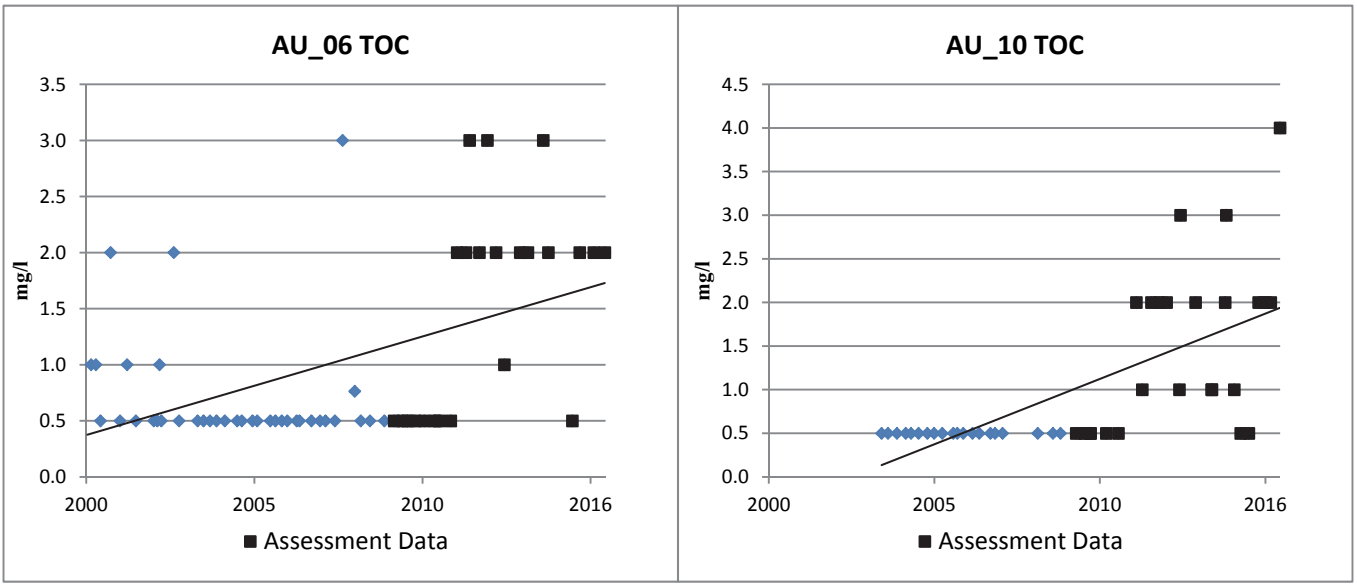
Trend analysis did not indicate any trends in total phosphorus concentrations over in either AU.

TSS		Status	# samples	Min	Max	Median
AU_06	mg/l	N/A	25	4	52	13
AU_10		N/A	24	6	74	17.5

Trend analysis did not indicate any trends in TSS concentrations over in either AU.

TOC		Status	# samples	Min	Max	Median
AU_06	mg/l	N/A	23	<0.5	3	2
AU_10		N/A	24	<0.5	6	2

Trend analysis indicates increasing trends in TOC concentrations in Segment AU_06 (t = 4.21, p = 0.000) and in Segment AU_10 (t = 5.75, p = 0.000) over time. The cause of these increasing trends is unknown.



Summary

CRP utilizes a watershed management approach to identify and evaluate water quality issues, establish priorities for corrective action, and work to implement those actions. Below is a brief narrative of the water quality conditions assessed in the report for each of the three major basins and the bays.

Water Quality in the San Antonio – Nueces Coastal Basin

The primary issue in the basin is bacteria with respect to contact recreation. There are also some concerns for low DO and nutrients. These issues are being addressed by the Copano Bay TMDL and Implementation Plan which was developed to address the bacteria impairment in Copano Bay, the tidal portions of the Mission River and both segments of the Aransas River. BMPs to address the issue include improvements and upgrades to WWTPs and the development and implementation of conservation plans in priority areas of the watershed. From 2011 through 2017, 126 WQMPs have been written for 69,142 acres in the Mission River watershed.

NRA will continue to conduct routine CRP monitoring in the basin, and any special studies that may be developed, to assist in the evaluation of the effectiveness of the BMPs that are implemented. NRA will continue to attend the stakeholder meetings and to provide input into the implementation of the Plan.

Water Quality in Nueces River Basin

The upper reaches of this basin, in general, have fewer water quality issues than the middle and lower reaches. Three of the upper reach segments, Upper Sabinal River, Upper Nueces River, and Seco Creek, meet all water quality standards. Low DO, bacteria, and nutrients are the primary concerns and impairments in the lower reaches. The continuing drought conditions throughout the basin, and state, are contributing factor to these issues. There are fewer rainfall events for continuous, diluting flow. When it does rain, the events are often large events, resulting in more non-point source loadings. The Lower Nueces WPP addresses the protection of the major water supply in the Coastal Bend area. The invasive giant cane (*Arundo donax*) in the headwaters of the Nueces River, Frio River, and Sabinal River out-compete native vegetation and consumes copious amount of water.

NRA will continue to serve as the Lower Nueces River watershed coordinator, seeking funding opportunities to implement the management measures identified in the WPP. NRA will pursue opportunities to conduct additional RUAAs on water bodies that are not currently meeting the primary contact recreation standard, which may not be the appropriate standard based on local knowledge. NRA will continue to spearhead the effort of *Arundo* removal and seek funding to maintain the program.

Water Quality in the Nueces – Rio Grande Coastal Basin

The issues within this basin differ greatly between the northern and southern areas. The primary issues in the northern area are being addressed by the Petronila Creek TMDL for chloride, sulfate, and TDS. NRA has been monitoring on the tributaries to the creek to try and pinpoint the source areas. The chloride, sulfate, and TDS concentrations are inversely correlated with the three-week antecedent rainfall amounts. The concentrations rise quickly from groundwater seepage during low flow periods. The creek is now also listed as being impaired for bacteria as of the Draft 2016 Integrated Report. NRA will continue to conduct routine CRP monitoring in Petronila watershed, including the tributary monitoring, to monitor chloride, sulfate, and TDS concentrations and provide yearly daily analysis reports. An RUAA is recommended to provide data for evaluating the appropriate contact recreation standard.

The southern area is dominated by the Arroyo Colorado. Water quality issues in the Arroyo Colorado include the following: elevated nutrients (nitrogen and phosphorus) and bacteria loads, instances of low DO, high levels of chlorophyll-*a,* and legacy pollutants resulting in fish consumption advisories (the above tidal portion). These water quality issues are being addressed by the Arroyo Colorado WPP. NRA will continue to conduct routine CRP monitoring on the Arroyo Colorado and its tributaries, and any special studies that may be developed, to assist in the evaluation of the effectiveness of the BMPs that are implemented. NRA will continue to attend the Arroyo Colorado Partnership stakeholder meetings and to provide input into the implementation of the Plan. While the impairments and concerns continue on both the tidal and above tidal segments, there does seem to be some improvement in the above tidal segment

Water Quality in the Bays and Estuaries

Bacteria in oyster waters, chlorophyll-*a,* and bacteria at recreational beaches are the primary issues within the coastal bays. Other issues include low DO and nutrients. The Oso Bay and Oso Creek TMDL is addressing the bacteria issues in those segments. The Oso Bay and Laguna Madre TMDL is addressing the DO issues in those segments. Four of the 13 bays, Mesquite Bay, Aransas Bay Redfish Bay, and South Bay, meet all water quality standards.

The low DO, based on current standards, in Oso Bay and the Laguna Madre, are naturally occurring and do not appear to negatively affect aquatic life. Many studies have been conducted and proposed changes to the standards are being evaluated. A TMDL and Implementation Plan to address the bacteria impairment in Oso Creek is under development. Management measures include creating habitat away from the creek for birds and wildlife, addressing failing OSSFs, and how the maintenance of the drainage ditches from the City of Corpus Christi to the creek can be improved to reduce loadings from rainfall runoff events. NRA will continue to conduct routine CRP monitoring in the basin, and any special studies that may be developed, to assist in the evaluation of the effectiveness of the BMPs that are implemented. NRA will continue to attend the stakeholder meetings and to provide input into the implementation of the Plan.

Each ship channel and harbor has different issues: metals in Conn Brown Harbor; ammonia and nitrates in the Corpus Christi Ship Channel, and bacteria in the Brownsville Ship Channel and Port Isabel Fishing Harbor.

Although not an assessed concern, local fishermen and women are concerned about nitrate and the health of Baffin Bay fisheries. Local scientists have conducted studies that concluded that the nitrogen levels are from organic nitrogen. A Baffin Bay work group has been formed and is working towards the development of a WPP for the bay. The tributaries to the bay, Petronila Creek, San Fernando Creek, and Los Olmos Creek will be included in the WPP. Additional monitoring is being planned on these creeks to better understand their contributions to pollutant loadings to the bay.

San Fernando Creek is also listed as being impaired for bacteria for contact recreation. An RUAA is recommended to provide data for evaluating the appropriate contact recreation standard.

Recommendations

TCEQ depends on the CRP partner agencies to provide the majority of the data used for in the bi-annual water quality assessments. Therefore, dedicated funds for CRP should be reinstated in order to enhance the current level of monitoring and to provide additional monitoring to support the TCEQ, WPPs, RUAAs, TMDLs, and Implementation Plans.

Collaborating and coordinating with all entities conducting water quality monitoring should be continued through the annual coordinated monitoring meetings. This reduces duplication of effort and increases the amount of information that can be collected and shared.

CRP should remain flexible to support proactive projects to protect water quality before a segment is listed on the 303 (d) List.

Annual CRP Partner meetings should be held to strengthen the program by promoting cooperative projects between the partner agencies and to provide opportunities to share knowledge and ideas.

To enhance the data available to TCEQ for assessments, CRP partners should continue to provide as much support to all water quality monitoring and protection efforts as possible as resources allow. Specifically related to NRA's CRP area of responsibility, NRA plans to:

- Continue to conduct routine CRP monitoring.
- Continue to implement the management measures identified in the Lower Nueces WPP.
- Submit a proposal to TCEQ to continue the OSSF repair and replacement program.
- Submit a proposal to the Texas General Land Office (TGLO) Coastal Management Program (CMP) to conduct event-based monitoring on tributaries to Baffin Bay using ISCO automated samplers.
- Submit a proposal to the TGLO CMP to conduct additional sampling on tributaries to Oso Creek to support the efforts of the Oso TMDL and Implementation Plan.
- Pursue opportunities to conduct RUAAs on Petronila Creek and San Fernando Creek.
- Be a partner in a Texas A&M AgriLife Extension proposal to the TCEQ to conduct event-based monitoring on tributaries to Baffin Bay using ISCO automated samplers.
- Continue the widespread education and outreach activities.
- Continue to battle the *Arundo donax* invasion in the upper Nueces Basin.
- Continue to serve as stakeholders on all water quality related projects within our areas of jurisdiction and responsibility.

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