2024

Basin Highlights Report
Rio Grande Basin

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Introduction

The Texas Clean Rivers Program (CRP) was created in the early nineties in response to growing concern about the quality of the surface water in the state. Through legislation, the Texas Clean Rivers program came to fruition and has been used to monitor the state's surface water quality since then with the Texas Commission on Environmental Quality (TCEQ) spearheading the program. The United States International Boundary and Water Commission (USIBWC) partnered with TCEQ in 1998 to administer the Texas Clean Rivers Program for the Rio Grande Basin.

The USIBWC is one of 15 partner river authorities collaborating with the TCEQ to administer the Texas Clean River Program in the 23 river and coastal basins of Texas. The main goals of the CRP include:

- Maintaining a basin-wide routine water quality monitoring program and a water quality database.
- Provide quality-assured data to TCEQ for use in water quality decision-making.
- Identify and evaluate water quality issues, and summarizer reports
- Promote cooperative watershed planning
- Inform and engage stakeholders
- Maintain efficient use of public funds
- Adapt the program to emerging water quality issues

This report will summarize the 2024 USIBWC CRP water quality monitoring activities as well as water quality data for the Rio Grande Basin in Texas.

Colorado Canyon Terlingua, TX

The Rio Grande Basin Overview

In Texas, the Rio Grande River extends 1,255 miles from El Paso down to the Texas valley, before reaching the Gulf of Mexico. The twelve hundred-plus miles also demarcate the boundary between the United States and Mexico, making the Rio Grande a bi-national water source. This water source is utilized by populations on both sides of the border for agriculture, drinking water, and hydroelectric power. This basin spans roughly 182,200 square miles encompassing three U.S. states and five states in Mexico.

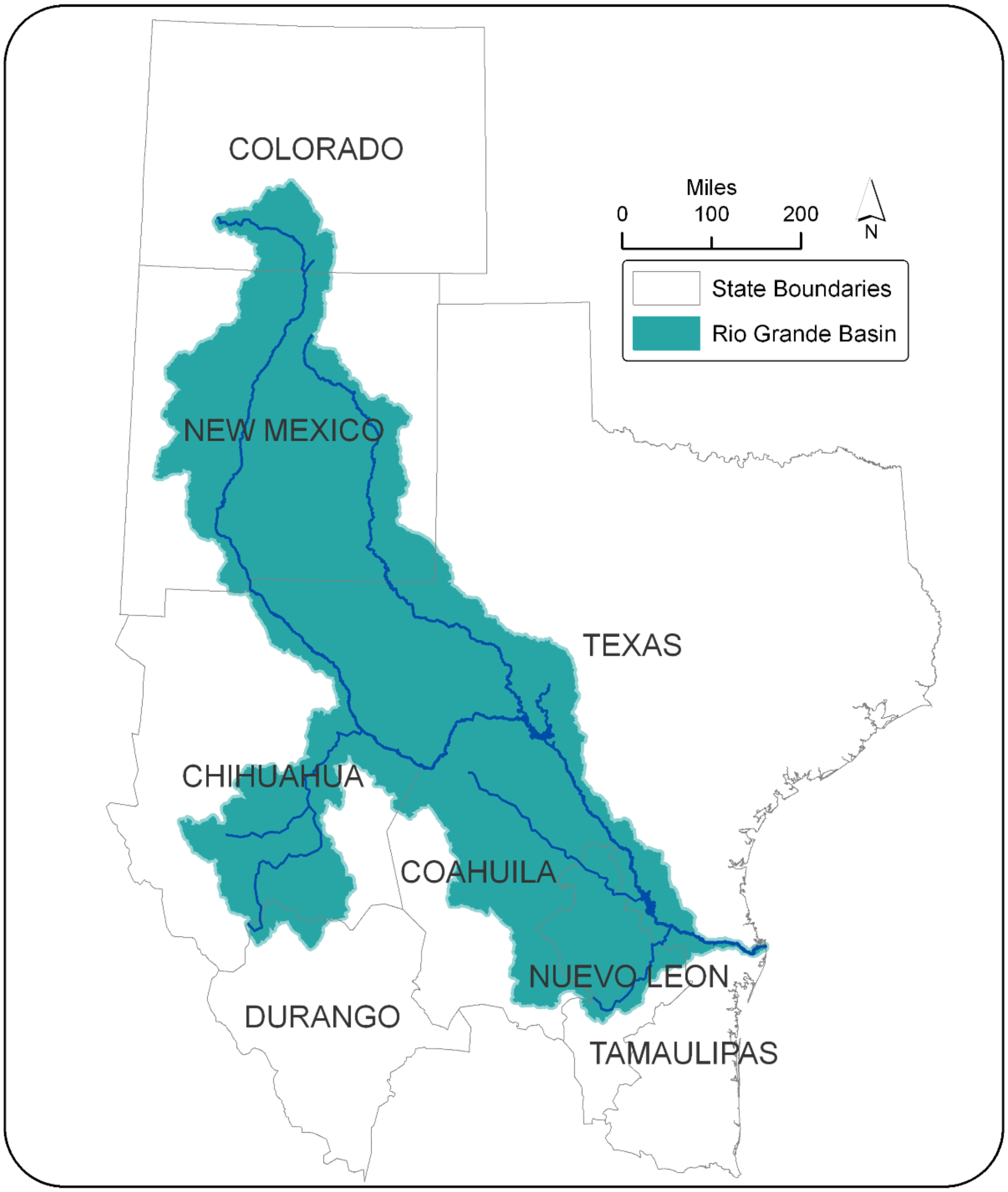


Figure: 1 Rio Grande Basin

The USIBWC CRP study area for this report is the Rio Grande Basin in Texas. For coordination and planning purposes, the USIBWC CRP study area has been divided into four subbasins (Figure 2):

- the Upper Sub-Basin extending from the New Mexico/ Texas state line downstream to the International Amistad Reservoir.

- the Pecos River Sub-Basin from the New Mexico/ Texas state line to its confluence with the Rio Grande upstream of Amistad Reservoir.

- the Middle Sub-Basin from International Amistad Reservoir downstream to International Falcon Reservoir and including the Devil's River; and

- the Lower Sub-Basin from International Falcon Reservoir downstream to the Gulf of Mexico.

Due to the basin's sheer size, the USIBWC CRP depends on sampling partners to collect the necessary water quality data for the State of Texas. CRP partners throughout the basin have been a valuable asset in water quality monitoring. In 2024 IBWC partnered with 13 entities, who collectively monitored 54 stations (Figure 2) through the basin. These entities also provided guidance and suggestions on how to improve the program and the basin, as well as assisting in special studies, and communicating and educating the public.

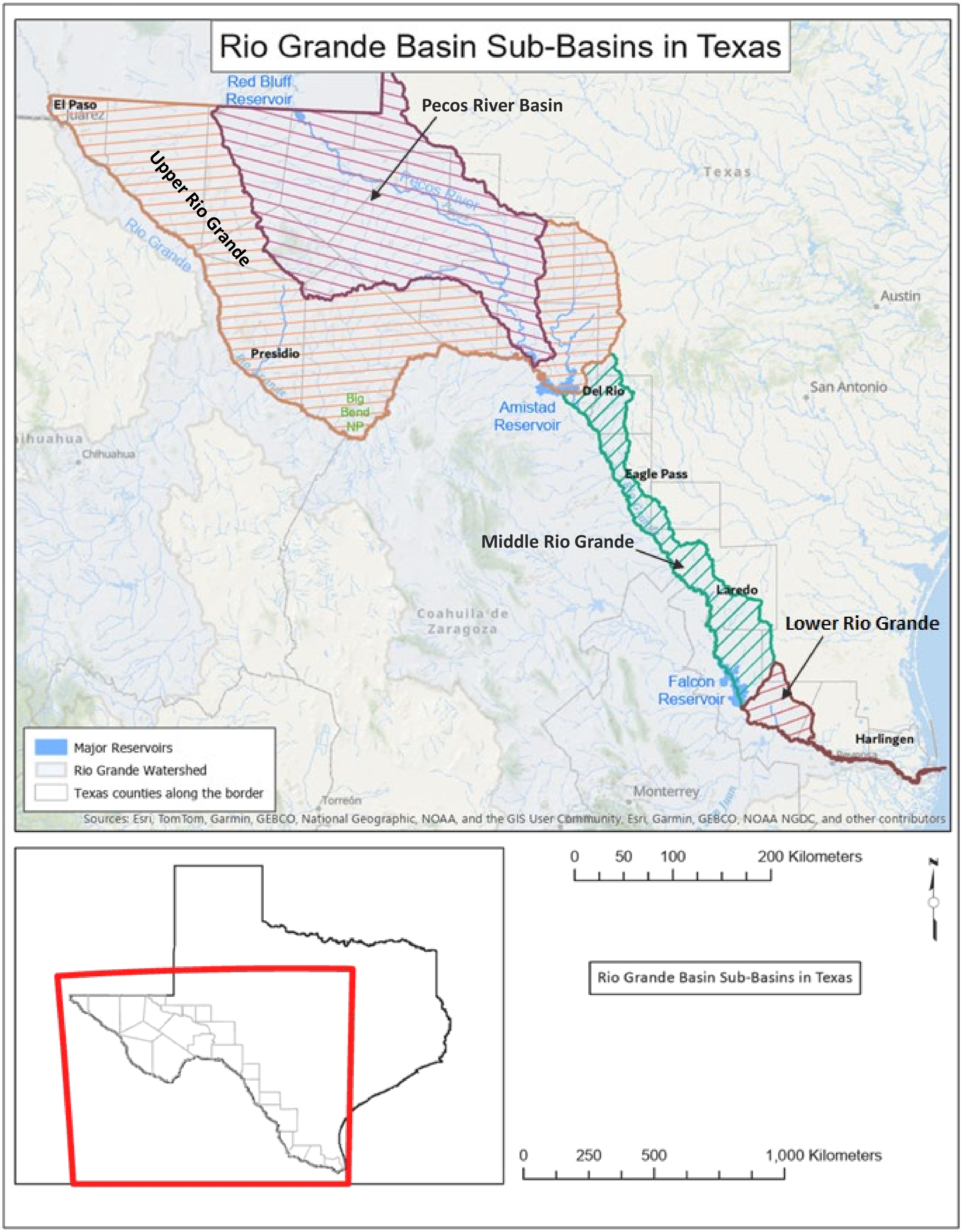


Figure 2. Map of the Sub-Basins that comprises the Rio Grande Basin

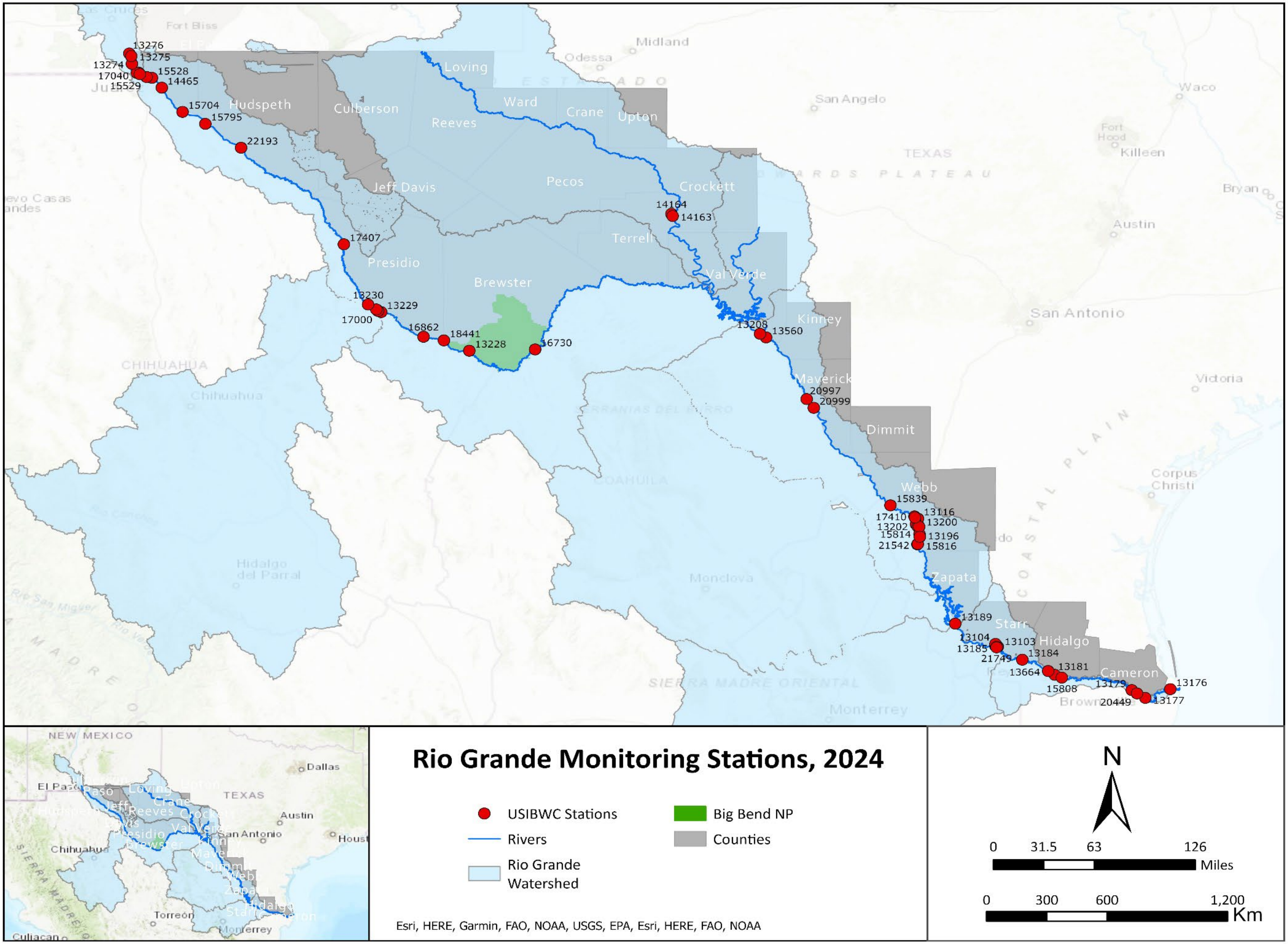


Figure 3. Map of USIBWC Monitoring Stations

Water Quality Monitoring Overview

Water quality monitoring is an essential process to assess the physical, chemical, and biological characteristics of water bodies. These characteristics help TCEQ determine at what capacity the water can be used for, and the overall health of the river. To continue to provide valuable water quality data the USIBWC CRP has maintained its large network of water quality stations through the years. By performing routine monitoring of these stations at regular intervals throughout the year, the health of the water system can be determined. Water quality standards for the Rio Grande set forth by TCEQ are shown in Table 1. Designated uses and water quality parameters are found in Tables 2 and 3.

Station 15795 located in Ft. Hancock facing the Mexican side.

Routine monitoring in the Rio Grande Basin helps us understand its unique characteristics, which can in turn help us to:

- Assess environmental health.
- Protect human health.
- Manage resources.

Partners collect water quality samples at approximately 54 routine monitoring stations throughout the basin. Sediment samples are also collected at some stations. In addition to collecting samples for laboratory analysis, personnel also make field observations to record conditions at the time the sample were taken. Field observations include things such as weather conditions, recent rain events in the area, watercolor, and other general notes pertinent to water quality and stream uses. Quantitative field measurements are made using specialized equipment. The parameters taken include water and air temperature, water depth, water clarity, stream flow, and how that flow compares to the normal flow for that water body. Table 3 describes field parameters in more detail.

The routine collection of field parameters, together with laboratory parameters, allows us to determine the health of the river ecosystem and can aid in the identification of potential issues. Data is compared against the Texas Surface Water Quality Standards (TSWQS) criteria and screening levels, which are outlined in Table 1. Indicators that are directly tied to support of designated uses and criteria adopted in the TSWQS include:

- Water temperature (general use)
- pH (general use)
- Dissolved Oxygen (DO) (aquatic life)
- Chloride (general use)
- Sulfate (general use)
- Total Dissolved Solids (TDS) (general use)
- *E. coli* (contact recreation)

Table 1. Primary Surface Water Quality Standards for the Rio Grande Basin

2022 Texas Surface Water Quality Standards for the Rio Grande Basin												
Segments		Uses				Criteria						
Segment No.	Segment Description	Recreation	Aquatic Life	Domestic Water Supply	Other	Cl-1 (mg/L)	SO4-2 (mg/L)	TDS (mg/L)	Dissolved Oxygen (mg/L)	pH Range (SU)	Indicator Bacteria* (#/100ml)	Temp (°F)
2301	Rio Grande Tidal	PCR1	E						5.0	6.5-9.0	35	95
2302	Rio Grande below Falcon Reservoir	PCR1	H	PS		270	350	880	5.0	6.5-9.0	126	90
2303	International Falcon Reservoir	PCR1	H	PS		200	300	1,000	5.0	6.5-9.0	126	93
2304	Rio Grande Below Amistad Reservoir	PCR1	H	PS		200	300	1,000	5.0	6.5-9.0	126	95
2305	International Amistad Reservoir	PCR1	H	PS		150	270	800	5.0	6.5-9.0	126	88
2306	Rio Grande above Amistad Reservoir	PCR1	H	PS		200	450	1,400	5.0	6.5-9.0	126	93
2307	Rio Grande below Riverside Diversion Dam	PCR1	H	PS		300	550	1,500	5.0	6.5-9.0	126	93
2308	Rio Grande below International Dam	NCR	L			250	450	1,400	3.0	6.5-9.0	605	95
2309	Devils River	PCR1	E	PS		50	50	300	6.0	6.5-9.0	126	90
2310	Lower Pecos River	PCR1	H	PS		1,700	1,000	4,000	5.0	6.5-9.0	126	92
2311	Upper Pecos River	PCR1	L			7,000	3,500	15,000	5.0	6.5-9.0	33	92
2312	Red Bluff Reservoir	PCR1	H			3,200	2,200	9,400	5.0	6.5-9.0	33	90
2313	San Felipe Creek	PCR1	H	PS		50	50	400	5.0	6.5-9.0	126	90
2314	Rio Grande above International Dam	PCR1	H	PS		340	600	1,800	5.0	6.5-9.0	126	92
2315	Rio Grande Below Rio Conchos	PCR1	H			450	750	2,100	5.0	6.5-9.0	126	93

PCR - Primary Contact Recreation NCR - Noncontact Recreation PS - Public Water Supply
E - Exceptional Aquatic Life L - Limited Aquatic Life H - High Aquatic Life TDS - Total Dissolved Solids
Cl- - chloride SO42- - sulfate DO - Dissolved Oxygen

*Indicator Bacteria is *E. coli* for freshwater and enterococci for saltwater (2301, 2311, 2312)

The critical low flow for Segments 2309 and 2313 is calculated according to §307.8(a)(2)(A) of the TSWQS.

Designated Uses

The State of Texas assigns designated uses for water bodies and determines the TSWQS. Standards are set to not only maintain the quality of the water but also improve it. Designated uses for the Texas surface waters are described in Table 2. Further information on standards and decision-making can be found on the TCEQ website.

Contact recreation (CR) –This is defined as Fishing, swimming, wading, boating, and direct water contact. *Escherichia coli* (*E. coli*) and *Enterococci* bacteria are used as indicators for bacterial contamination. The 2010 revisions to the TSWQS created subcategories of Primary (PCR) and Secondary Contact Recreation (SCR). PCR refers to activities such as swimming, and SCR refers to non-immersing recreation activities such as canoeing and fishing.

Public water supply (PS) – The listed water body is used as a designated drinking water source. The primary concern is total dissolved solids (TDS). The TSWQS includes a list of parameters that are screened to ensure safe domestic water supply use. Table 2 provides more information on these parameters and their effects on a water body.

Aquatic life use (ALU) – Designed to protect aquatic species including fish and benthic macroinvertebrates (aquatic insects). This designation has five levels depending on the ability of a water body to support aquatic life (exceptional, high, intermediate, limited, and minimal). The primary parameter used to determine the ALU of a water body is dissolved oxygen (DO).

Table 2. Designated uses

Designated Uses			
Designated use	Description	Primary parameter	Criteria
Contact Recreation (CR)	Three levels depending on the use: Fishing, swimming, wading, boating, etc. *Note: Secondary contact recreation criteria are not applied in any of the segments in the Rio Grande Basin*	Freshwater: *E. coli* Tidal and saline: *Enterococcus (Entero)*	Primary contact recreation (significant possibility of water ingestion, i.e., swimming)
			Secondary contact recreation (limited body contact that possesses a less significant risk of ingestion of water, i.e., fishing, boating)
			Non-contact recreation: Unsuitable for contact recreation
Public Water Supply (PS)	Drinking water source	See full list of Human Health Criteria in Table 2 of the TSWQS	
Aquatic Life Use (ALU)	4 levels depending on the ability of water body to support aquatic life	Dissolved Oxygen-average values*	(E) Exceptional 6.0 mg/L
			(H) High 5.0 mg/L
			(I) Intermediate 4.0 mg/L
			(L) Limited 3.0 mg/L
			(M) Minimal 2.0 mg/L
	Toxics in Water	See full list of Aquatic Life Criteria in Table 1 of the TSWQS	
Fish Consumption (FC)	Prevent contamination to protect human health	See full list of Human Health Criteria in Table 2 of the TSWQS. Example: Mercury - 0.0122 ug/L in water & fish	
General Use (GU)	General water quality	Water Temperature, High pH, Low pH, Dissolved Solids, Nutrients, and Chlorophyll-a. See Tables 2 and 4 in this document.	

Fish consumption (FC) – This designation applies to all water bodies where citizens may collect and consume fish. The TSWQS includes a list of parameters that are used to screen waters and ensure the fish consumption use is met.

General use – To safeguard general water quality.

Table 3. Water Quality Parameters

Field Parameters		
Parameter	**Description**	**Effects on water body**
Temperature (degrees centigrade)	Water temperature plays a crucial role in determining water quality, as it influences a variety of physical, and biological processes.	Physically affecting dissolved oxygen levels, density, and mixing rates. Chemical effects on reaction rates and solubility. Biological effects on algae growth, and metabolism of aquatic organisms.
pH	Measure of how acidic or basic the water is. The values range from 0 to 14, with 7 being neutral. pH values less than 7 indicate acidity, whereas a pH greater than 7 indicates a base.	Values greater than 9.0 and less than 5.0 can have detrimental effects on the health of aquatic life, wildlife, and humans.
Specific Conductance	Indicator of how well the water conducts electricity. Pure water does not conduct electricity; impurities like salts and metals allow electricity to pass through the water. Since total and dissolved metal values should be very low, conductivity primarily measures how much salt is in the water. Most naturally occurring waters have some level of conductivity.	High conductivity can cause physiological effects in animals and plants. It also could be a result of high TDS. The indirect effects of excess dissolved solids are primarily the elimination of desirable food plants and habitat-forming plant species. Agricultural uses of water for livestock watering are limited by excessive dissolved solids and high dissolved solids can be a problem in water used for irrigation.
Dissolved Oxygen (DO)	The measure of how much oxygen is freely available in water.	Low DO values can lead to reduced abundance and diversity in aquatic communities. Very low levels (<2 mg/L) can be indicative of higher levels of oxygen-demanding plants that use up DO during the decay process.
Secchi Depth	A measure of the transparency of water - the maximum depth at which a black and white disk is visible.	Higher transparency leads to a more robust aquatic plant life (particles in water block sunlight for photosynthesis). High transparency coupled with high nutrients can lead to negative impacts on DO and aquatic life.
Stream Flow	The volume of water moving over a location over a period. Low flow conditions common in the warm summer months create critical conditions for aquatic organisms.	At low flows, the stream has a lower assimilative capacity for waste inputs from point and nonpoint sources.
Conventional Laboratory Parameters		
Solids	Total and dissolved materials of any kind (calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates).	High total dissolved solids indicate higher amounts of dissolved salts which can reduce the diversity of aquatic life and can render the water unusable for human consumption, industry, and agriculture.
Nutrients	Nutrients include nitrogen compounds, ammonia, and phosphorus.	High levels can cause excessive plant growth, which can lead to reduced dissolved oxygen and fish kills, reduced stream flow, and reduced navigability of the waters. Elevated ammonia can also be toxic to aquatic life.
Chlorophyll-a	Chlorophyll-a is used as an indicator of algal growth in water.	High levels for long periods may indicate low water quality and are indicative of excess nutrient levels.
Bacteria	Bacteria found in the intestinal tracts of warm-blooded animals. They are introduced into a system via excrement.	These organisms are used as indicators of bacterial pollution and the possible presence of waterborne pathogens. Sources of high bacteria include untreated, concentrations of animals, and application of manure-based fertilizers.
Non-conventional Laboratory Parameters		
Metals	Aluminum, arsenic, barium, chromium, copper, lead, mercury, nickel, silver, and zinc. Metals can be tested as total or dissolved metals in water or metals in sediment to determine long-term accumulation.	High concentrations can result in adverse long- and short-term effects on aquatic life and human health.
Organics	Chemicals containing carbon and hydrogen. Organic compounds analyzed are herbicides, pesticides, and industrial compounds both in water and in sediment.	Organics can result in adverse long- and short-term effects on aquatic life and human health.
Biological Parameters		
Nekton	Fish captured in the river during biological surveys using both electrofishing and seining methods	Using the Index of Biotic Integrity (IBI) can indicate biodiversity and overall health of the river.
Benthic	Freshwater macroinvertebrates collected during a five-minute kicknet or snage methods.	Using IBI, this biological aquatic assemblage analysis indicates biodiversity and overall health of the river. Healthy macroinvertebrate communities can be excellent indicators of high-water quality.

What happens to the data?

Once samples are collected, an accredited laboratory analyzes the lab parameters in Table 3, and then CRP checks both field and laboratory data for accuracy, quality, and adherence to approved methods. CRP submits the reviewed and quality-assured data to the TCEQ, which also runs quality assurance checks on the data before including the data in TCEQ's Surface Water Quality Monitoring Information System (SWQMIS) database. This public interface can be accessed at (https://www80.tceq.texas.gov/SwqmisPublic/index.htm). Data from the past seven years that contain at least 10 data points are then compared to the TSWQS that have been assigned to each stream segment (Table 1). This comparison is used to create a summary of water quality, the Integrated Report which is done by the TCEQ every two years as required by the Clean Water Act. Any section of a water body that does not meet the primary standards is then placed on the 303(d) list, which contains impaired water bodies throughout the state.

- **Impairments** are determined when a section does not meet the primary standards assigned to the segment. The designated use of the stream segment (Table 2) determines what value will be set for the standard. Primary water quality standards (Table 1) are set for chloride, sulfate, total dissolved solids (TDS), DO, pH, temperature, and bacteria.

- **Concerns** are identified when data is compared to secondary screening levels, which are listed in Table 4. Secondary screening levels are determined based on the water body type. The entire Rio Grande Basin is a freshwater stream except Segment 2301, which is listed as a tidal stream. A section is listed as having a concern if more than 25% of the data fails to meet the screening levels. Sections of a water body on the 303(d) list are then assessed to determine the course of action to take in identifying the source of the impairment and possible corrective solutions.

Table 4. Secondary Screening Levels for Water Quality Concerns

Secondary Screening Levels	
Freshwater	
Ammonia	0.33 mg/L
Nitrate + Nitrite	1.95 mg/L
Total Phosphorus	0.69 mg/L
Chlorophyll-a	14.1 µg/L
Tidal	
Ammonia	0.46 mg/L
Nitrate + Nitrite	1.10 mg/L
Total Phosphorus	0.66 mg/L
Chlorophyll-a	21.0 µg/L

How is the quality of the water?

Major water quality issues throughout the basin include bacteria and salinity. Figure 4 shows the river segments of the Rio Grande that are impaired for bacteria and Figure 5 shows the segments that are impaired for salinity and dissolved oxygen (DO). The 2024 Integrated Report lists two additional concerns for depressed dissolved oxygen, and total dissolved solids (TDS) at segment 2308 – Rio Grande Below International Dam. Depressed dissolved oxygen moved from being a parameter of concern to an impairment in segment 2307. Sulfate is a newly added impairment in this segment as well. In contrast, chloride was removed as a parameter of concern for segment 2305, and sulfate was removed as a concern for segment 2310. Impairments and concerns in the Rio Grande Basin are listed in Table 5. Water bodies with high bacteria levels pose health risks to swimmers and other recreational users. High salinity in the water can damage crops, and it is harmful to freshwater fish and aquatic invertebrates. Rio Grande water is also a source of drinking water, and treating water high in salinity is more expensive.

Discharge creating foam in the river at Fort Quitman

Discharge causing water to be cloudy by International Dam

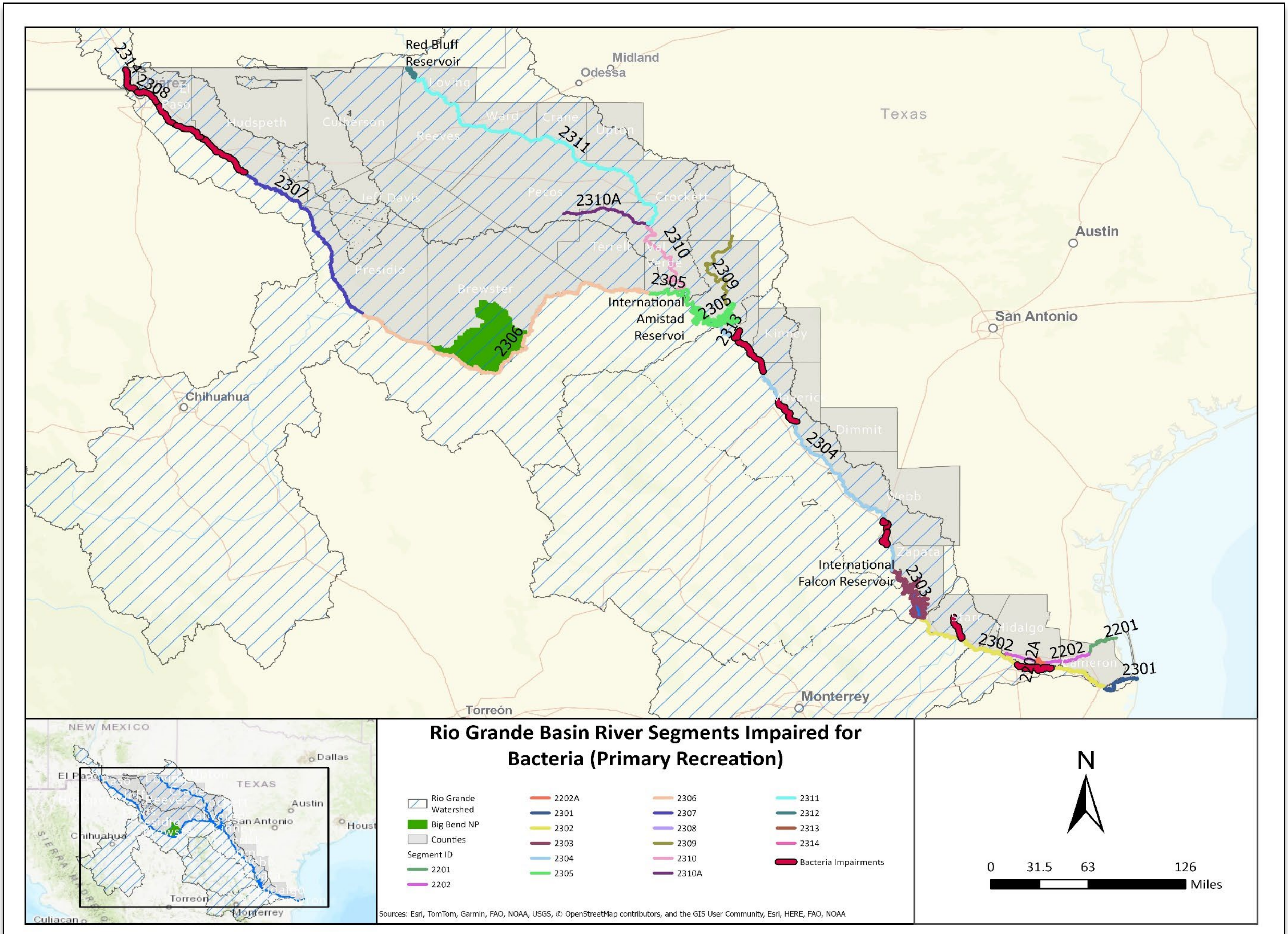


Figure 4. Map of river segments in the Rio Grande Basin impaired for bacteria

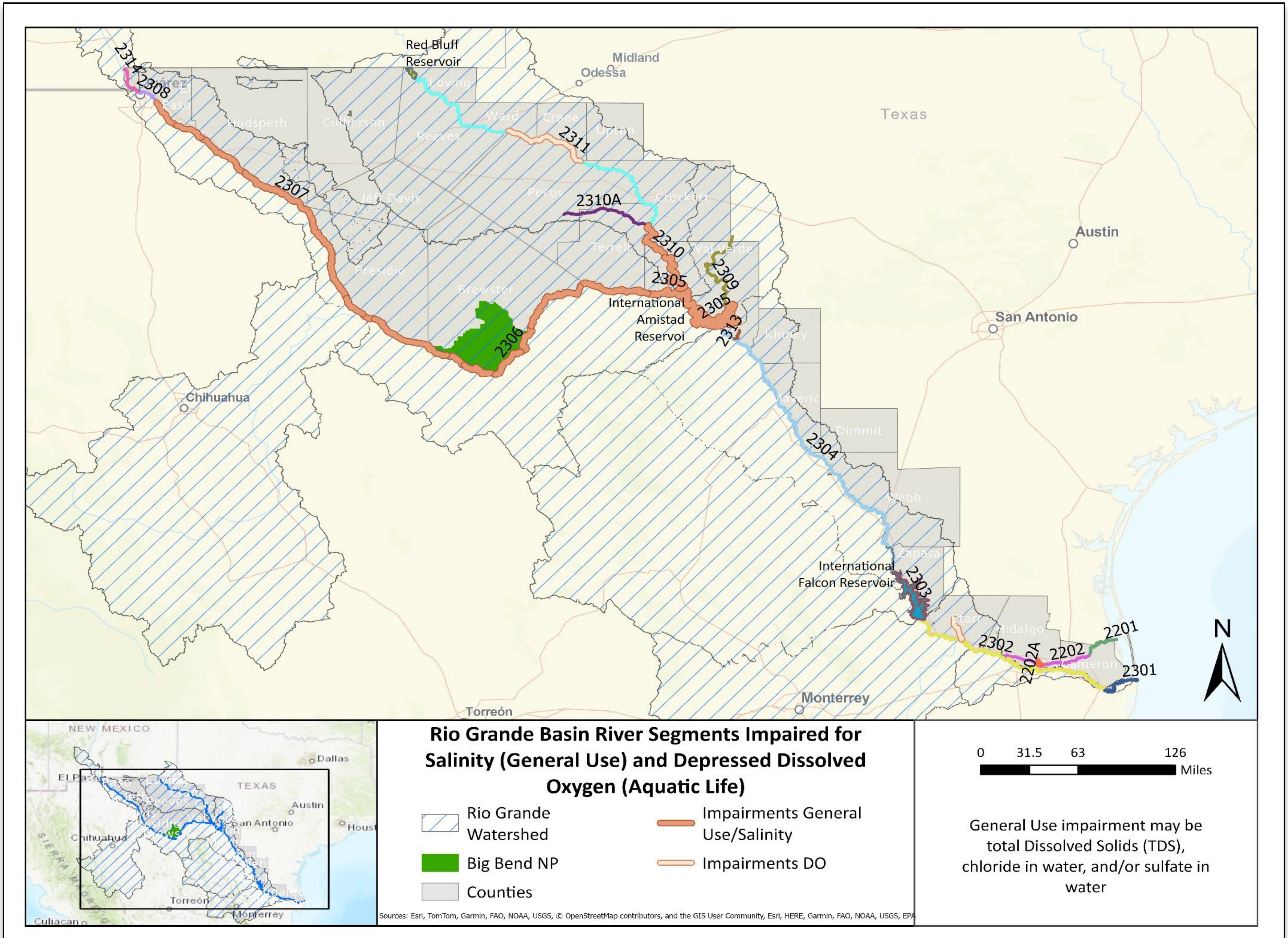


Figure 5. Map of river segments in the Rio Grande Basin impaired for salinity and DO

Table 5. Summary of Water Quality Impairments and Concerns in the Rio Grande Basin

Segment	Segment Name	Impairment(s)	Year Listed	Concern(s)	Type
2301	Rio Grande Tidal	No impairment		Bacteria Chlorophyll-a Nitrate	CN CS CS
2302	Rio Grande Below Falcon Reservoir	Bacteria	1996	Ammonia Chlorophyll-a pH	CS CS CN
2302A	Arroyo Los Olmos	Bacteria Depressed dissolved oxygen	2004 2022	Chlorophyll-a Depressed DO	CS CS
2303	International Falcon Reservoir	No Impairment		Ambient toxicity Fish kill	CS CN
2304	Rio Grande Below Amistad International Reservoir	Bacteria	1996	Ambient toxicity Ammonia Chlorophyll-a Depressed dissolved oxygen	CS CS CS CS
2304B	Manadas Creek	No Impairment		Antimony in sediment Bacteria Nitrate Total phosphorus Depressed dissolved oxygen	CS CN CS CS CS
2305	International Amistad Reservoir	No Impairment		Fish kill	CN
2306	Rio Grande Above Amistad International Reservoir	Sulfate	2010	Chlorophyll-a	CS
2306A	Alamito Creek	No Impairment		No Concern	
2307	Rio Grande Below Riverside Diversion Dam	Chloride Total dissolved solids Bacteria Depressed dissolved oxygen Sulfate	1996 1996 2002 2024 2024	Ammonia Chlorophyll-a Nitrate Total phosphorus	CS CN CS CS
2308	Rio Grande Below International Dam	Bacteria Depressed dissolved oxygen Total Dissolved solids	2014 2024 2024	Ammonia Chlorophyll-a Total phosphorus	CS CS CS
2309	Devils River	No Impairment		No Concern	
2310	Lower Pecos River	Total dissolved solids	2020	No Concern	
2310A	Independence Creek	No Impairment		No Concern	
2311	Upper Pecos River	Depressed DO	2006	Bacteria Chlorophyll-a	CN CS
2312	Red Bluff Reservoir	No Impairment		No Concern	
2313	San Felipe Creek	Bacteria	2014	No Concern	
2314	Rio Grande Above International Dam	Bacteria	2002	Chlorophyll-a Total phosphorus	CS CS

CN - Concern for near-nonattainment of the Water Quality Standards

CS - Concern for water quality based on screening levels.

Note: Each segment is further subdivided into assessment units (AU). The entire segment may not be impaired. The complete list of impairments and AUs can be found on the TCEQ 303(d) website.

Sub-Basin Summaries

Upper Rio Grande Sub-Basin

The Upper Rio Grande Sub-Basin stretches 650 miles (1,045 km) from the Texas-New Mexico state line to Amistad Dam, crossing 9 counties in the U.S. and including river segments 2314, 2308, 2307, 2306, and 2305. Figures 6 and 7 show sampling site locations. While the Pecos Sub-Basin was initially included, monitoring is on hold due to staff shortages.

The 2024 Integrated Report lists additional concerns for depressed dissolved oxygen and total dissolved solids (TDS) at segment 2308 (Rio Grande Below International Dam). Access to the two monitoring stations at segment 2308 is currently blocked by the National Guard due to heightened border security. In segment 2307, depressed dissolved oxygen has progressed from a concern to an impairment. Six stations monitor this segment; however, one station is blocked by BP, and another was dry for most of the year.

Middle Rio Grande Sub-Basin

The Middle Rio Grande Sub-Basin extends from the International Amistad Reservoir to the International Falcon Reservoir. Covering a 303-mile (487-km) stretch across five counties in Texas and the Mexican States of Coahuila, Nuevo Leon, and Tamaulipas, this region includes major cities such as Del Rio, Eagle Pass, and Laredo, Texas, along with sister cities Ciudad Acuna, Coahuila, and Nuevo Laredo, Tamaulipas. The Middle section of the Rio Grande includes river segments 2304, 2309, 2309A, and 2313. Figure 8 shows the coverage area and sampling sites located in this section.

The 2024 Integrated Report lists segments 2304 and 2313 as impaired for bacteria. Segment 2304 also has listings of concern for ambient toxicity, ammonia, chlorophyll, and depressed dissolved oxygen. There were no new listings for segments in the Middle Rio Grande Sub-Basin or de-listing of parameters.

Lower Rio Grande Sub-Basin

The Lower Rio Grande Sub-Basin stretches from below the International Falcon Dam to its confluence with the Gulf of Mexico. Figure 9 shows the monitoring stations in the lower portion of the Rio Grande Basin. This 280-mile (451-km) stretch of the Rio Grande runs through Starr, Hidalgo, and Cameron counties of Texas and forms the border between those counties and the Mexican state of Tamaulipas. The lower section of the Rio Grande includes river segments 2302, 2302A, and 2301.

In this sub-basin, the 2024 Integrated Report lists segment 2301 impaired for bacteria, chlorophyll, and nitrate. Segment 2302 is impaired for ammonia, chlorophyll, and pH, while segment 2302A is listed as impaired for chlorophyll and depressed dissolved oxygen. Like in the river segments in the middle section, there were also no new listings or de-listing of parameters in the lower portion of the basin.

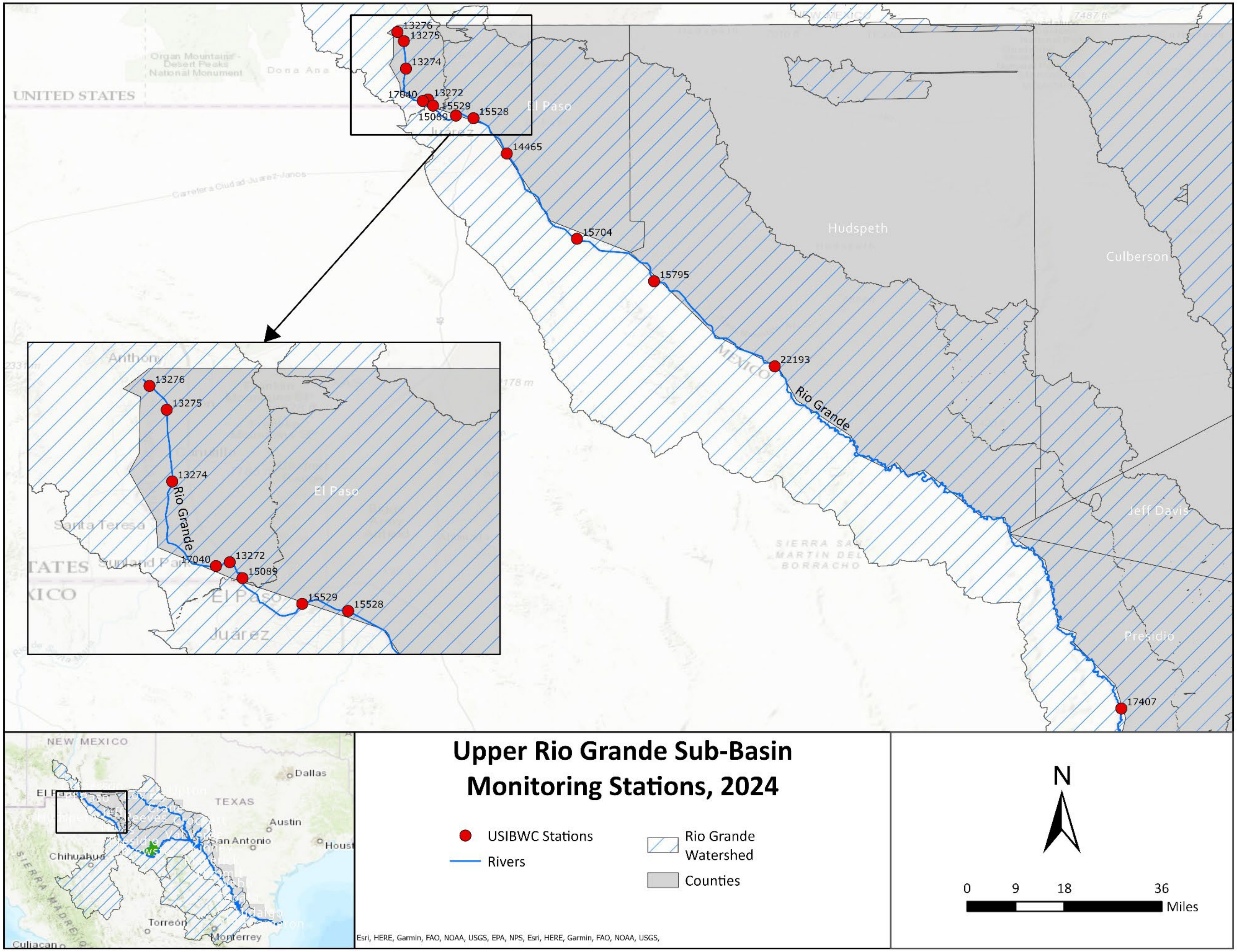


Figure 6. Map of the sampling stations at the Northern portion of the Upper Rio Grande Sub-Basin

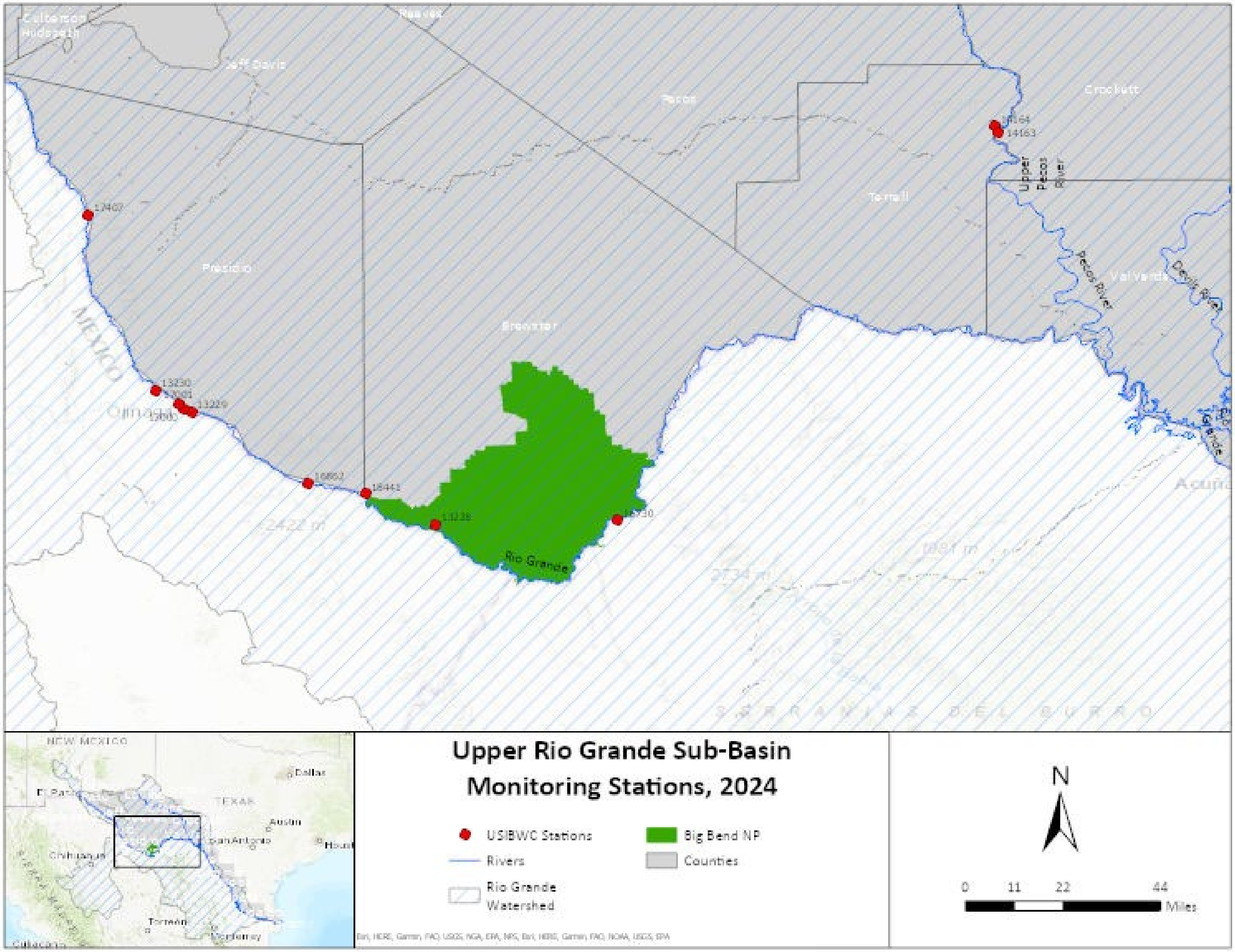


Figure 7. Map of the sampling stations at the Southern portion of the Upper Rio Grande Sub-Basin

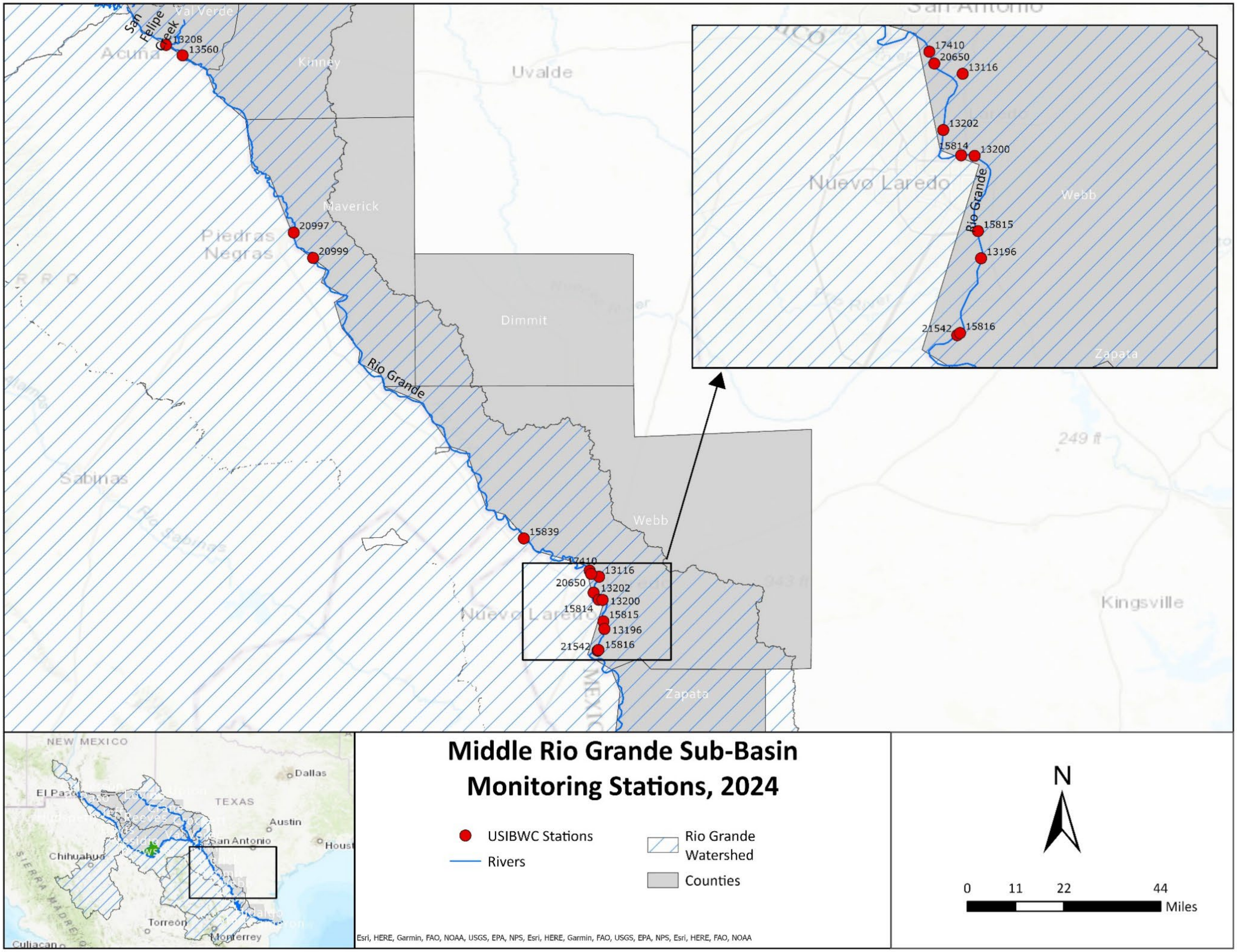


Figure 8. Map of the sampling stations at the Middle Rio Grande Sub-Basin

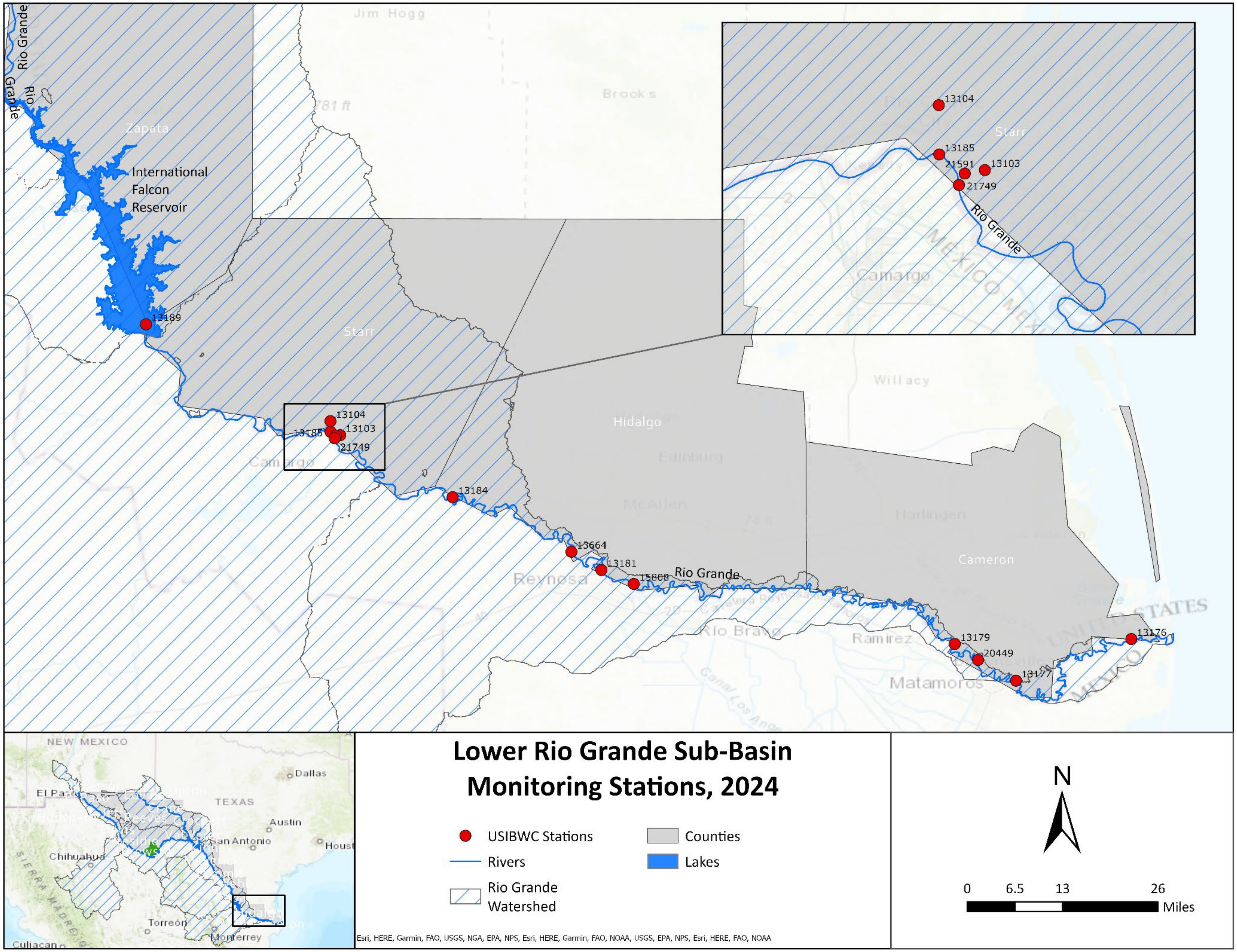


Figure 9. Map of the sampling stations at the Lower Rio Grande Sub-Basin

This Year's Highlights

Water Infrastructure

Aging water infrastructure in Texas poses significant challenges to the state's water supply and quality. In 2022, an analysis revealed that water systems are losing 572,000 acre-feet annually due to leaking pipes and connections. This amount exceeds the combined annual water demand of several major cities in the state. Frequent breaks and leaks often result in contaminated drinking water or, in some cases, leave residents without access to drinking water.

A wastewater pipeline break occurred on November 25, 2024, downstream of Chacon Creek, TX. dumping over 100,000 gallons of raw sewage near the river by South Zapata Highway. The city of Laredo addressed the situation, containing the spill, and initiated cleanup efforts. The city also announced plans to investigate whether repeated patrols by border agents and erosion issues contributed to the pipe's rupture (KGSN, 2024). The pipeline was bypassed with a temporary line restoring service to prevent further contaminants from entering the river. At time of writing the restoration of the pipeline is still underway (KGNS, 2024). This poses a risk to the public health of communities downstream and negatively affects aquatic life. The sewage can introduce harmful pathogens, chemicals, and nutrients into the river.

Sewage spill past Chacon Creek in Laredo Tx.

The City of Laredo, TX issued a citywide boil water notice on October 10, 2024. Due to the public water supply's water sample results exceeding permissible *E. coli* maximum contaminant levels (EMCL). This city-wide notice advised its residents to boil their water before consumption as a precautionary measure, affecting over 256,000 individuals. The TCEQ performed an investigation showing that the main cause was outdated infrastructure (Garcia, 2024).

Drought

The National Oceanic and Atmospheric Administration (NOAA) has analyzed Texas's precipitation data from 1895 to the present. This paired with paleoclimate data from tree rings as far back as year zero indicates drought patterns are increasing in frequency and intensity. This pattern of severe droughts affects the Rio Grande Basin water quality negatively in several ways causing the Rio Grande to become one of the most at-risk rivers in the United States. To make matters worse climate scientists and weather models are predicting larger more intense droughts paired with higher average temperatures are in store for West Texas's future (Nielsen et al. 2020). To see the current drought conditions in Texas see Figure 10.

Texas reservoir levels are reaching record lows in 2024 due to extreme drought conditions. This has affected agricultural irrigation, municipal water supply, overall surface water quality, and hydropower production. Amistad Reservoir hit a record low on July 17, 2024, at approximately 25% capacity. To see the reservoir water levels through 2024, see Figure 11. Reservoir managers in an attempt to conserve water levels reduced the output of water from the dam. This lowers streamflow and leads farmers to rely more on groundwater. Pumping groundwater not only costs more, but the water often has elevated levels of salt. This increases the saline levels in the surface water as you travel downstream. To visualize the effects and severity of the drought, see the satellite imagery depicting the Amistad Reservoir from Figure 13. August 2016 and Figure 12. August 2024, respectively.

Effects on Water Quality

Drought brings with it many water quality implications. It increases water scarcity lowering river flow which in turn increases salinization making the water unusable for irrigation and leading to municipal water shortages. This also has a broad range of negative effects on flora and fauna, leading to overall lowered biodiversity. The lower water levels directly correlate with reduced dissolved oxygen levels, which can lead to fish kills and macroinvertebrate loss. Drought also leads to a reduced dilution of contaminants. High average temperatures and higher levels of available nutrients (particularly phosphate and nitrogen) can cause algae blooms, exacerbating fish kills and promoting toxic cyanobacterial blooms, which are a potential health risk to communities that rely on the river for drinking water (Mosley, 2015). As 7.7 million Texans are currently impacted by drought, we should continue water monitoring efforts to reduce and manage adverse impacts. To learn more about the current drought in Texas, you can utilize the National Integrated Drought Information System (NIDIS) to see real-time data on drought monitoring, forecasting, and planning at the state and local levels.

Agricultural Impact

Farmers in the Rio Grande Valley faced significant challenges due to the drought. Many had to rely on groundwater for irrigation because of low river levels, which is more expensive and less effective than surface water. The pumped groundwater contains high levels of dissolved salts, leading to saline soils and lowering overall soil productivity. Soil degradation occurs as soils become dry and compacted, reducing fertility and increasing the risk of erosion. Increased erosion negatively impacts surface water and results in the loss of biodiversity. Additionally, the drought has led to reduced crop yields and increased financial strain on farmers.

Environmental Impact

In summary, drought in Texas significantly impacts the environment, particularly water resources. Reduced river flows and lower water levels in lakes and reservoirs lead to a higher concentration of pollutants, exacerbating water quality issues. Figures 12 and 13 show the dramatic decrease in water volume at Amistad Reservoir in an 8-year period. Groundwater levels also decline, forcing many to rely on more expensive and less effective groundwater for irrigation. This groundwater often contains high levels of dissolved salts, resulting in soil salinization, which diminishes soil productivity. Additionally, the lack of water affects wetlands, leading to habitat loss for various species and a reduction in biodiversity. The dry conditions increase the risk of wildfires, which can destroy large areas of land and further degrade the environment. Overall, drought in Texas severely stresses both water quality and the ecosystem, necessitating comprehensive water management and conservation efforts.

Response and Mitigation Efforts

In 2024, Texas implemented several response and mitigation efforts to address the ongoing drought. The Texas Commission on Environmental Quality (TCEQ) encouraged public water systems to increase conservation efforts, secure alternative water supplies, and implement drought contingency plans. Public education and outreach activities were conducted to promote water conservation. Infrastructure improvements, such as repairing leaks and extending intake structures to deeper waters, were prioritized to ensure a reliable water supply. The Texas Water Development Board (TWDB) provided financial assistance to help communities respond to drought. These efforts aimed to mitigate the impacts of drought on water quality and availability, ensuring that communities had access to safe and reliable water supplies. Federal funding of nearly $25 million was allocated to address drought conditions in the Upper Rio Grande Basin. Projects included managing low water flows, restoring ecosystems, and improving water infrastructure. These efforts aim to enhance the region's resilience to drought and mitigate its impacts on water quality and supply.

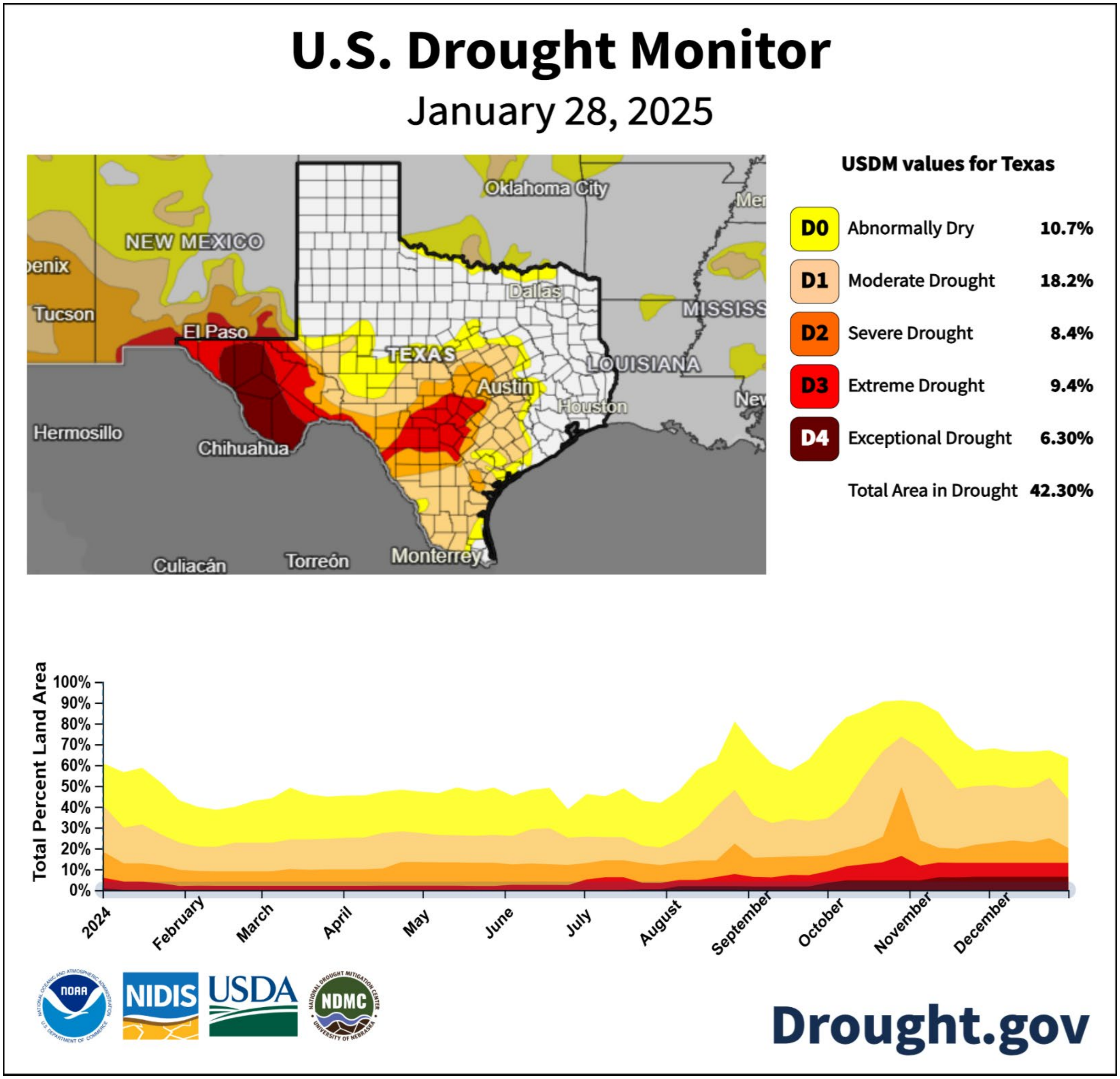


Figure 10. Shows current drought conditions in Texas and the percentage of drought-affected areas in 2024.

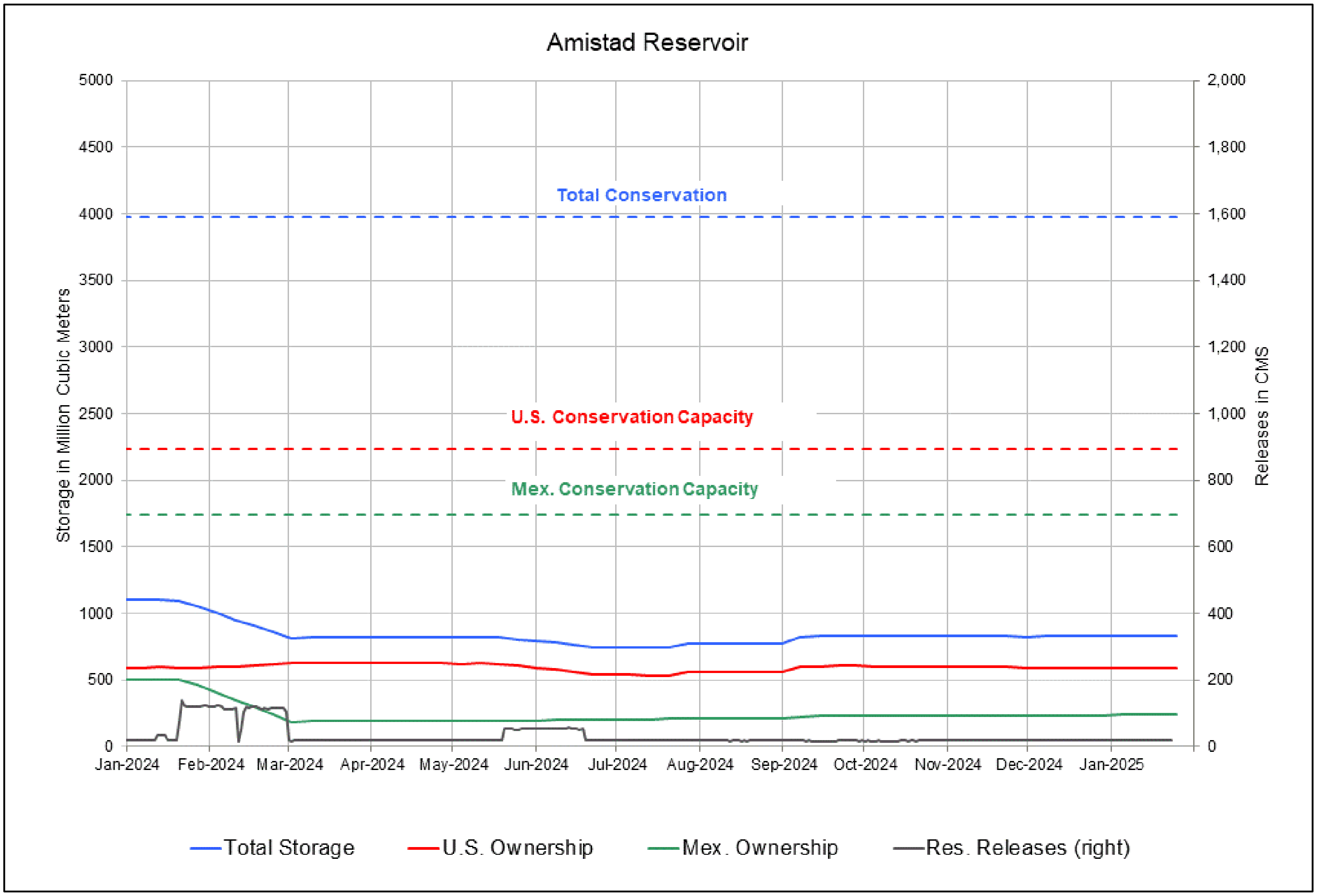


Figure 11. Current water levels at Amistad Reservoir

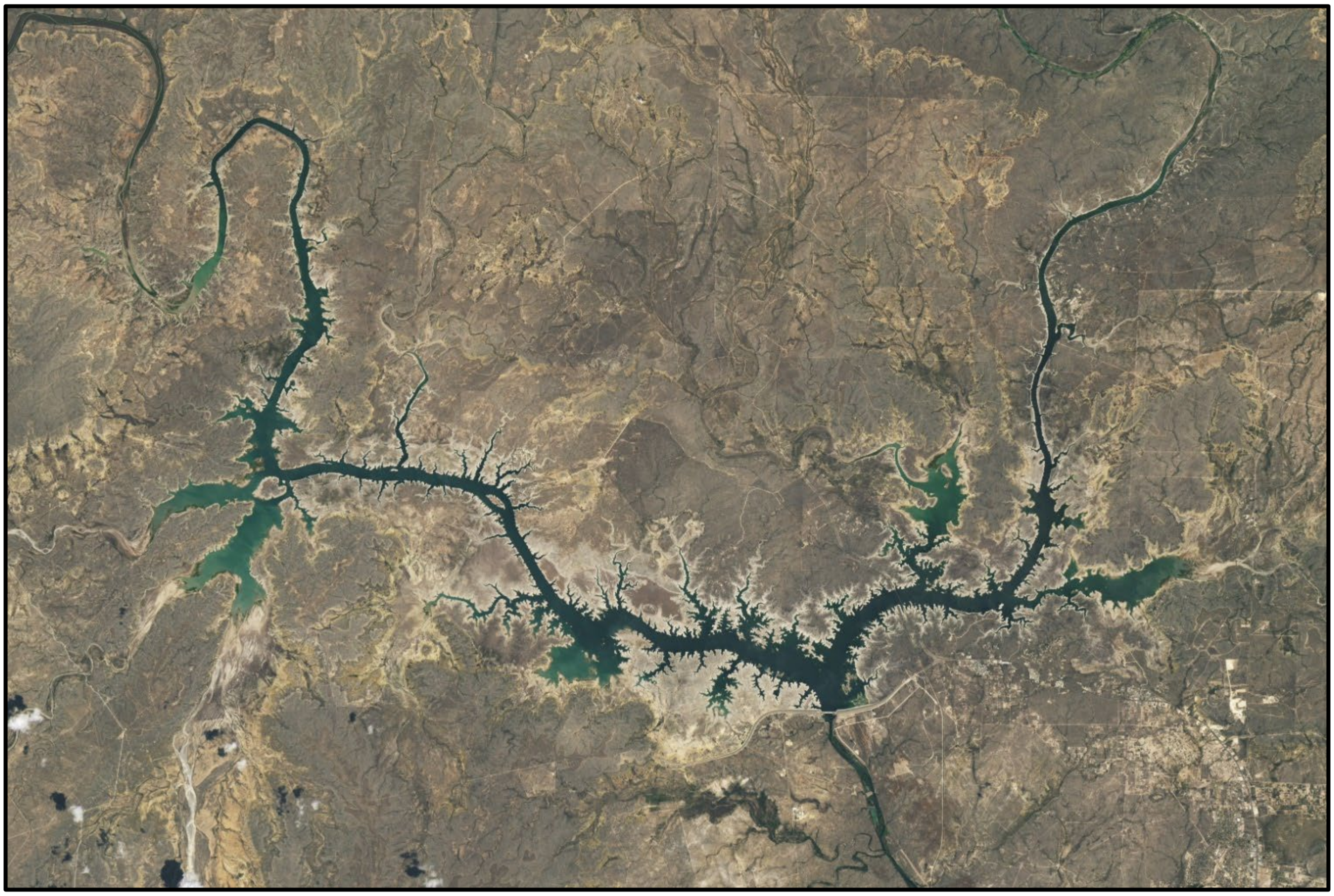


Figure 12: August 19, 2024. Landsat 8 OLI satellite imagery, Amistad Reservoir.

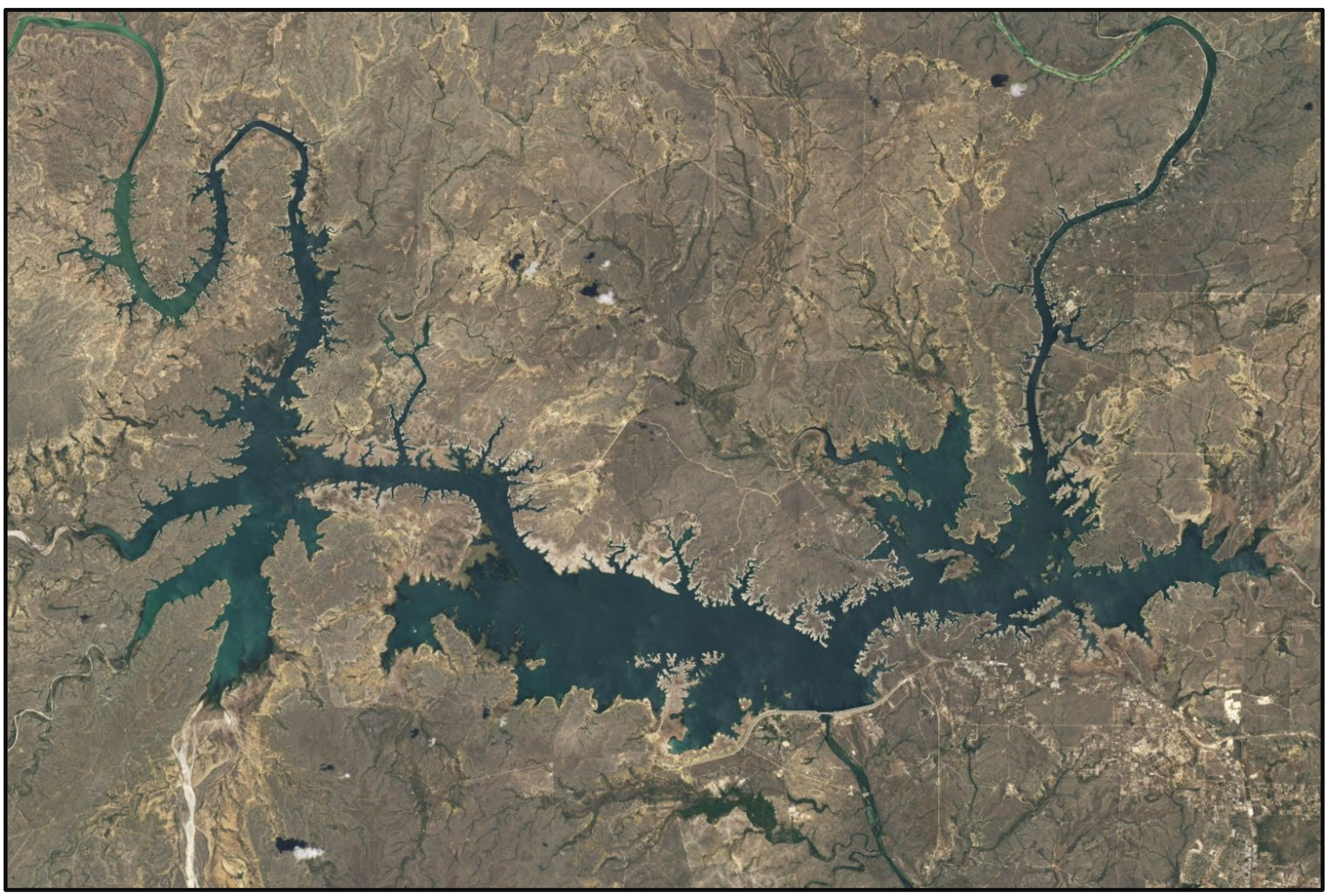
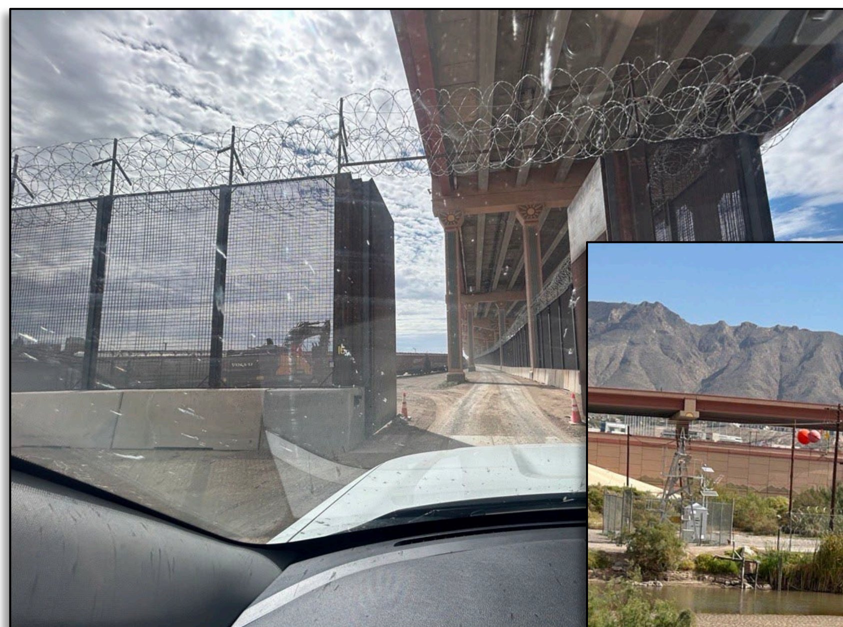


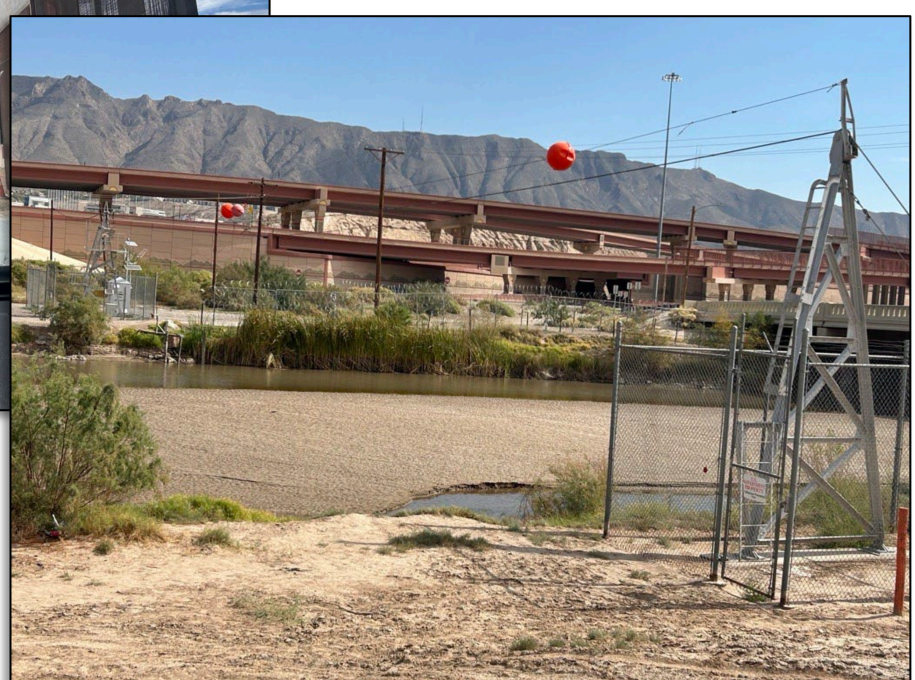
Figure 13: August 6, 2016. Landsat 9 OLI-2 satellite imagery, Amistad Reservoir.

Border safety

Border safety is a critical issue at the Rio Grande. In recent years, the border has seen an influx of migrants from various parts of the world entering the United States through Texas. This increase has made sampling more challenging for IBWC CRP partners. Border cities have experienced a rise in law enforcement. In El Paso, for example, the deployment of National Guard Troops has reduced access to sampling sites. These sites are located behind the border wall, which was already a challenge. However, the National Guard has now set up concertina wire along the river, further impeding access. The picture to the right shows an American Dam Hydrotech alongside a National Guardsman, cutting the wire to access a sampling site. This was made possible through various discussions and engagements between IBWC, the National Guard, and immigration authorities. To provide accurate assessments of water quality and collect representative samples, CRP needs continuous access to its permanent sites.

American Dam Hydrotech cutting through concertina wire to access sampling station.





Challenges faced to gain access to sampling sites in El Paso, TX.

Public Participation and Outreach

Public involvement is crucial for the Clean Rivers Program (CRP) and manifests in many ways. CRP staff attend numerous meetings organized by various interest groups to address water quality issues. These presentations inform attendees about the program's goals and efforts in the basin, to learn about others' activities, and prevent duplicating efforts. Additionally, support is provided for academic research within the basin, such as chemical and bacteriological studies near major metropolitan areas and potential adverse impacts on wildlife due to domestic wastewater.

IBWC staff presenting at an elementary school career fair (top) and at a Water week event at UTEP (bottom).

A key objective of the CRP is to maximize efforts within the basin by leveraging grant funds with CRP dollars. CRP has also assisted other agencies that received grants for research in the Rio Grande by providing additional field personnel, lab support, or project coordination with Mexico.

Outreach efforts are vital for raising awareness about water conservation, pollution prevention, and the importance of maintaining healthy river ecosystems. Presentations at the University of Texas at El Paso (UTEP) offer valuable educational opportunities for students and faculty to learn about Texas CRP's initiatives, research findings, and the significance of their work in preserving Texas rivers. These presentations not only inform but also engage the academic community in discussions about environmental stewardship and sustainability.

For the past two years, USIBWC CRP staff have participated in Earth Week at UTEP. Earth Week serves as a platform to amplify the message of environmental awareness and conservation to a broader audience. Through events, workshops, and activities during Earth Week, CRP staff can reach students, faculty, and the local community, encouraging them to protect their natural resources. Last year, CRP staff were also invited to participate in Water Week, where water quality experts came together to discuss various issues with the quality of the water in the border. Students from Mexican universities also participated and presented their research.

Overall, these outreach efforts raise awareness about Texas CRP's mission and objectives and foster a sense of responsibility and ownership among individuals and communities toward protecting Texas rivers for future generations. By engaging with diverse audiences through presentations, school visits, and community events, the Texas Clean Rivers Program can continue to build support and momentum for its vital conservation efforts.

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References and Additional Links

TCEQ 2024 Integrated Report: https://www.tceq.texas.gov/waterquality/assessment/2024-integrated-report

Texas surface Water Quality Standards (TSWQS): https://www.tceq.texas.gov/waterquality/standards/eq_swqs.html

The Texas Clean Rivers Program: https://www.tceq.texas.gov/waterquality/clean-rivers/index.html

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