GBRA.ORG

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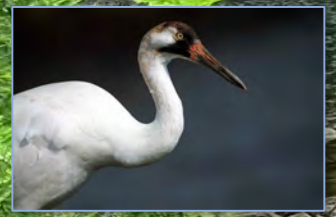
Guadalupe-Blanco River Authority

Your Trusted
Water Resource



GBRA
Guadalupe-Blanco River Authority

Guadalupe River Habitat Conservation Plan

4TH PUBLIC STAKEHOLDER MEETING

July 30, 2024

GBRA HCP Team

Nathan Pence
Executive Manager of Environmental Science

Chad Norris
Deputy Executive Manager of Environmental Science

Daniel Large
HCP Director

Jana Gray
HCP Coordinator

Lee Gudgell
Aquatic Biologist

HCP Consulting Team

Prime – ESA/HCP Policy Expertise and Project Management

Biological expertise and consulting

Water quantity modeling

Water quality modeling

GRHCP Planning Process Update

National Habitat Conservation Plan Coalition Annual Meeting

- GBRA HCP team submitting multiple presentation abstracts

USFWS Central Texas Freshwater Mussels Final Rule

- All three rare mussels covered by GRHCP listed as endangered with critical habitat designations
- Published June 4, 2024
- Effective July 5, 2024

48034 Federal Register / Vol. 89, No. 108 / Tuesday, June 4, 2024 / Rules and Regulations

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2019–0061; FXES1111090FEDR–245–FF09E21000]

RIN 1018–BD16

Endangered and Threatened Wildlife and Plants; Endangered Species Status With Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, Balcones Spike, and False Spike, and Threatened Species Status With Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for the Guadalupe fatmucket (*Lampsilis bergmanni*), Texas fatmucket (*Lampsilis bracteata*), Guadalupe orb (*Cyclonaias necki*), Texas pimpleback (*Cyclonaias* (=*Quadrula*) *petrina*), Balcones spike (*Fusconaia* (=*Quincuncina*) *iheringi*), and false spike (*Fusconaia* (=*Quincuncina*) *mitchelli*), and threatened species status for the Texas fawnsfoot (*Truncilla macrodon*), seven species of freshwater mussels from central Texas. We also issue a rule under section 4(d) of the Act for the Texas fawnsfoot that provides measures that are necessary and advisable to provide for the conservation of the Texas fawnsfoot. In addition, we designate critical habitat for all seven species. In total, approximately 1,577.5 river miles (2,538.7 river kilometers) in Blanco, Brown, Caldwell, Coleman, Comal, Concho, DeWitt, Gillespie, Gonzales, Guadalupe, Hays, Kendall, Kerr, Kimble, Lampasas, Llano, Mason, [illegible], Menard, Mills, Palo Pinto, [illegible]nels, San Saba, Shackelford, [illegible]tton, Throckmorton, Tom [illegible]s, and Victoria Counties, [illegible]ithin the boundaries of the [illegible]at designation. This rule [illegible]protections of the Act to [illegible]s and their designated [illegible]tats. [illegible]rule is effective July 5. [illegible] This final rule is available [illegible]et at *https://* [illegible]*tions.gov*. Comments and [illegible]e received, as well as [illegible]documentation we used in preparing this rule, are available for public inspection at *https://www.regulations.gov* at Docket No. FWS–R2–ES–2019–0061.

Availability of supporting materials: Supporting materials we used in preparing this rule, such as the species status assessment report, are available for public inspection at *https://www.regulations.gov* at Docket No. FWS–R2–ES–2019–0061. For the critical habitat designation, the coordinates or plot points or both from which the maps are generated are included in the decision file and are available at *https://www.regulations.gov* at Docket No. FWS–R2–ES–2019–0061.

FOR FURTHER INFORMATION CONTACT: Karen Myers, Field Supervisor, U.S. Fish and Wildlife Service, Austin Ecological Services Field Office, 1505 Ferguson Lane, Austin, TX 78754; telephone (512) 937–7371. Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, a species warrants listing if it meets the definition of an endangered species (in danger of extinction throughout all or a significant portion of its range) or a threatened species (likely to become endangered within the foreseeable future throughout all or a significant portion of its range). If we determine that a species warrants listing, we must list the species promptly and designate the species' critical habitat to the maximum extent prudent and determinable. We have determined that the Guadalupe fatmucket (*Lampsilis bergmanni*), Texas fatmucket (*Lampsilis bracteata*), Guadalupe orb (*Cyclonaias necki*), Texas pimpleback (*Cyclonaias* (=*Quadrula*) *petrina*), Balcones spike (*Fusconaia* (=*Quincuncina*) *iheringi*), and false spike (*Fusconaia* (=*Quincuncina*) *mitchelli*) meet the Act's definition of endangered species, and the Texas fawnsfoot (*Truncilla macrodon*) meets the Act's definition of a threatened species; therefore, we are listing them as such, finalizing a rule under section 4(d) of the Act for the Texas fawnsfoot, and designating critical habitat. Both listing a species as an endangered or threatened species and designating critical habitat can be completed only by issuing a rule through the Administrative Procedure Act rulemaking process (5 U.S.C. 551 *et seq.*).

What this document does. This rule makes final the listing of the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, Balcones spike, and false spike as endangered species, and the Texas fawnsfoot as a threatened species with a rule issued under section 4(d) of the Act (a "4(d) rule"). In addition, this rule designates critical habitat for all seven central Texas mussel species in 20 units (including 32 subunits) totaling 1,577.5 river miles (2,538.7 river kilometers (km)) on private, State, and Federal property within portions of 31 counties in Texas.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence; we also take into account conservation efforts, such as Candidate Conservation Agreements with Assurances (CCAAs). We have determined that increased fine sediment, changes in water quality, and altered hydrology in the form of inundation and loss of flow and scour of substrate (Factor A), collection (Factor B), predation (Factor C), and barriers to fish movement (Factor E) are the primary threats to these species. These factors are all exacerbated by the ongoing and expected effects of climate change.

Section 4(a)(3) of the Act requires the Secretary of the Interior (Secretary), to designate critical habitat, to the maximum extent prudent and determinable, concurrent with listing. Section 3(5)(A) of the Act defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protections; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination by the Secretary that such areas are essential for the conservation of the species. Section 4(b)(2) of the Act states that the Secretary must make the designation on the basis of the best scientific data

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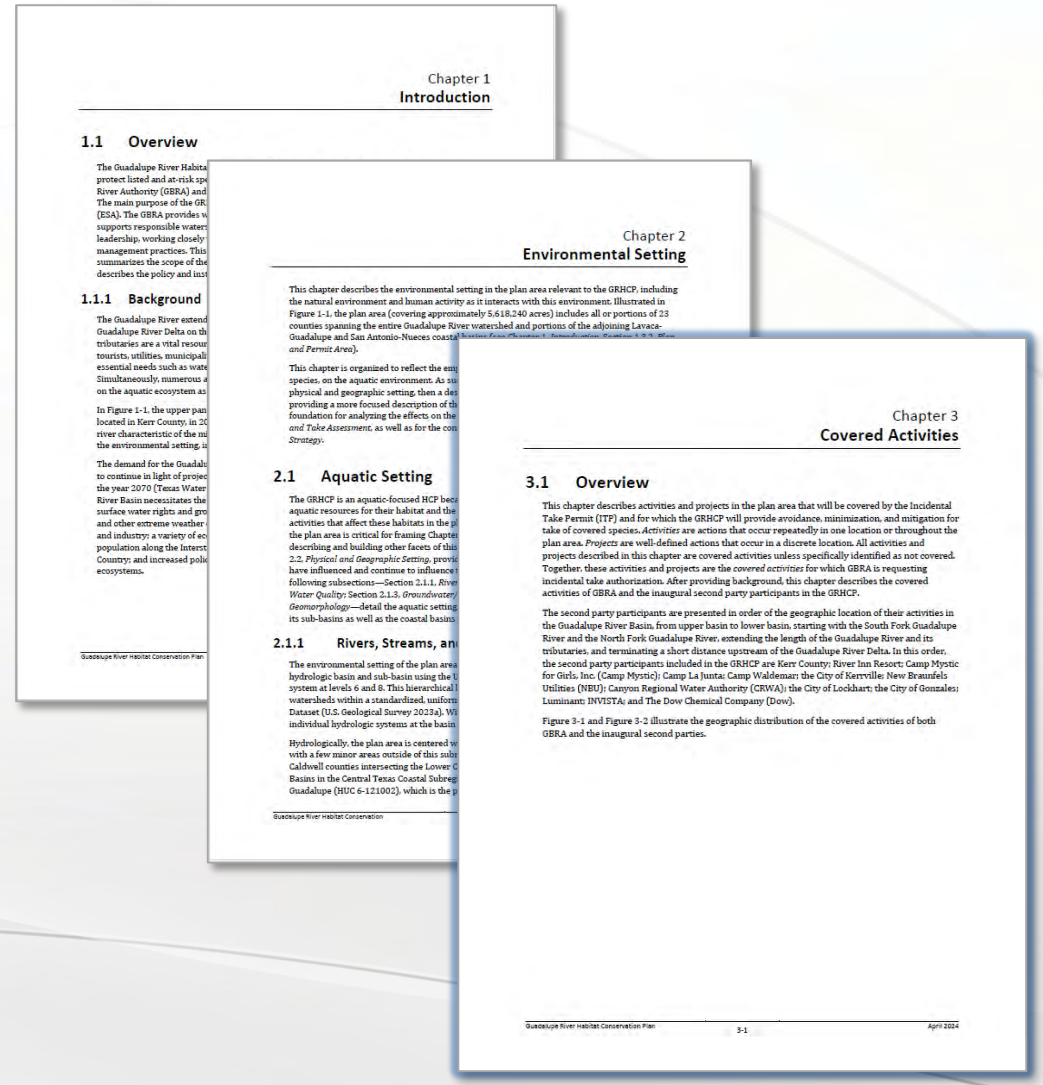
GRHCP Taking Shape

- Three complete working draft chapters submitted to USFWS in April
- 247 pages total
- Up next:
  - *Impact/Take Assessment* &
  - *Conservation Strategy* chapters



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USFWS HCP Planning Grant

- $1M award from USFWS Section 6 program
  - 25% match requirement
- **Expanded scope:** modeling, second party participation, technical advisory group process
- **Two-year grant period** (2024 - 2026)
- TPWD is state grant administrator

2024 Summer Mussel Sampling and Monitoring

- Quantitative mussel surveys
- Building on past presence/absence surveys
- Inform development of impact assessment and monitoring methods

Covered Activities - Methodology

Selection Criteria	
Location	Within the permit area
Timing	Within the proposed 50-year permit term
Impact	Reasonable likelihood of resulting in take of a covered species
Control	Is/could be, under direct control of GBRA (includes Second Party Participants)
Data	Sufficient information available to evaluate impact of the activity

Resulting List

1. Water Diversions
2. Raw Water Intake Infrastructure
3. Treated Wastewater Discharges
4. On-channel Impoundments
   - Hydropulsing
   - Flow modification
5. Streambed & Bank-disturbing Activities
   - Dewatering
   - Dredging
   - Debris removal
   - Recreation

Species Considered for Coverage

- Total of 350+ species in the plan area carefully evaluated against coverage criteria.

1. First round eliminated approx. 90% of species according to:
   - **species range** (known or expected occurrence in the plan area in the specific aquatic and riparian environments relevant to GBRA's operations) and
   - **ESA listing status** (currently listed or likelihood of listing over the permit term) criteria

2. Second round evaluated resulting list of approximately 50 species, according to:
   - **impact** (likelihood of take to result from covered activities) and
   - **species data** (sufficient data available to evaluate the species within the HCP) criteria

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GRHCP Covered Species

Guadalupe orb

Guadalupe fatmucket

False spike

Eastern black rail

Whooping crane

Guadalupe darter

GBRA and Second Party Covered Activities

Activity type	Species potentially impacted
Surface water diversions	
Water intake operations	
Treated wastewater discharges	
On-channel impoundments	
Dewatering, dredging, debris removal, recreation	

Second Party Take Program Update

Enabling a Collaborative, Basin-wide Approach

Background

- Engaging other entities in basin to participate in the HCP
- No direct regulatory or economic benefit to GBRA
- GBRA, as regional leader, spearheading with support of the Board

RESOLUTION AUTHORIZING THE GUADALUPE-BLANCO RIVER AUTHORITY TO INITIATE DEVELOPMENT OF A HABITAT CONSERVATION PLAN

WHEREAS, pursuant to its Enabling Act and its mission and vision statements, the GBRA is committed to supporting responsible watershed protection, stewardship, providing quality operational service, and promoting conservation and educational opportunities in order to enhance quality of life for those we serve; and

WHEREAS, Habitat Conservation Plans (HCPs) can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing, and conserving those species before they are in danger of extinction or are likely to become so, which can provide early benefits and prevent the need for listing; and

WHEREAS, a Guadalupe Basin HCP can fulfill the commitments of the GBRA / The Aransas Project Agreement; and

WHEREAS, HCPs are recognized under Section 10(a)(1)(B) of the Endangered Species Act (ESA) in order to provide a means whereby ecosystems upon which endangered species and threatened species depend may be conserved and to provide a program for the conservation of such species; and

WHEREAS, HCPs are planning documents required as part of an application for an Incidental Take Permit, which describe the anticipated effects of the proposed incidental taking, how those impacts will be minimized, or mitigated, and how the HCP is to be funded; and

WHEREAS, GBRA recognizes that HCPs can provide for stability of services provided by GBRA, allow for long-term assurances and sustainability of resources, can build on GBRA's past efforts and represent a proactive approach to environmental management;

NOW THEREFORE, BE IT RESOLVED that the Board of Directors of the Guadalupe-Blanco River Authority authorizes the development of a Guadalupe Basin Habitat Conservation Plan to fulfill the requirements of Section 10(a)(1)(B) of the Endangered Species Act in order to better protect and steward the watershed and resources of the Guadalupe Basin for the people of Texas.

Specifically, GBRA staff are directed to:

a) Plan for and take actions that lead to the development of a basin-wide HCP; and
b) Initiate a procurement process to consider utilization of a contractor to assist in the development of a HCP; and
c) Seek and apply for external funding to assist in development of a HCP; and
d) Shall allocate up to $100,000 annually to fund efforts and be used for grant match in support of the HCP; and
e) Keep the Board informed and engaged as decision points arise and on progress of the HCP development process.

PASSED and **APPROVED** by the Board of Directors of the Guadalupe-Blanco River Authority, Texas on the 17th day of April 2019.

Dennis L. Patillo
Chairman, Board of Directors
Guadalupe-Blanco River Authority

ATTEST:
Kenneth A. Motl
Secretary-Treasurer, Board of Directors
Guadalupe-Blanco River Authority

GBRA Board Resolution

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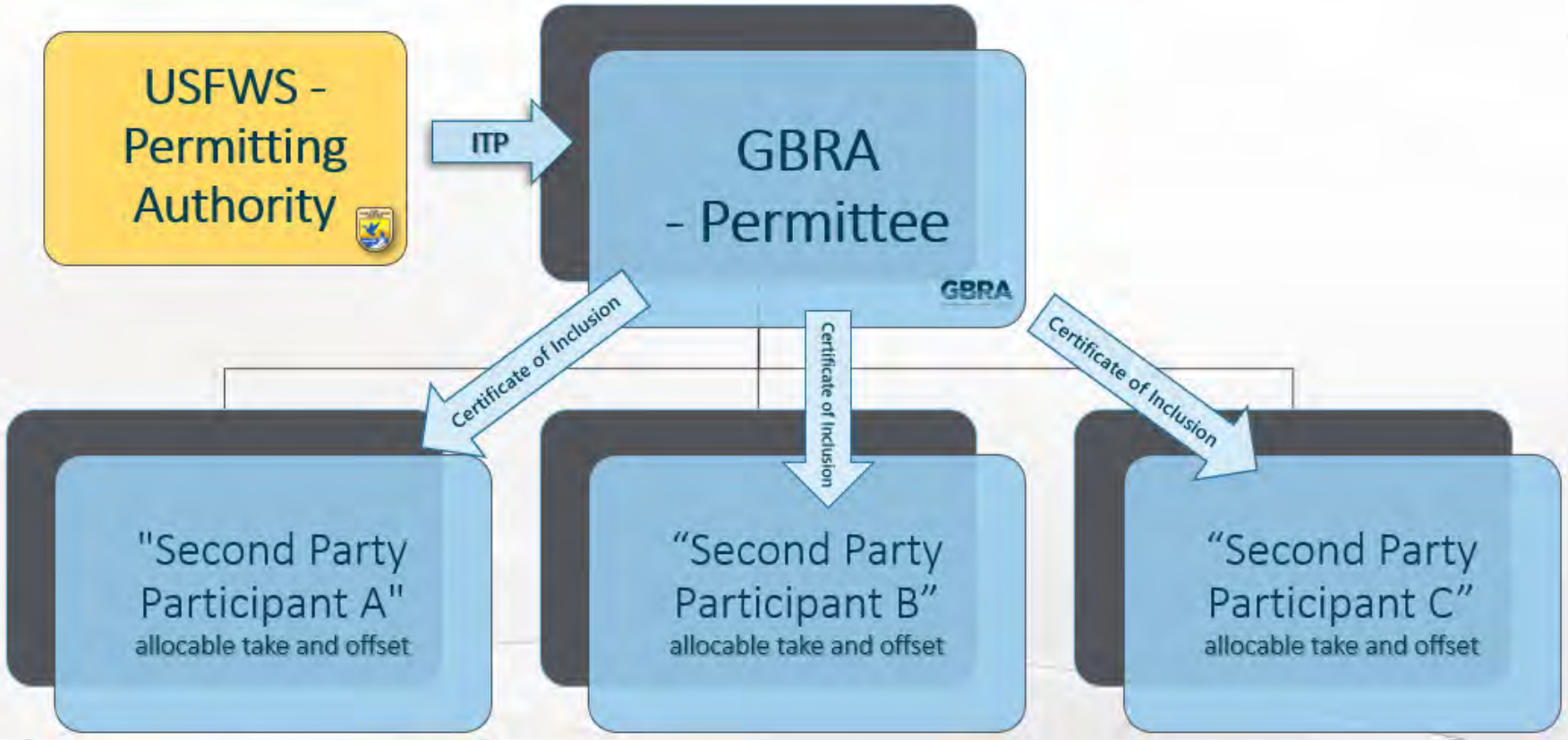
Benefits of the Second Party Program

- **Extends limited public funding** by avoiding duplication of efforts
- **Lowers barriers to compliance** for entities that would otherwise not have been able to pursue an HCP
- **Assists USFWS in addressing one comprehensive HCP**, rather than 10+, streamlining compliance
- **Expands the reach of species conservation efforts**, with benefits to water quantity/quality, and the watershed

Second Party Take Authorization



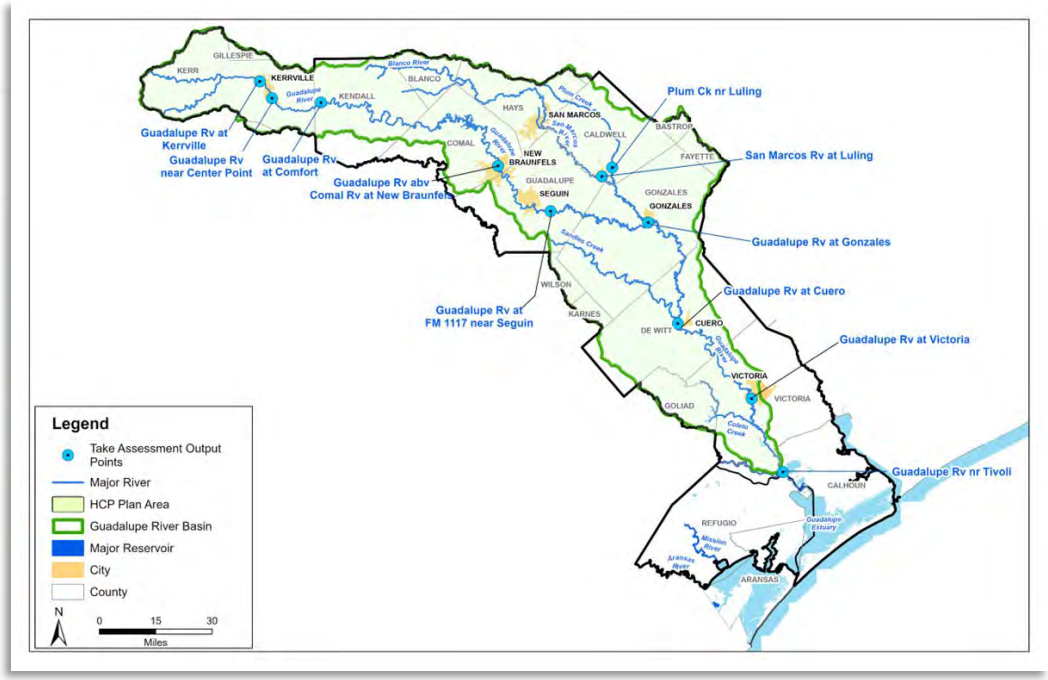
Second Party Participation Update

- 13 inaugural participants
- Basin-wide, entire watershed scope
- Same set of covered activities (operations) as GBRA
- Potential impacts to same set of covered species as GBRA
- Conservation and take will be addressed individually

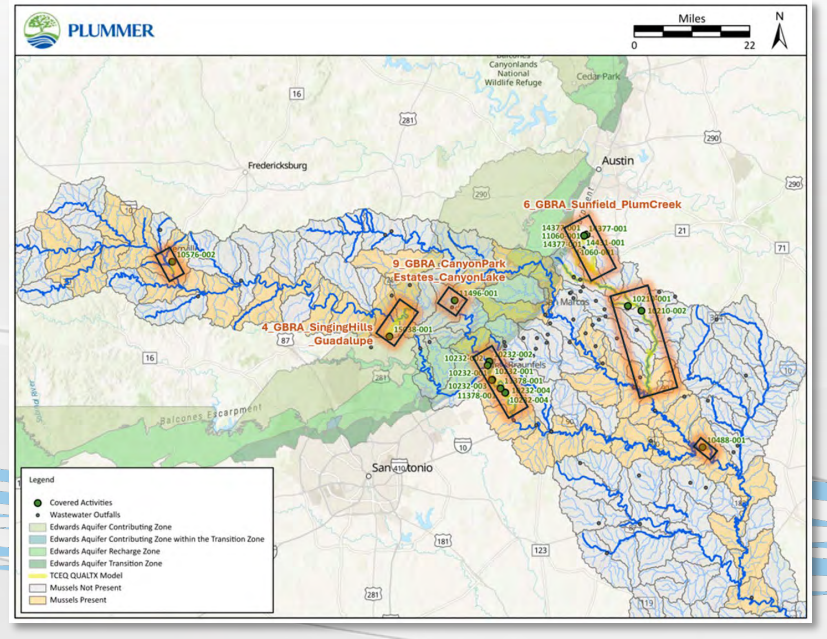
Second Party Modeling

- Comprehensive, integrated impact analysis and ultimately, take assessment
- Modeling incorporates second party activities/locations throughout the basin
- Each entity's impacts can be parsed out

WAM Control Points



QUAL-TX Locations



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Formalizing Participation

- **Memorandum of Agreement (MOA)** – legal agreement between GBRA and entity to formalize entity's commitment to participation
  - Before HCP submission to USFWS

- **Certificate of Inclusion (COI)** - legal agreement between GBRA and entity recognized by FWS for take authorization
  - After ITP

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GRHCP Water Quantity Modeling

GRHCP Hydrologic Effects Analysis Framework

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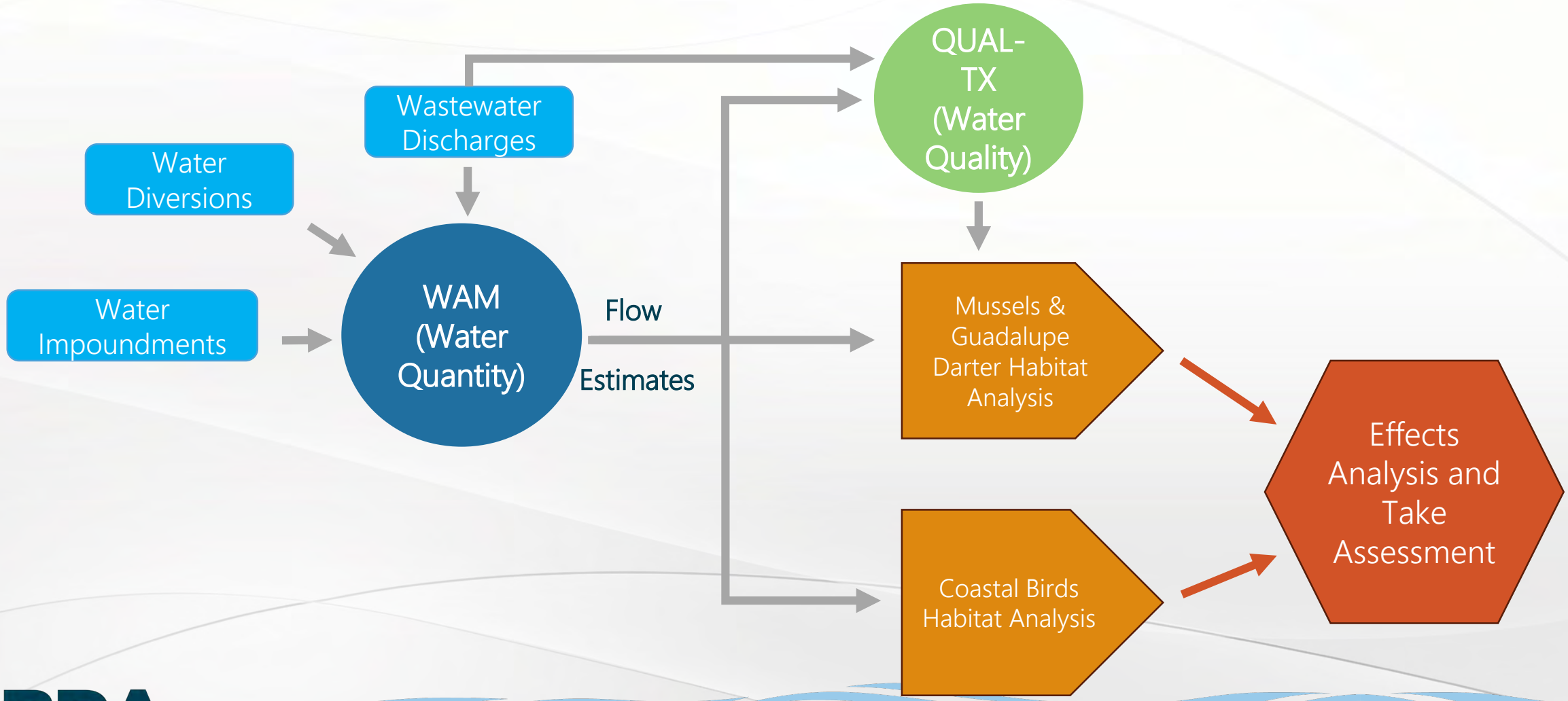

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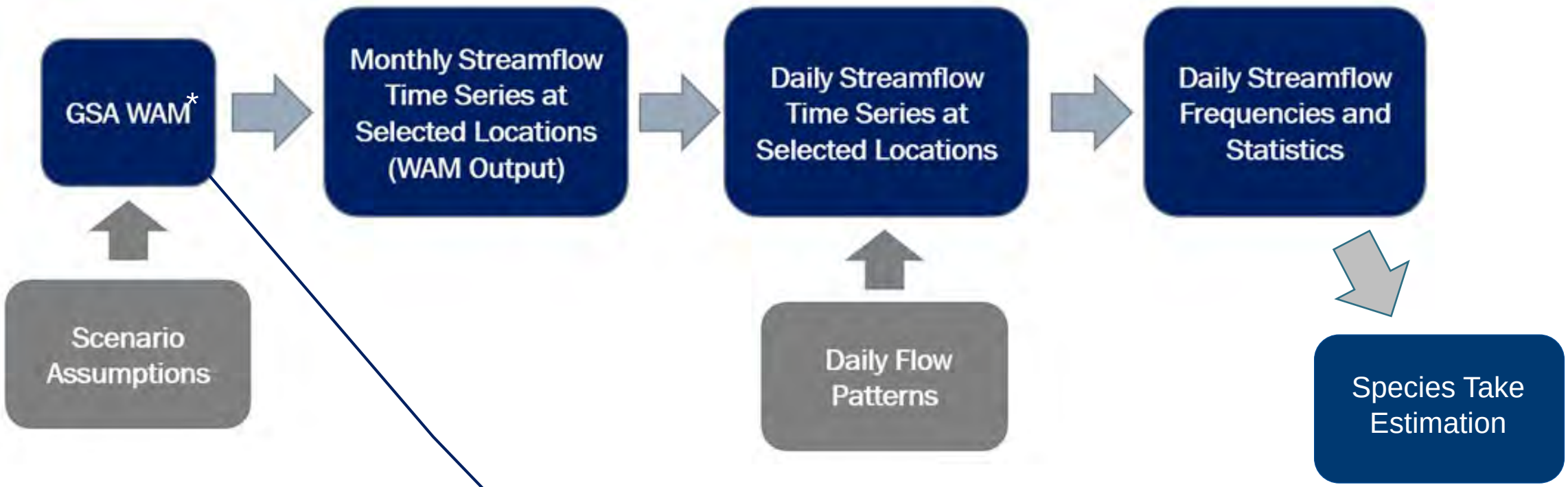
Surface Water Quantity Modeling Approach



- **Basin-wide monthly timestep model**
- **Period of Record: 1934-1989**
- **Simulates strict enforcement of prior appropriations**

***GSA WAM = Guadalupe San Antonio Water Availability Model

Covered Activities Included in Water Quantity Modeling

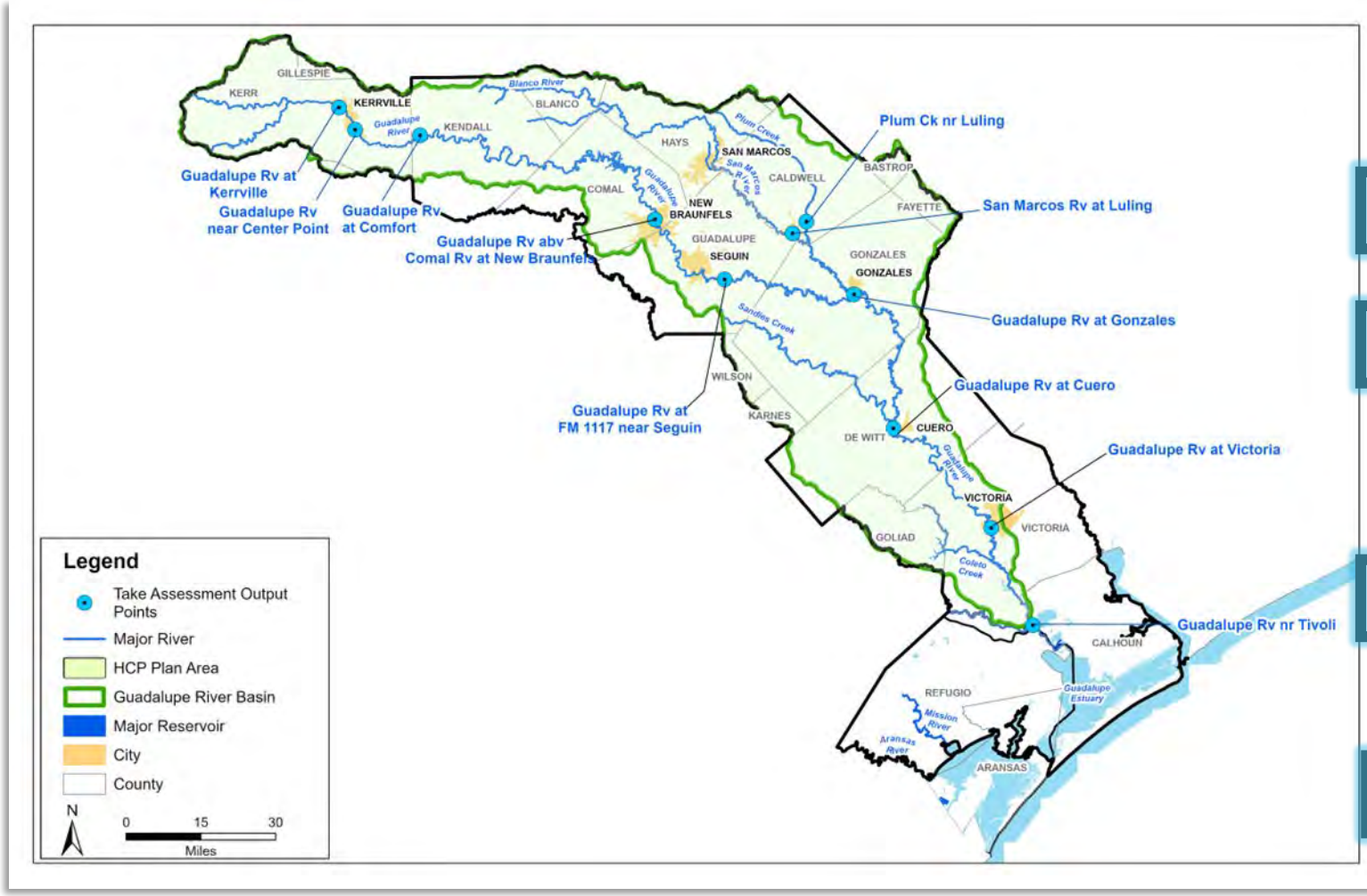
Activity type	Species potentially impacted
Surface water diversions	
Water intake operations	
Treated wastewater discharges	
On-channel impoundments	
Dewatering, dredging, debris removal, recreation	

Modeling Scenarios & Assumptions

Summary of Surface Water Model Scenarios and General Surface Water Modeling Assumptions (February 28, 2024)								
Scenario		Scenario Purpose	Water Quality (Temperature and Headwater flows) Attributes	Covered Activities (GBRA and 2nd Parties)		Other Entities		Large Dams or Other Existing Infrastructure/ Sediment Conditions
				Water Use & Operations	Return Flows	Water Use & Operations	Return Flows	
Initial Scenarios								
1	Reference	Comparison point for HCP impact analysis	Ambient temperature from gaged data and Headwater flows from WAM Reference Run	No	No	Yes/Current	Yes/Current	Yes/ Current Sediment Conditions for All Large Reservoirs[a]
2a	Full discharge, full use of water rights	Impact Analysis Reference Point for Max Water Quality Effects	Ambient temperature from gaged data and Headwater flows from WAM Impact Analysis and Take Estimates Run	Yes/Future (full water rights)	Yes/Full Permitted	Yes/Current	Yes/Current	Yes/Current Sediment Conditions for All Large Reservoirs Except Canyon & 2nd Party Reservoirs[b]
2c	Full reuse, full use of water rights	Impact Analysis Reference Point for Minimum Water Quantity Effects	No effluent discharge	Yes/Future (full water rights)	No (100% Re-use)	Yes/Current	Yes/Current	Yes/Current Sediment Conditions for All Large Reservoirs Except Canyon & 2nd Party Reservoirs[b]

- TAG/FWS has requested an additional run which is currently in progress

Selected WAM Control Points



Location	USGS Gage No.
Guadalupe River at Kerrville	08166200
Guadalupe River near Center Point	08166250
Guadalupe River at Comfort	08167000
Guadalupe River above Comal River at New Braunfels	08168500
Guadalupe River at FM 1117 near Seguin[a]	08169792
San Marcos River at Luling	08172000
Plum Creek near Luling	08173000
Guadalupe River at Gonzales	08173900
Guadalupe River at Cuero	08175800
Guadalupe River at Victoria	08176500
Guadalupe River near Tivoli	08188800

[a]Control point added to WAM

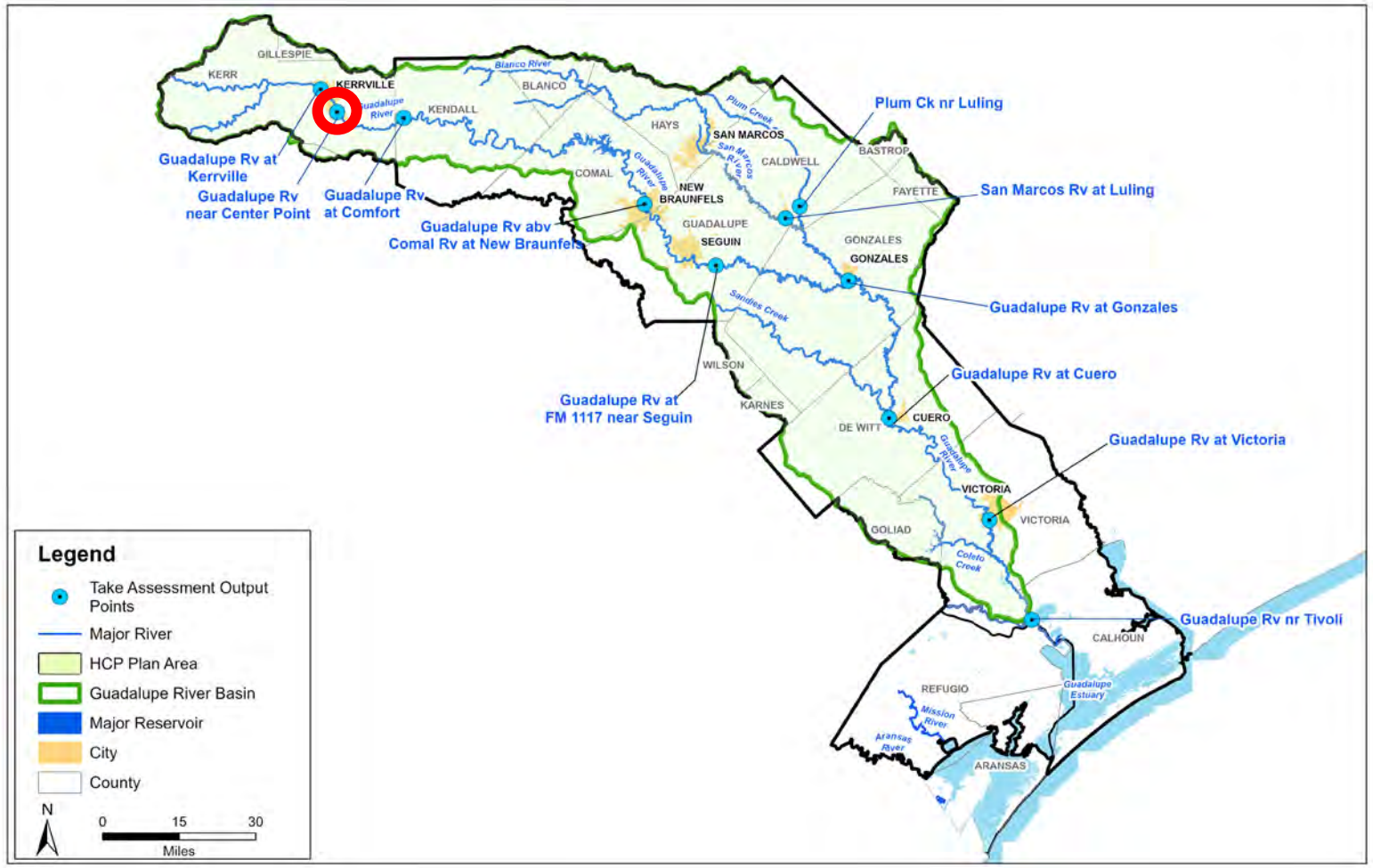
Guadalupe River near Center Point

Upstream Covered Activities

- Effluent from second party treated wastewater discharges
- Second party upstream diversions

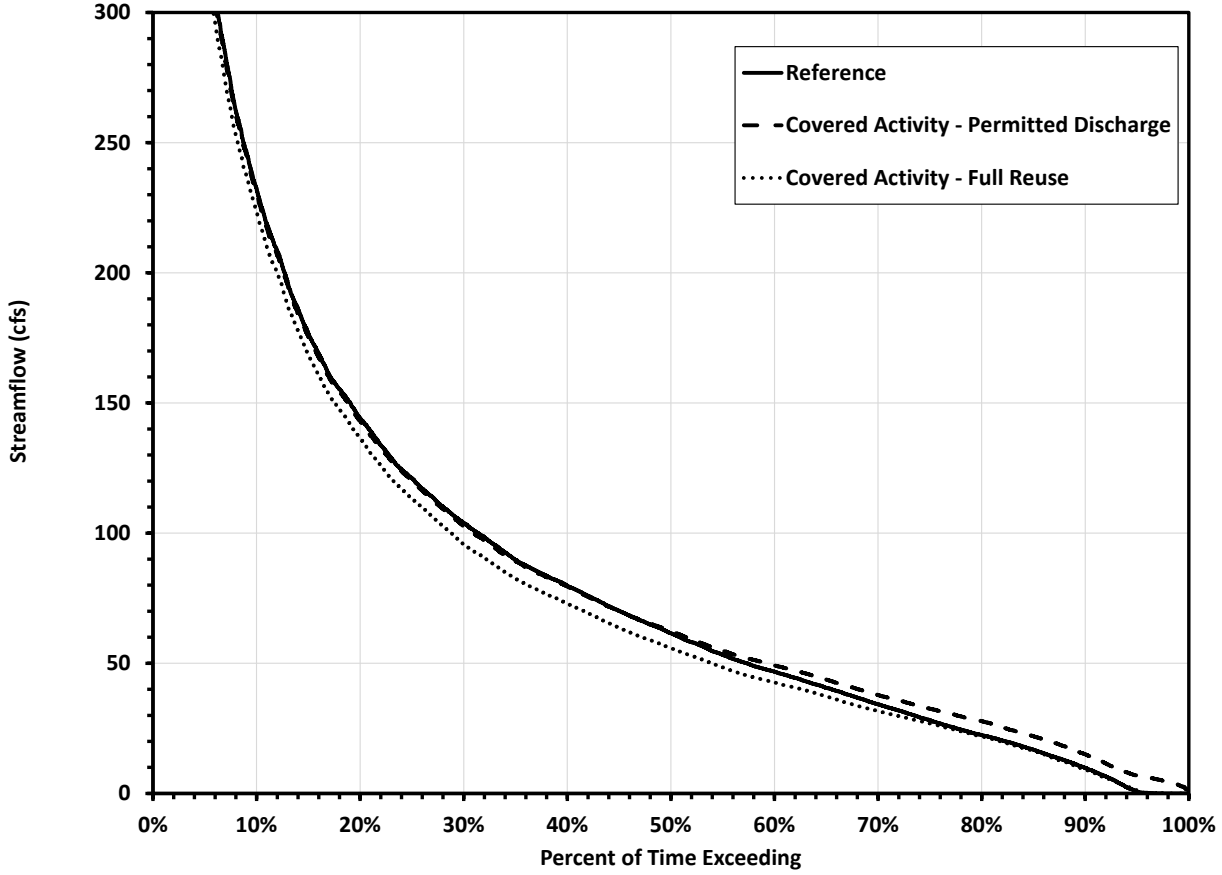
Key Streamflow Observations

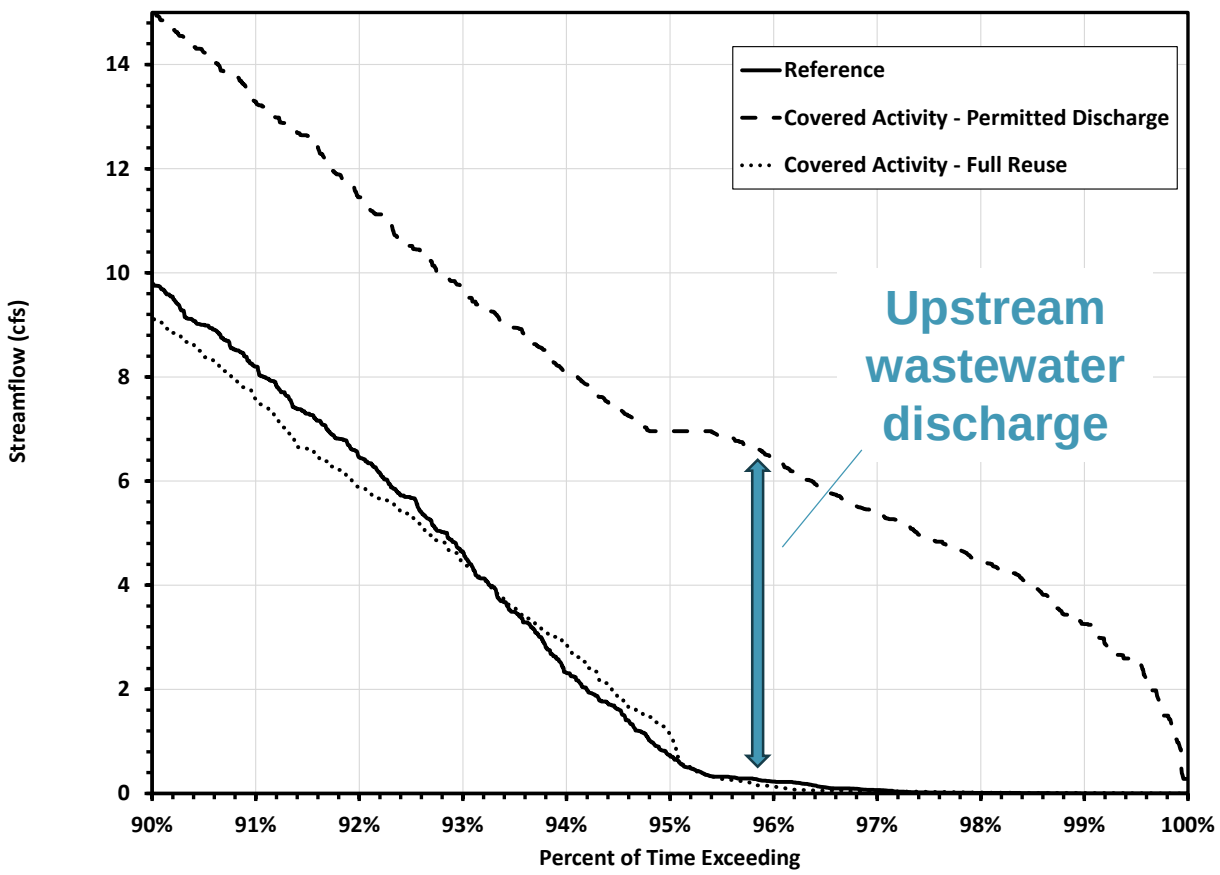
- Wastewater discharge increases low flows in Full Discharge Scenario



PRELIMINARY

Guadalupe River near Center Point





PRELIMINARY

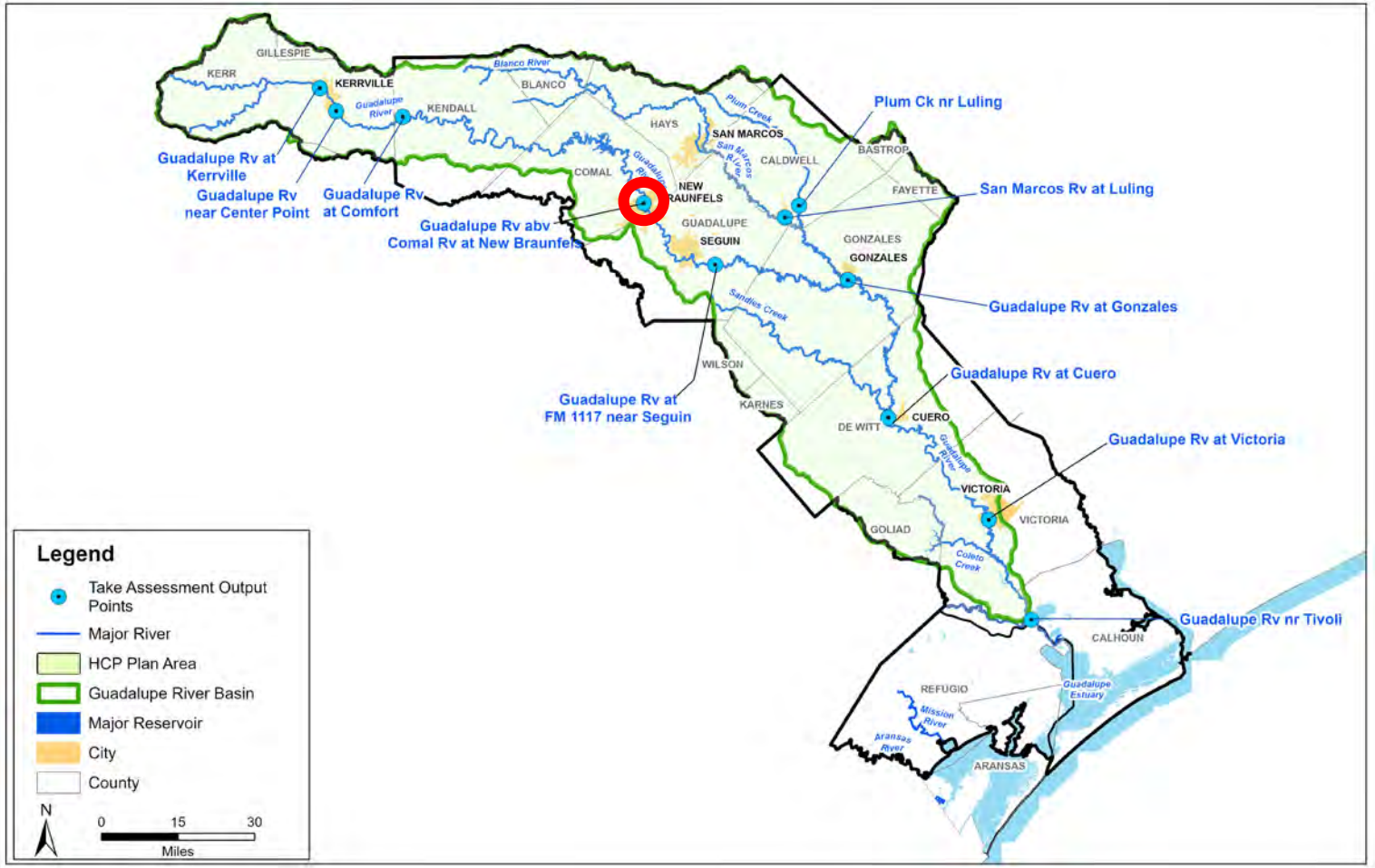
Guadalupe River above Comal River at New Braunfels

Upstream Covered Activities

- Canyon Reservoir impoundment
- GBRA water diversion from Canyon Reservoir
- GBRA releases of contract water from Canyon for downstream customers

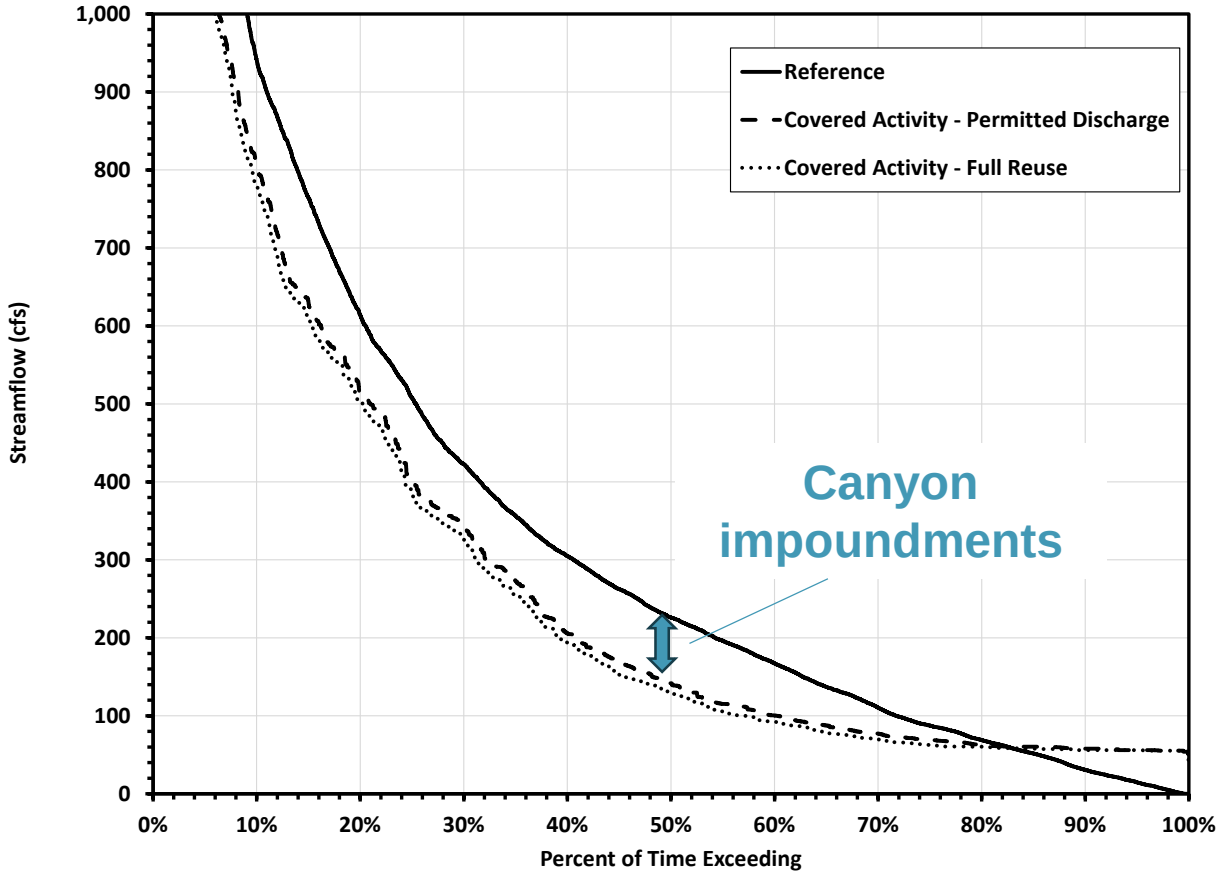
Key Streamflow Observations

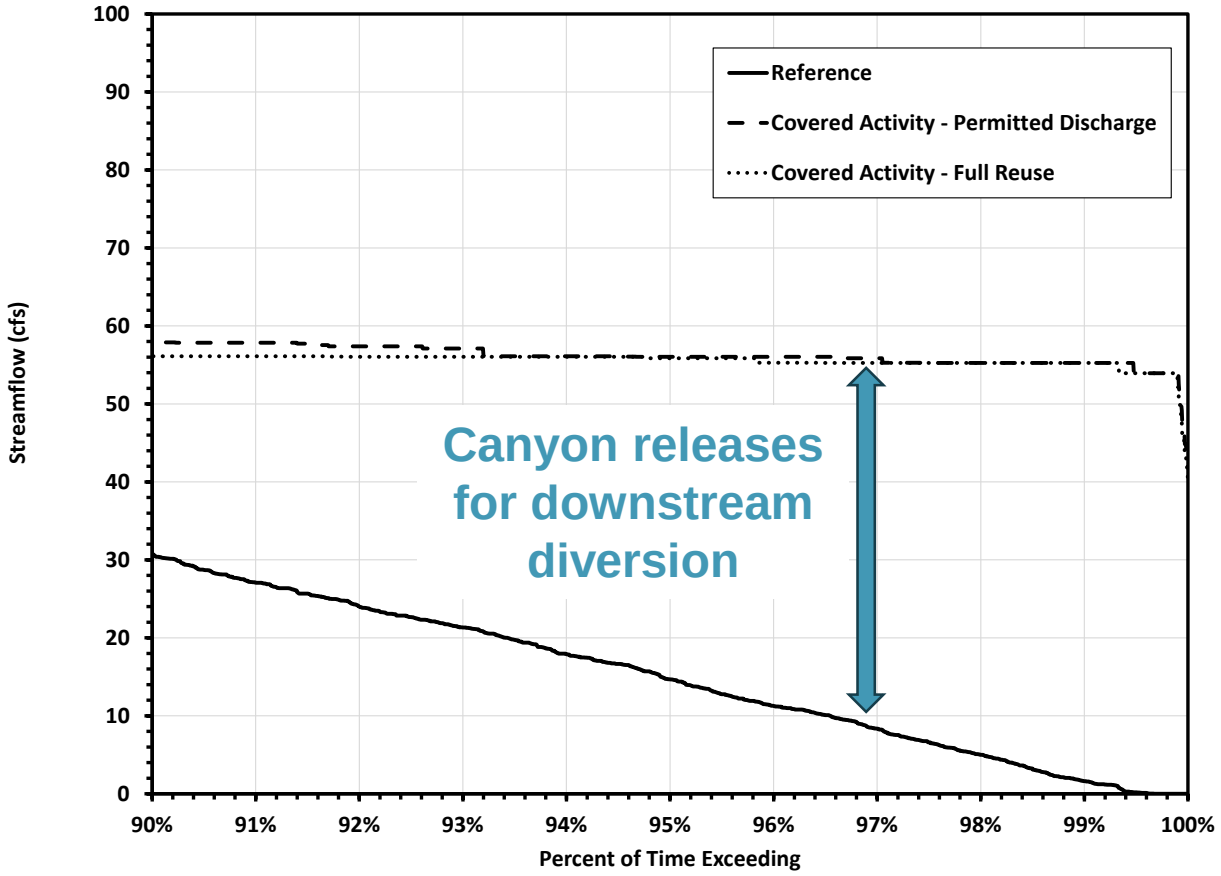
- Canyon Reservoir operations drive flow changes for full flow range under Covered Activities scenarios



PRELIMINARY

Guadalupe River above Comal River at New Braunfels





PRELIMINARY

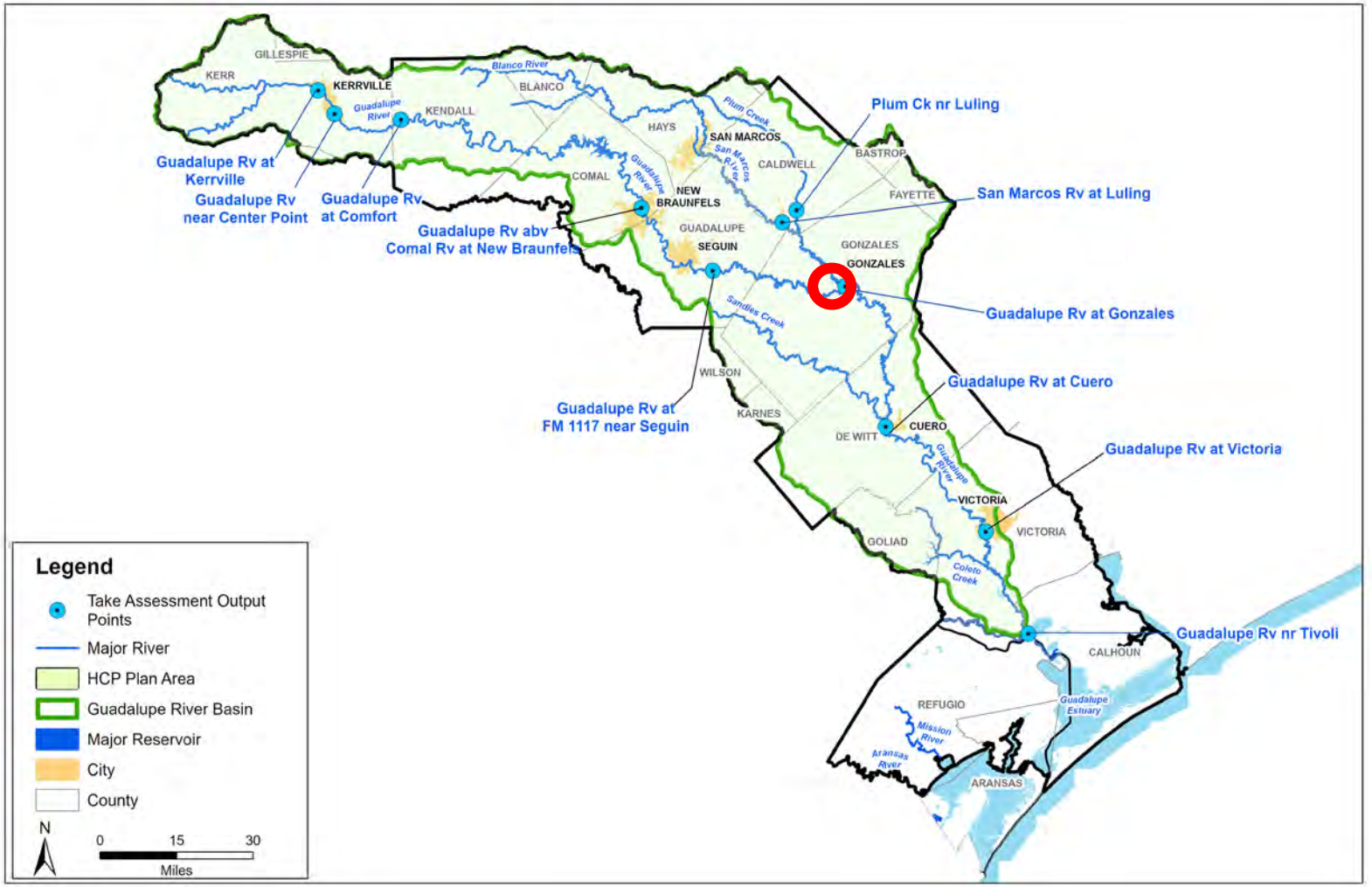
Guadalupe River at Gonzales

Upstream Covered Activities

- Second party impoundment and surface water diversion
- GBRA Mid-Basin water right water diversion

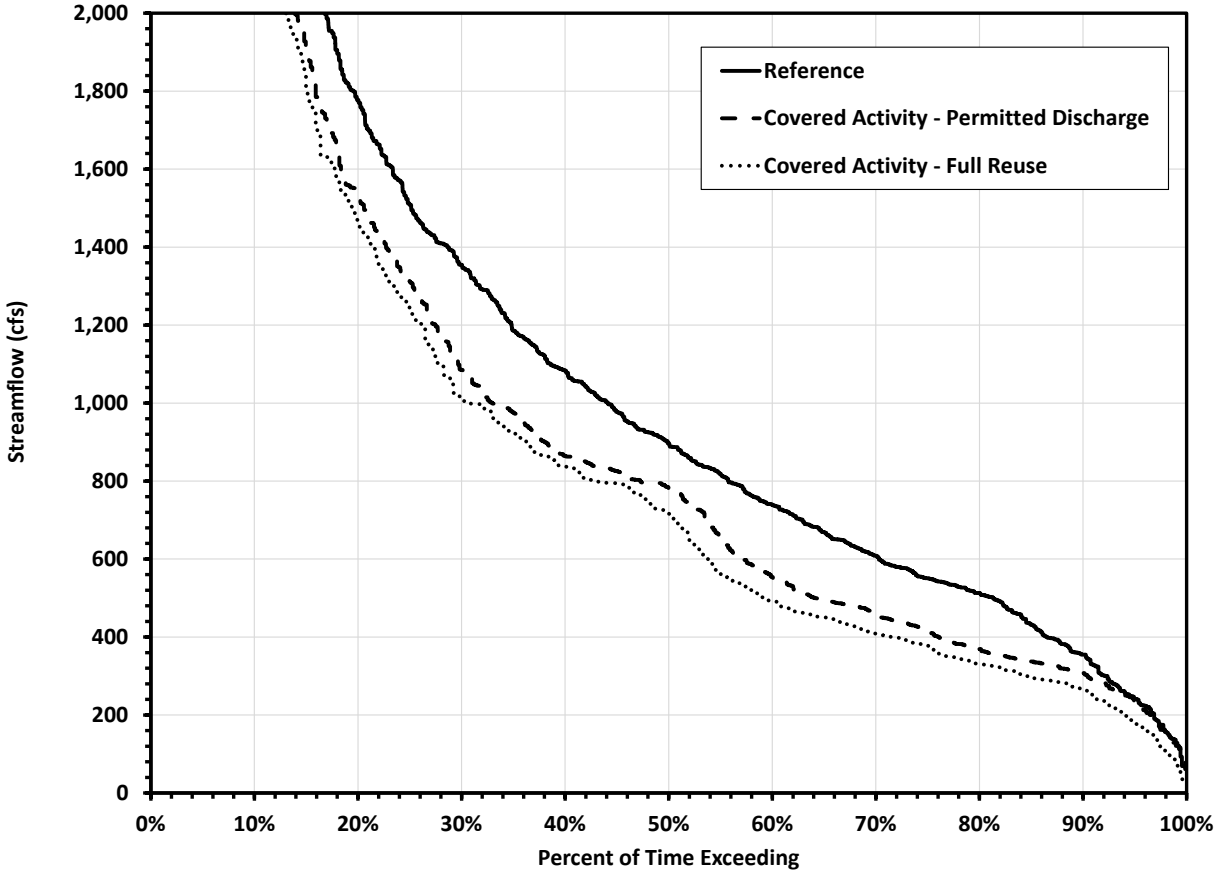
Key Streamflow Observations

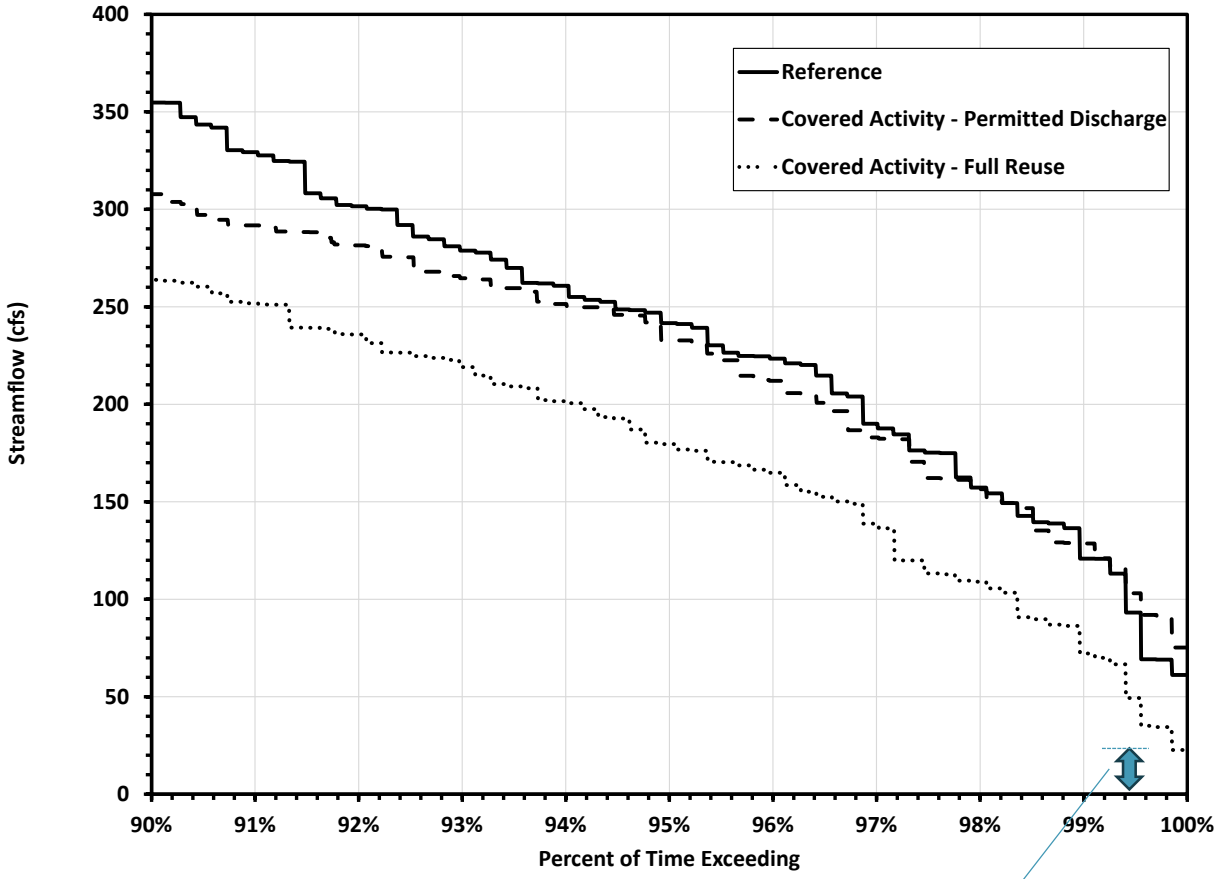
- Water use covered activities reduce full range of flows
- Canyon operations and Edwards springflows still influence streamflows, but effects are attenuated



PRELIMINARY

Guadalupe River at Gonzales





- GBRA and other lower basin senior calls for water
- Instream flow restrictions
- Edwards springflows
- Canyon releases

PRELIMINARY

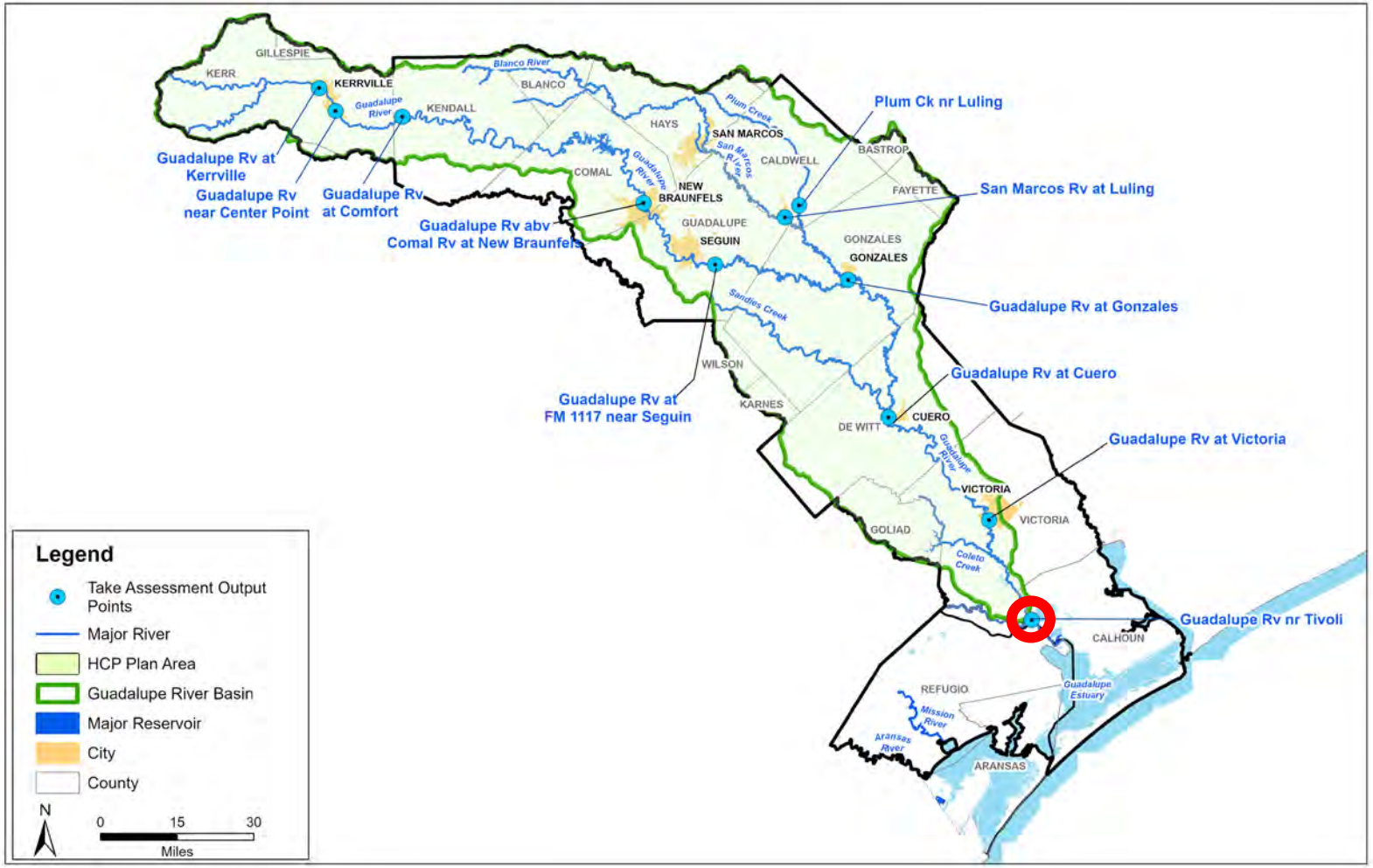
Guadalupe River near Tivoli (Saltwater Barrier)

Upstream Covered Activities

- Second party industrial water diversions
- Second party industrial and domestic wastewater discharges
- Coleto Creek Reservoir impoundment
- GBRA lower basin water diversion

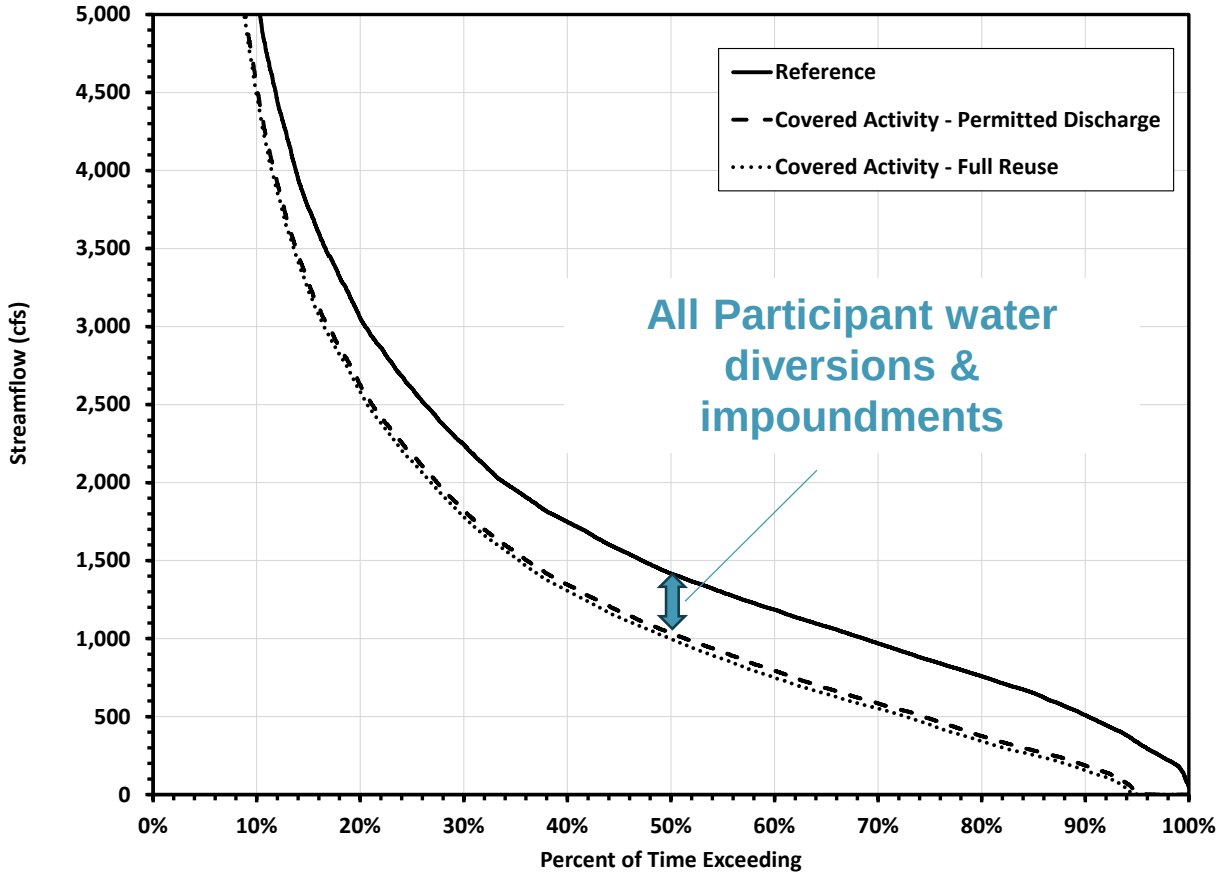
Key Streamflow Observations

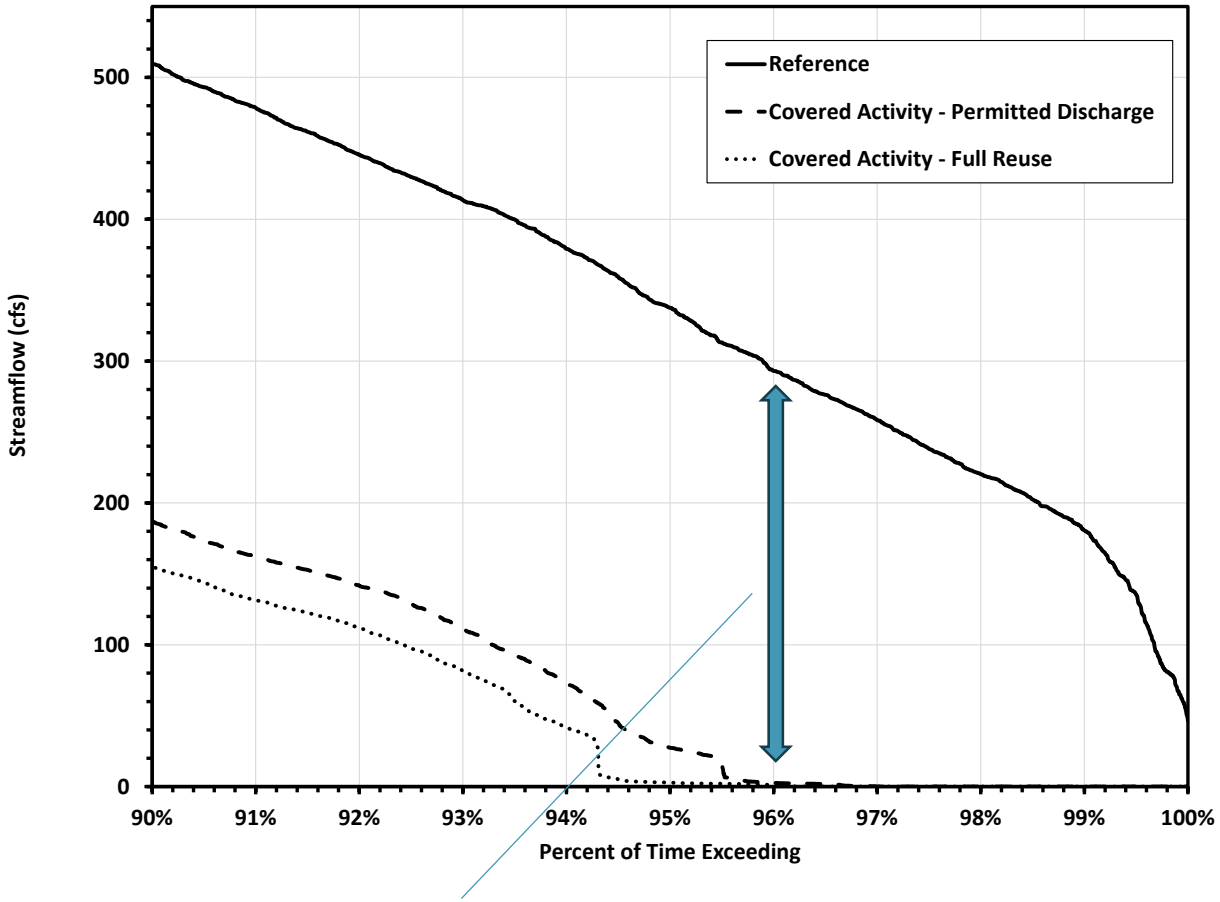
- Covered activities result in reduction in full flow range



PRELIMINARY

Guadalupe River near Tivoli (Saltwater Barrier)





PRELIMINARY

Water Quantity Modeling Summary

- Canyon Reservoir operations reduce mid and high flows in middle portion of basin
- Canyon Reservoir operations increase low flows in upper and middle portions of basin
- GBRA and other major lower basin water right holders' priority calls and their diversions help sustain drought flows in the mid and lower Guadalupe River Basin
- Participant water diversions and impoundments reduce flows at Saltwater Barrier
- Participant wastewater discharges increase flows at select locations in upper and mid portions of basin
- Water quantity modeling results are being used to inform take analysis

GRHCP Water Quality Modeling

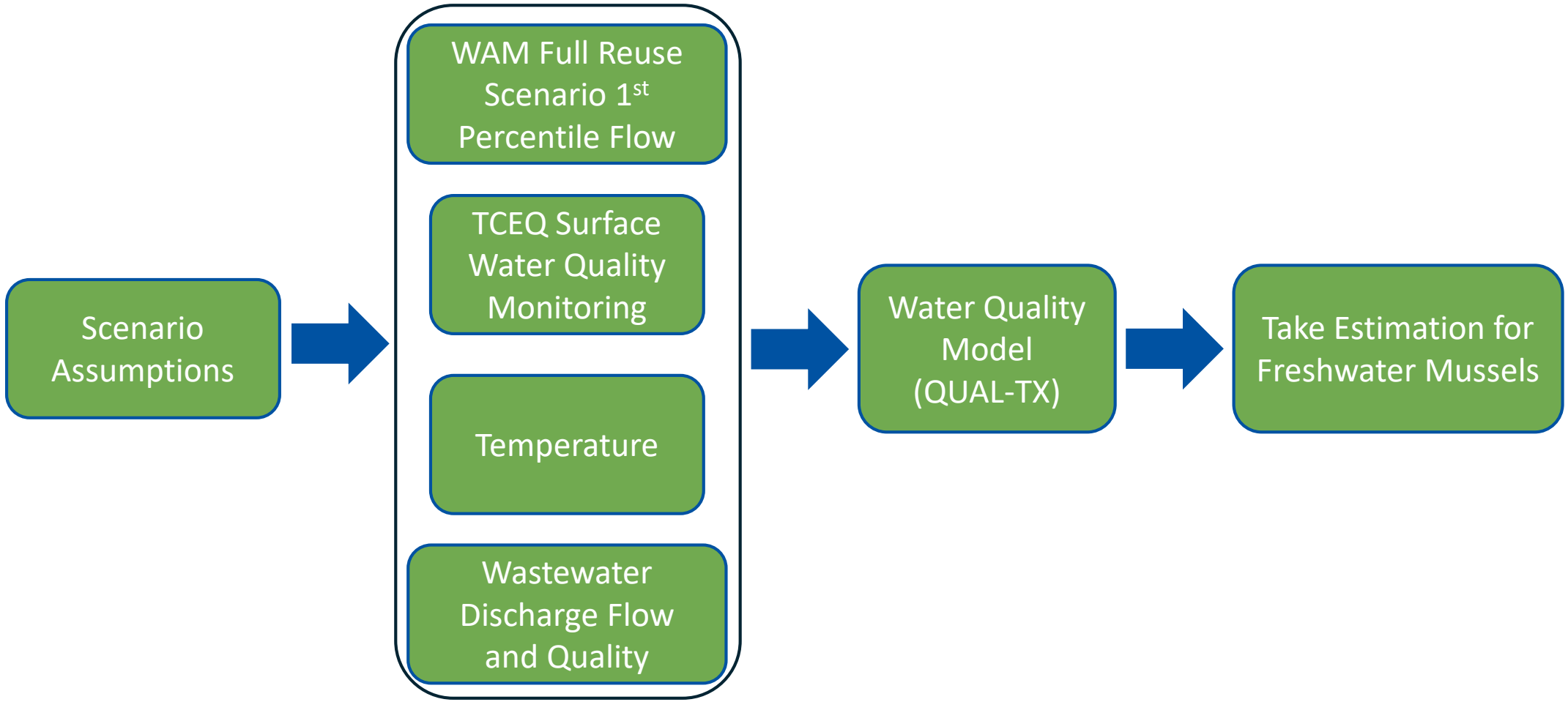
GRHCP Updated Water Quality Modeling Results

PLUMMER

Kristin Arnold, Project Manager

July 2024

Water Quality Modeling Overview



Water Quality Modeling Assumptions

- WAM Full Reuse Scenario 1st Percentile Flow
- TCEQ Surface Water Quality Monitoring
- Temperature
- Wastewater Discharge Flow and Quality

Table 1. Summary table of temperature regression equ.

Location	TCEQ Summer Months Only (May-Sep)		TCEQ Summer Months Only (May-Sep) with GBRA Thermistor Data	
	Regression Equation	R^2 Value	Regression Equation	R^2 Value
South Fork Guadalupe River at Hunt	y = -0.370ln(x) + 79.915	0.0099	y = -1.961ln(x) + 84.97	0.3304
Guadalupe River at Kerrville	y = -0.507ln(x) + 83.124	0.0099	y = -1.096ln(x) + 85.352	0.1189
Lower San Marcos River at Luling	y = -2.201ln(x) + 92.881	0.1982	y = -2.896ln(x) + 97.004	0.3933
Plum Creek near Luling	y = -1.161ln(x) + 81.526	0.2328	y = -1.928ln(x) + 85.386	0.3699
Guadalupe River at US183 in Hochheim downstream of USGS Guadalupe River at Gonzales gage (USGS 08173900)	y = -2.288ln(x) + 98.933	0.4411	y = -1.538ln(x) + 94.398	0.3115
Guadalupe River at FM 766 upstream of USGS Guadalupe River at Cuero gage (USGS 08175800)	y = -2.255ln(x) + 99.341	0.3285	y = -2.402ln(x) + 100.48	0.5258
Guadalupe River at FM 447 upstream of USGS Guadalupe River at Victoria gage (USGS 08176500)	y = -0.94ln(x) + 90.882	0.1247	y = -1.673ln(x) + 96.344	0.4126

Temperature is regression from thermistors/USGS streamflow data and WAM headwater flow + wastewater flow

ECHO Enforcement and Compliance History Online

Effluent flow & quality:

- Permitted flow & quality for covered activities
- Median flow & quality from existing data for other entities

In the event, that there is no permitted NH3-N limit, a value of 12 mg/L was assumed.

Temperature-Flow Relationships

Data Sources

- **TCEQ Surface Water Quality Monitoring Database**
  - Periodic historical data
- **GBRA Thermistor Data (Summer 2023)**
  - 15-minute interval data
  - One interval recording selected per day for consistency with TCEQ database sampling
- **USGS Streamflow Data**
  - Used to fill missing streamflow measurements in the TCEQ and USGS data

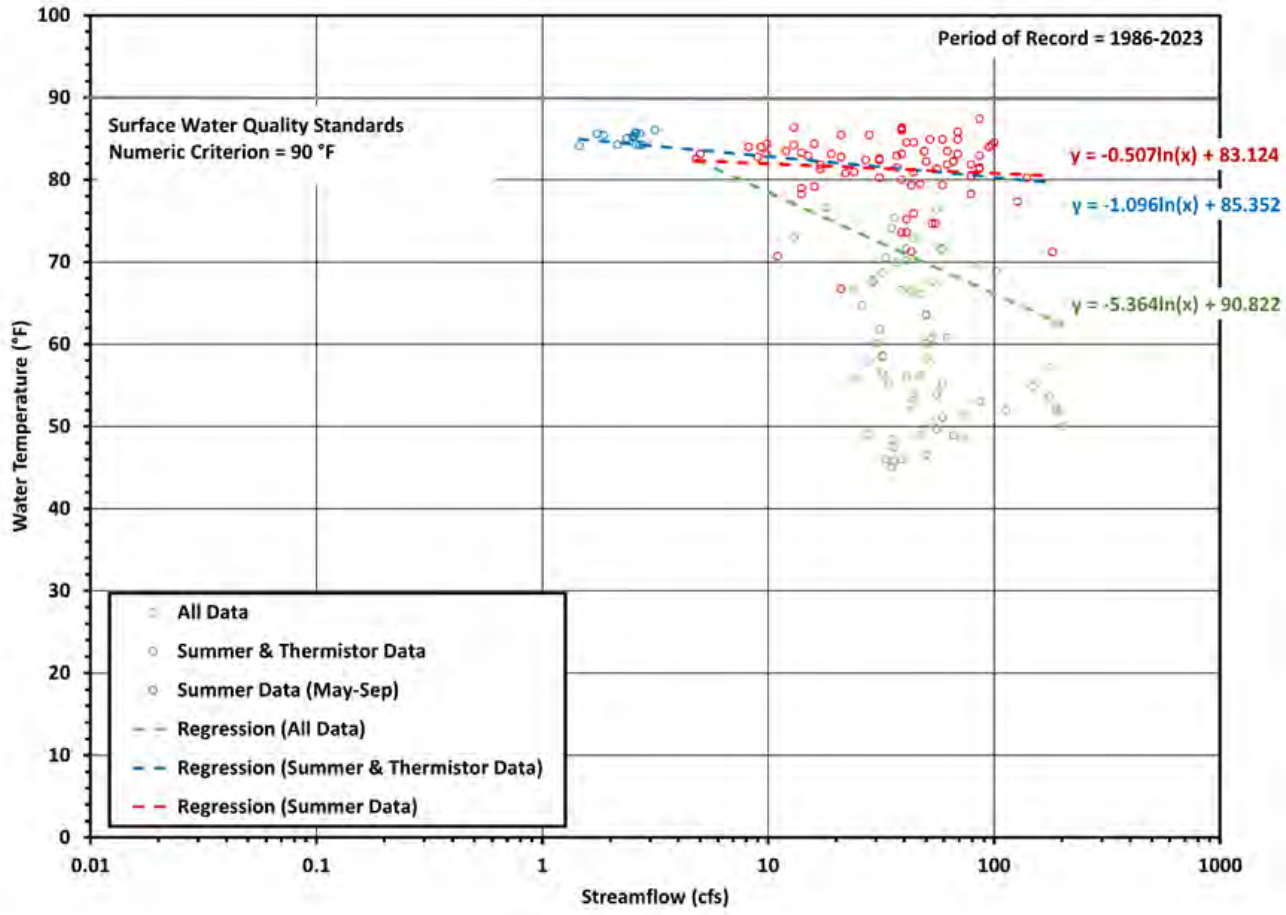
Temperature-Flow Relationships

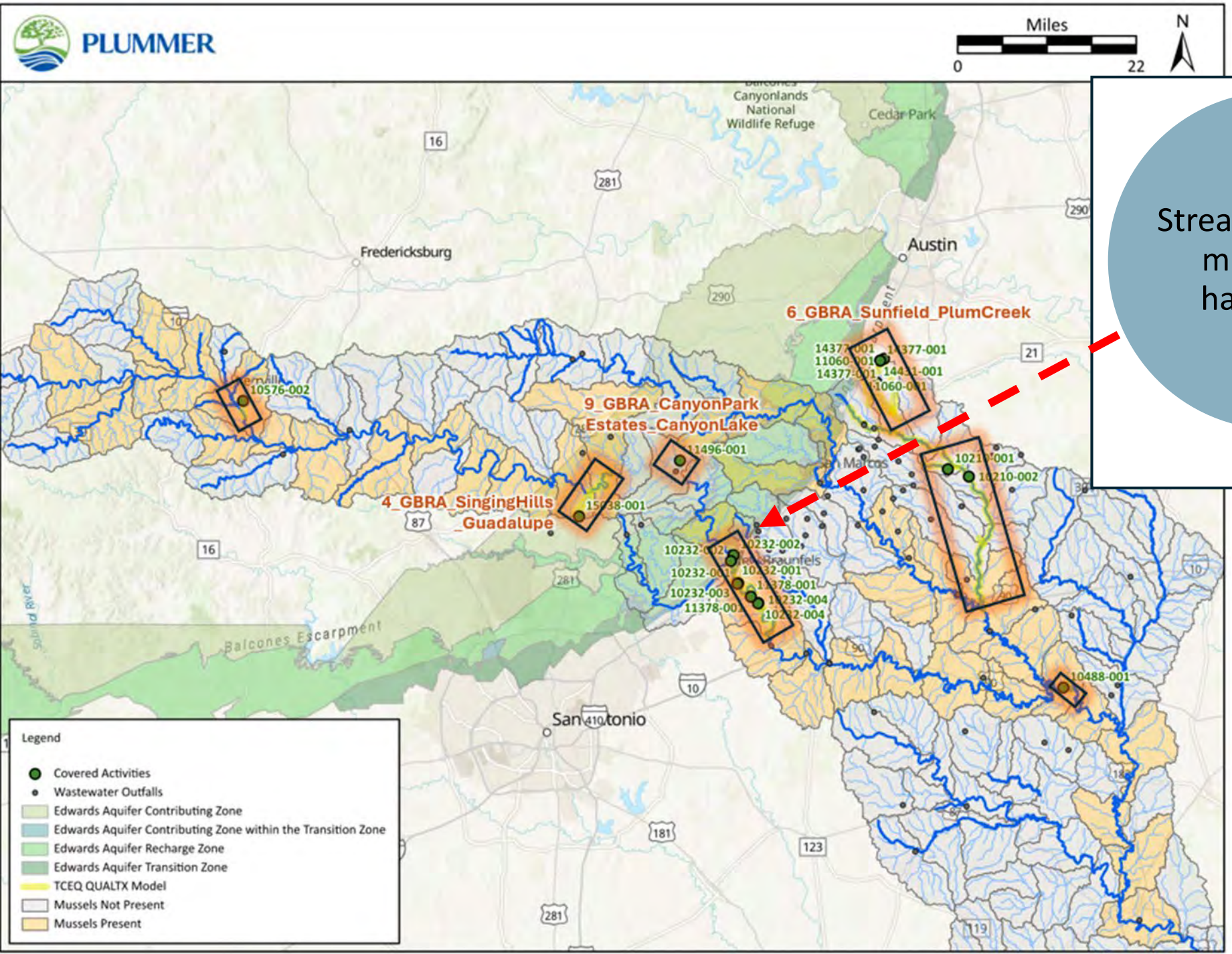
- **Log-linear regressions developed at selected output locations**

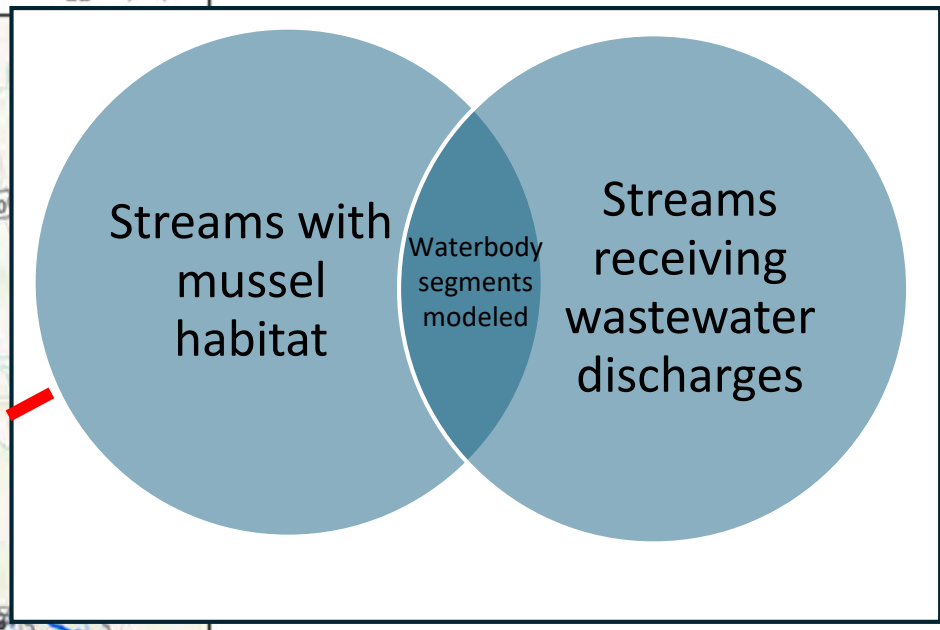
- **Locations**

1. South Fork Guadalupe River at Hunt
2. Guadalupe River at Kerrville
3. Guadalupe River near Center Point
4. Guadalupe River above Comal River at New Braunfels
5. Guadalupe River at FM 1117 near Seguin
6. Lower San Marcos River at Luling
7. Plum Creek near Luling
8. Guadalupe River at US183 in Hochheim downstream of USGS Guadalupe River at Gonzales gage (USGS 08173900)
9. Guadalupe River at FM 766 upstream of USGS Guadalupe River at Cuero gage (USGS 08175800)

USGS Gaging Station #08166200







Streams that have mussel habitat & are impacted by Covered Activities wastewater treatment plants can be evaluated with TCEQ QUAL-TX models.

Scenarios

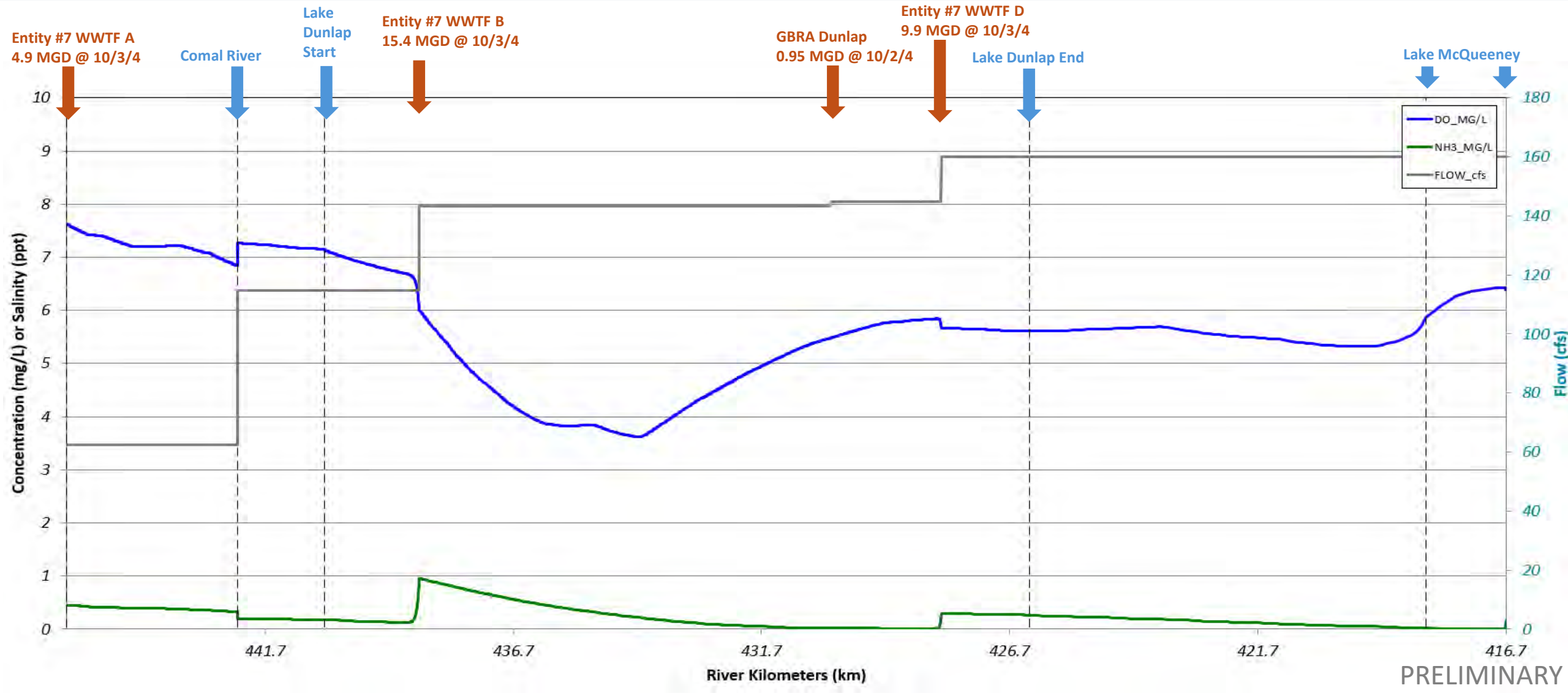
Note: No QUAL-TX modeling conducted for Full Reuse Scenario

Scenario	Scenario Purpose	Covered Activities (GBRA and 2nd Parties)	Other Entities
2a: Full discharge, full use of water rights	Impact analysis reference point for max water *quality* effects	Full Permitted	Current based on EPA ECHO
2c: Full reuse, full use of water rights	Impact analysis reference point for max water *quantity* effects	No (100% Reuse)	N/A

2_Dunlap_Guadalupe

Scenario	Entity	Facility Name	TPDES Permit	WAM Headwater Flow (cfs)	Headwater Quality (mg/L CBOD5/NH3-N/DO)	Model Temperature (deg C)	Effluent Flow (MGD)	Effluent Quality (mg/L) CBOD5/ NH3-N/DO)
Full Discharge	#7	A	1	55	1.3/0.1/8.12	25.8	15.4	10/3/4
	#7	B	2				4.9	10/3/4
	#7	C	3				3.1	10/-/5
	#7	D	4				9.9	10/3/4
	GBRA	Dunlap WWTF	WQ0011378001				0.95	10/2/4
Full Reuse	No Quality Modeling Required							

2_Dunlap_Guadalupe



PRELIMINARY

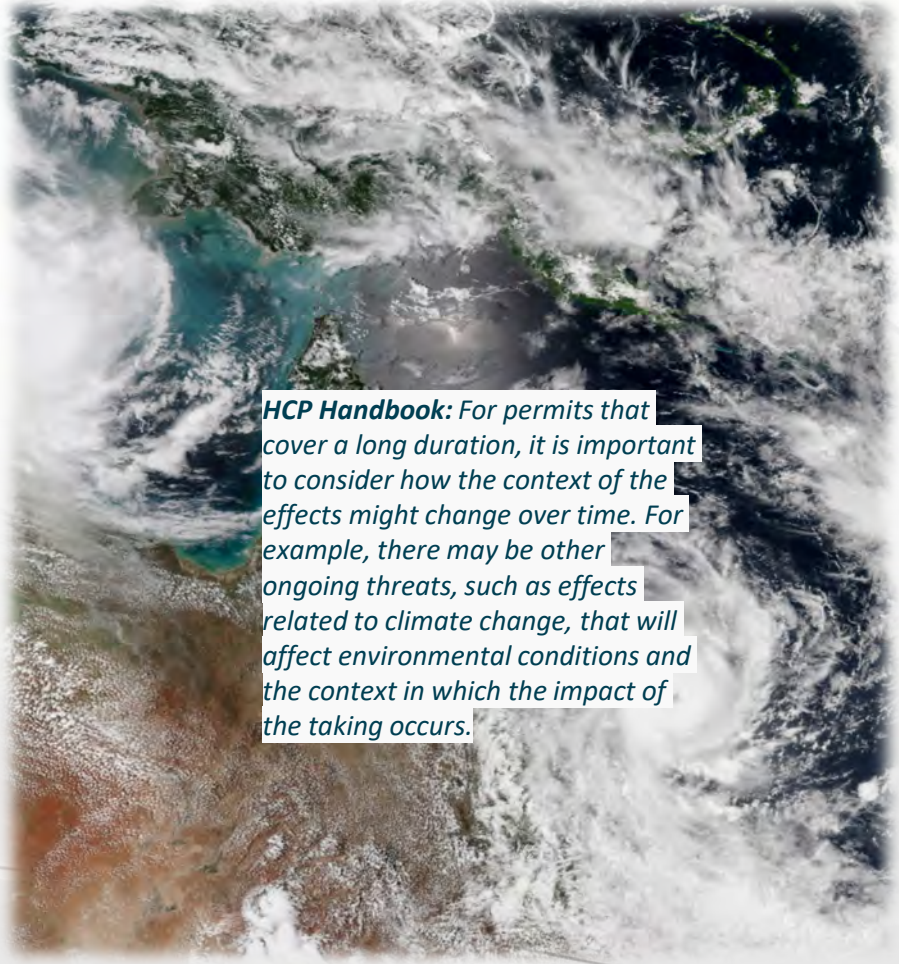
Water Quality Modeling Summary

- First percentile ambient flow and GBRA/Second Party Participant permitted wastewater discharge assumptions are main drivers of this approach.
- Key areas investigated include locations where existing QUAL-TX models have been developed and mussel habitat has been identified.
    - Upper Plum Creek watershed was modeled but does not have overlap with covered species mussel habitat.
    - Lake Dunlap has the lowest predicted dissolved oxygen.
- Modeling results generally show when wastewater discharges enter the system, dissolved oxygen decreases, and ammonia-nitrogen increases until the wasteload is assimilated and begins to recover over time and distance.
- Water quality modeling results and thresholds for ammonia, dissolved oxygen, and temperature will be used to analyze the effects on covered species from treated water discharge.
- Ongoing analysis of other potential parameters for which there is no yet known impact mechanism

Approach to Climate Change

Climate Change: Introduction

- HCPs and Climate Change:
  - To meet issuance criteria, USFWS must assess the impact of the taking with consideration of likely future changes due to climate change or other causes.
    - No specific requirements on how to assess climate change
- GRHCP Focus:
  - Analyzing potential effects of climate change on covered species
  - Consider climate change effects in changed circumstances



Guidance for Assessing Effects to Covered Species

- The HOW of the GRHCP approach to addressing climate change
- Focus: stressors affecting covered species and their habitats:
  - What are the climate variables covered species are sensitive to?
  - How might climate variables change in future climates?
  - Will these changes have indirect effects that are important to covered species?

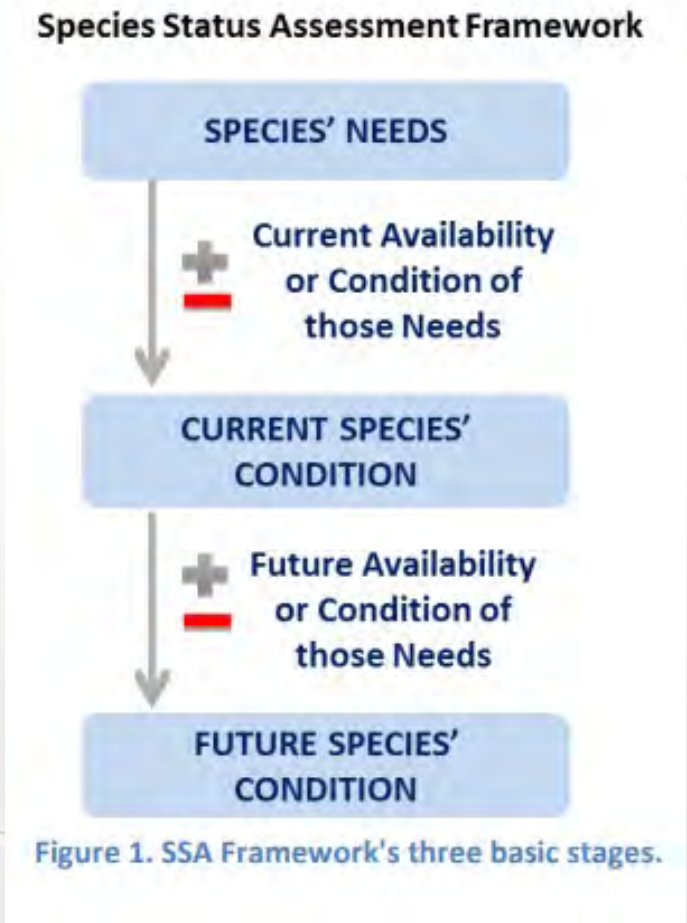


Figure 1. SSA Framework's three basic stages.

Changed Circumstances

- Changed Circumstances = Changes affecting species or geographic area covered in a plan that can be reasonably anticipated by plan developers and USFWS. **What climate effects can be reasonably anticipated and impact species' needs?**
- How changed circumstances are described in the HCP:
  - An HCP defines changed circumstances and remedial measures and assures funding
  - The changed circumstances provision in the HCP needs to consider:
    - Species range shift
    - Increase probability of catastrophic event that adversely affect species or conservation measures
- Changed circumstances vs. unforeseen circumstances:
  - Unforeseen circumstances: changes affecting species or geographic area covered in a plan that could not be reasonably anticipated
    - For unforeseen circumstances, a permittee is not required to implement remedial measures

What Climate Variables are Covered Species Sensitive To?

- Temperature and Precipitation
- Sea Level Rise
- Extreme Events
  - Drought
  - Flood
  - Storm surges
  - Winter storms

Approach to Addressing Climate Variables in the HCP

- Identify current trends using available data
- Assess potential future conditions: what can be reasonably anticipated (changed circumstance)
  - YES: future species condition, conservation strategy resiliency, changed circumstances
  - No: monitoring conditions, unforeseen circumstances

Current Trends: Temperature in South Central Texas (TX-07)

- Historical climate data from 1895 available through:
  - Southern Regional Climate Center (https://www.srcc.tamu.edu/)
  - NOAA's National Centers for Environmental information (https://www.ncei.noaa.gov)
- Temperatures in Texas have risen almost 1.5˚F since the beginning of the 20th century

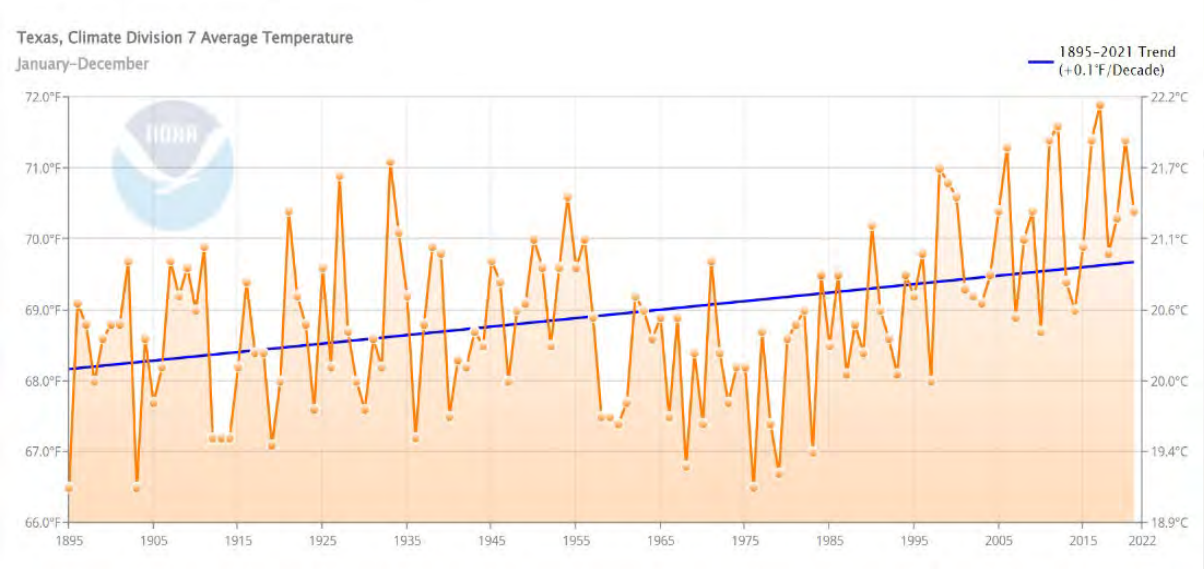


Figure 2. Sample analysis of annual average temperature data for the South Central Climate Division (Division 7, 1895-2021); https:www.ncei.noaa.gov

Current Trends: Precipitation in South Central Texas (TX-07)

- Historical climate data from 1895 available through:
  - Southern Regional Climate Center (https://www.srcc.tamu.edu/)
  - NOAA's National Centers for Environmental information (https://www.ncei.noaa.gov)
- The 1950s Drought of Record continues to be used as the worst-case scenario for water-resources planning.
- Precipitation in this region is highly variable.

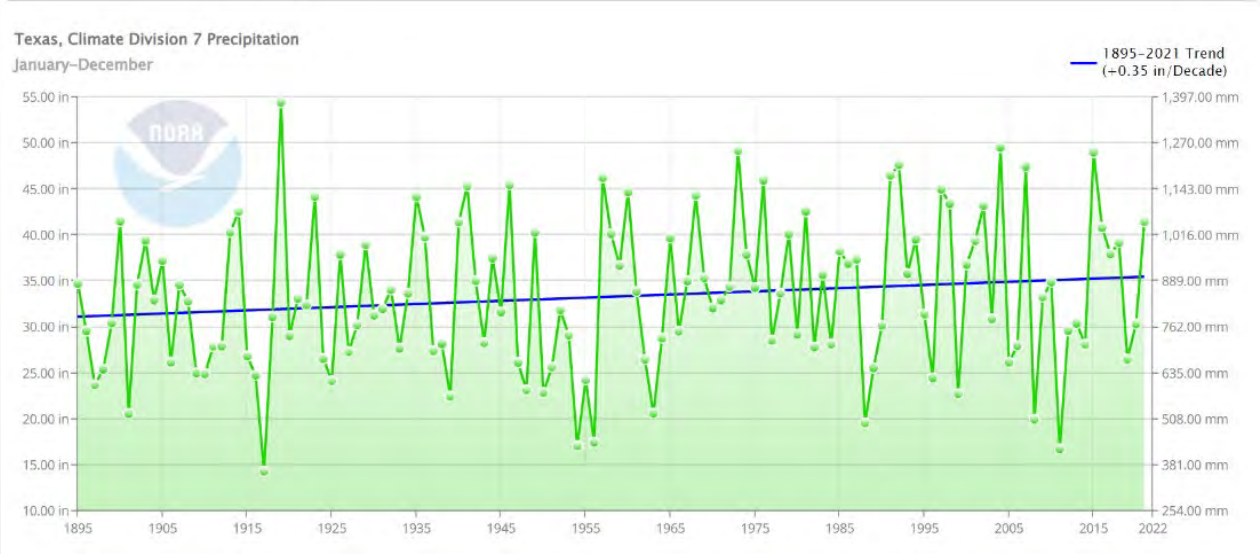
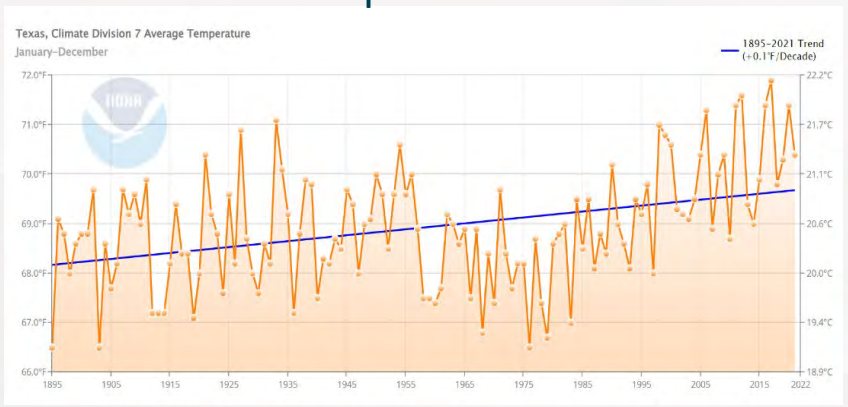


Figure 2. Sample analysis of annual average temperature data for the South Central Climate Division (Division 7, 1895-2021); https:www.ncei.noaa.gov

What climatic variables are covered species sensitive to?

- Mussels and Guadalupe Darter

Increased air temperature



Increased frequency of hot summers → Increased water temperature → Loss of habitat

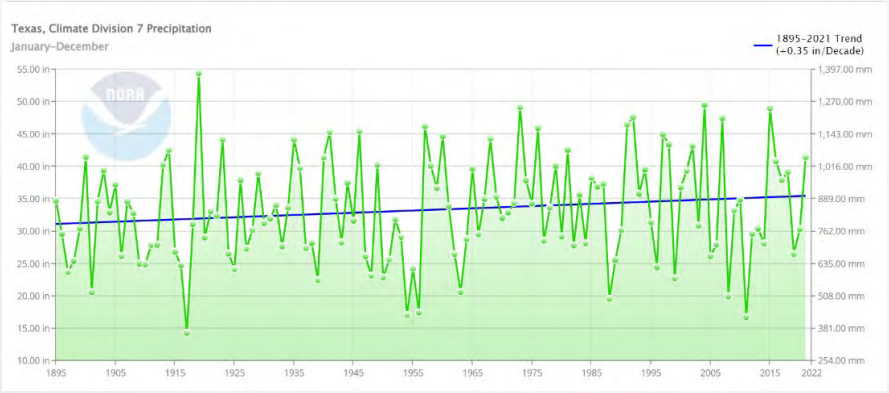
Increased water temperature → Mortality

Increased evaporation → Decreased streamflow → Loss of habitat

What climatic variables are covered species sensitive to?

- Mussels and Guadalupe Darter

Uncertain trend in precipitation
Increased variability?



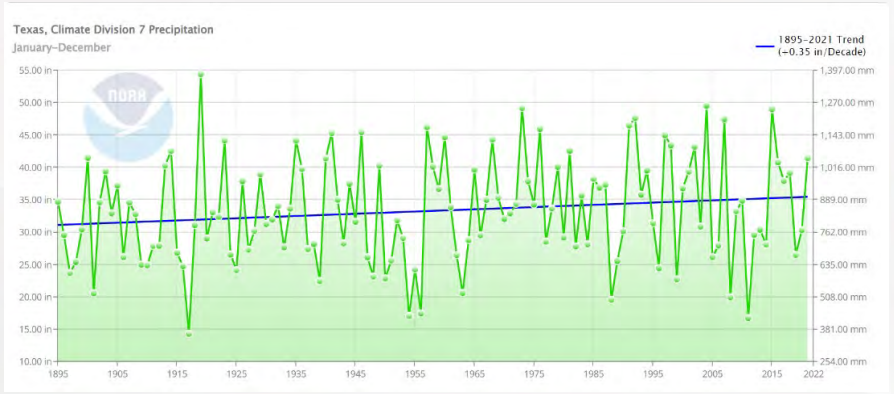
Increased magnitude of flooding?
- Loss of habitat
- Mortality

Increased frequency, duration, and magnitude of drought conditions?
- Loss of habitat
- Mortality

What climatic variables are covered species sensitive to?

- Coastal birds

Uncertain trend in precipitation
Increased variability?



Increased magnitude of flooding?
- Loss of habitat
- Mortality

Increased frequency, duration, and magnitude of drought conditions?
- Decreased food/water availability
  - Mortality
  - Decreased productivity
- Loss of habitat

Tools for Projecting Temperature and Precipitation

- Global Climate Models (GCMs)
- Many downscaling methods exist for future climate datasets (LOCA2[1], NEX-GDDP[2], STAR-ESDM[3], etc.)
- LOCA2 Dataset
  - Incorporates data from CMIP6[4] GCMs
  - Widely-used, peer-reviewed source applied in authoritative assessments such as the 5th National Climate Assessment
  - Sophisticated and robust downscaling method
  - ¼ degree (~6 km) grid resolution
  - Many (23+) shared ensemble members across multiple SSPs
  - Future climate is uncertain, and leveraging a full model ensemble creates a range of projections that allow for risk-based decision making.

1. LOCA2 = Localized Constructed Analogs Version 2
2. NEX-GDDP = NASA Earth Exchange Global Daily Downscaled Projections
3. STAR-ESDM = Seasonal Trends and Analysis of Residuals Empirical Statistical Downscaling Model
4. CMIP6 = Coupled Model Intercomparison Project Phase 6

Tools for Projecting Temperature and Precipitation

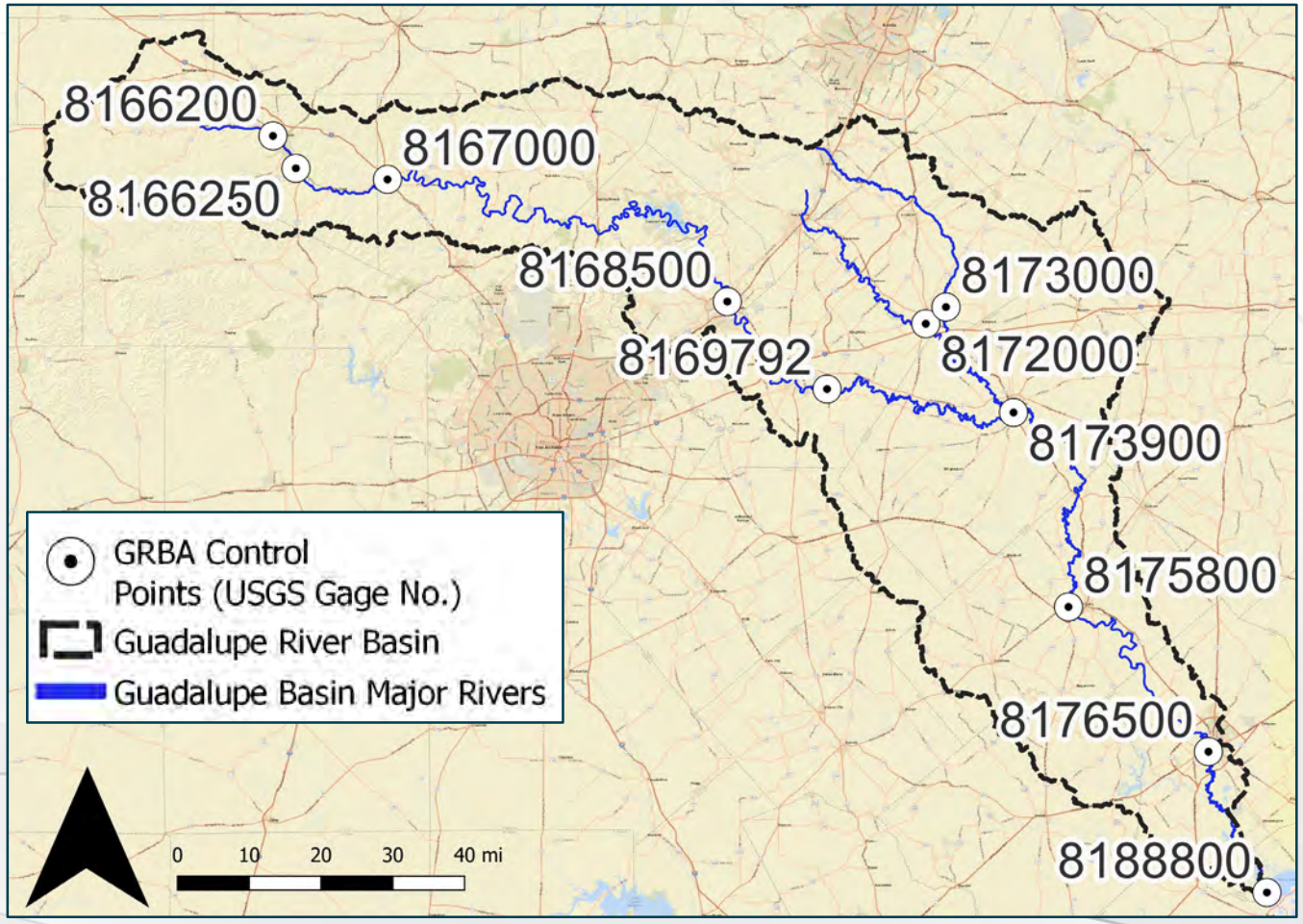
- Emissions scenarios for CMIP6 called “shared socioeconomic pathways”
  - SSP2-4.5 (additional radiative forcing of 4.5 W/m² by the year 2100)
    - Medium pathway for future greenhouse gas emissions
    - Assumes that climate protection measures are being taken
  - SSP5-8.5 (additional radiative forcing of 8.5 W/m² by the year 2100)
    - Upper boundary of the range of scenarios
    - Fossil-fueled development

- LOCA2 Dataset and SSP scenarios 2-4.5 and 5-8.5 for a time horizon of 2030-2080
  - Future climate is uncertain, and leveraging a full model ensemble creates a range of projections that allow for risk-based decision making
  - 2-4.5 more likely, 5-8.5 allowed consideration of “worst case”

SSP = Shared socioeconomic pathway

Tools for Projecting Temperature and Precipitation

- Monthly temperature and precipitation observations and future projections were developed for 11 control points across the Guadalupe River Basin.
- Projections use LOCA2[1] downscaled temperature and precipitation dataset for 23 climate models common across SSP2-4.5 and SSP5-8.5 (medium and high emissions scenarios) for the period 2020-2080.
- Observed data were synthesized from the historical reanalysis the LOCA2 training dataset, Livneh V2[2], and include temperature and precipitation data from 1950-2014.



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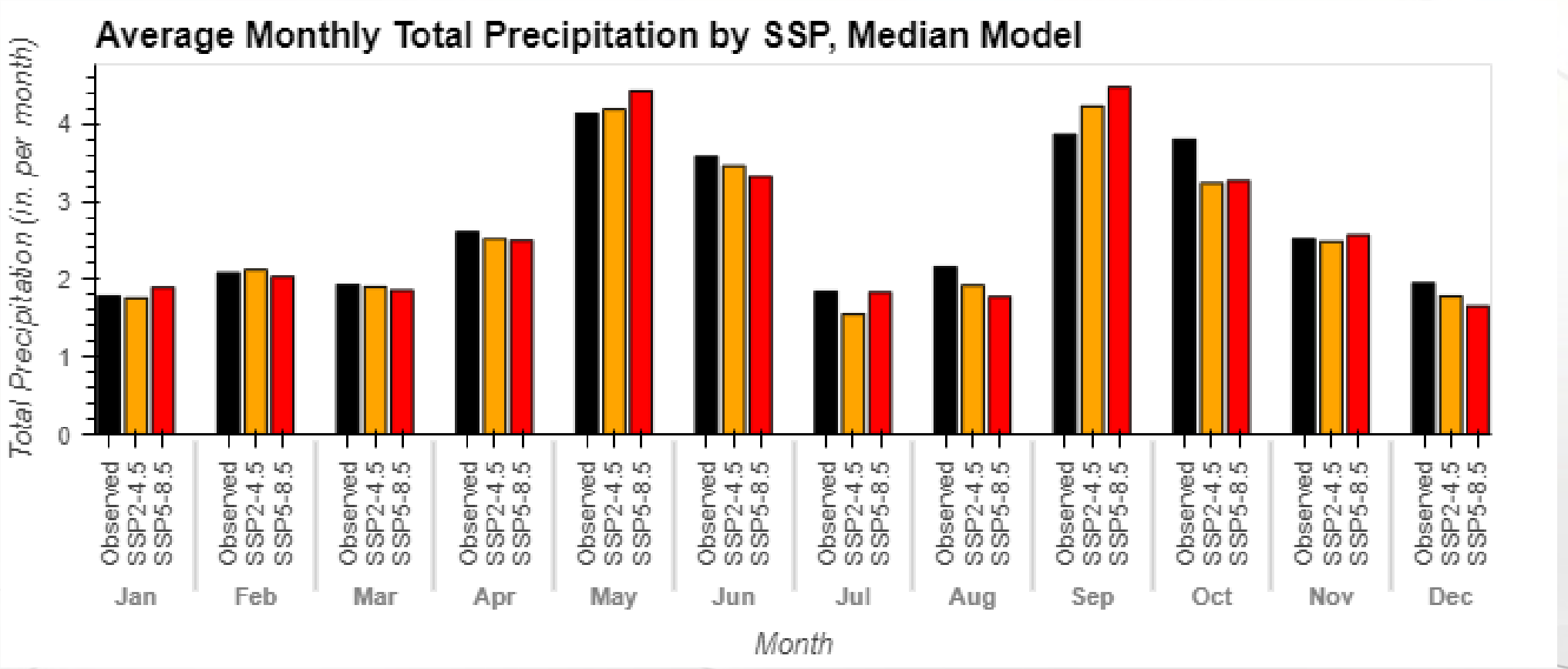
[1]Pierce, D. W., D. R. Cayan, D. R. Feldman, and M. D. Risser, 2023: Future Increases in North American Extreme Precipitation in CMIP6 downscaled with LOCA. J. Hydrometeor., https://doi.org/10.1175/JHM-D-22-0194.1, in press.

[2]Pierce, D. W., L. Su, D. R. Cayan, M. D. Risser, B. Livneh, and D. P. Lettenmaier, 2021: An Extreme-Preserving Long-Term Gridded Daily Precipitation Dataset for the Conterminous United States. J. Hydrometeor., 22, 1883–1895, https://doi.org/10.1175/JHM-D-20-0212.1.

Observed and Future Monthly Precipitation Trends

- Historically during the record of 1950-2014, precipitation totals by month follow a bi-modal distribution in the Guadalupe River Basin.
- Future projections for 2020-2080 for precipitation totals by month maintain a similar bi-modal distribution and indicate the potential for increased precipitation in the wettest historical months (May and September) and the potential for decreases in precipitation in the months of August, October, and December.



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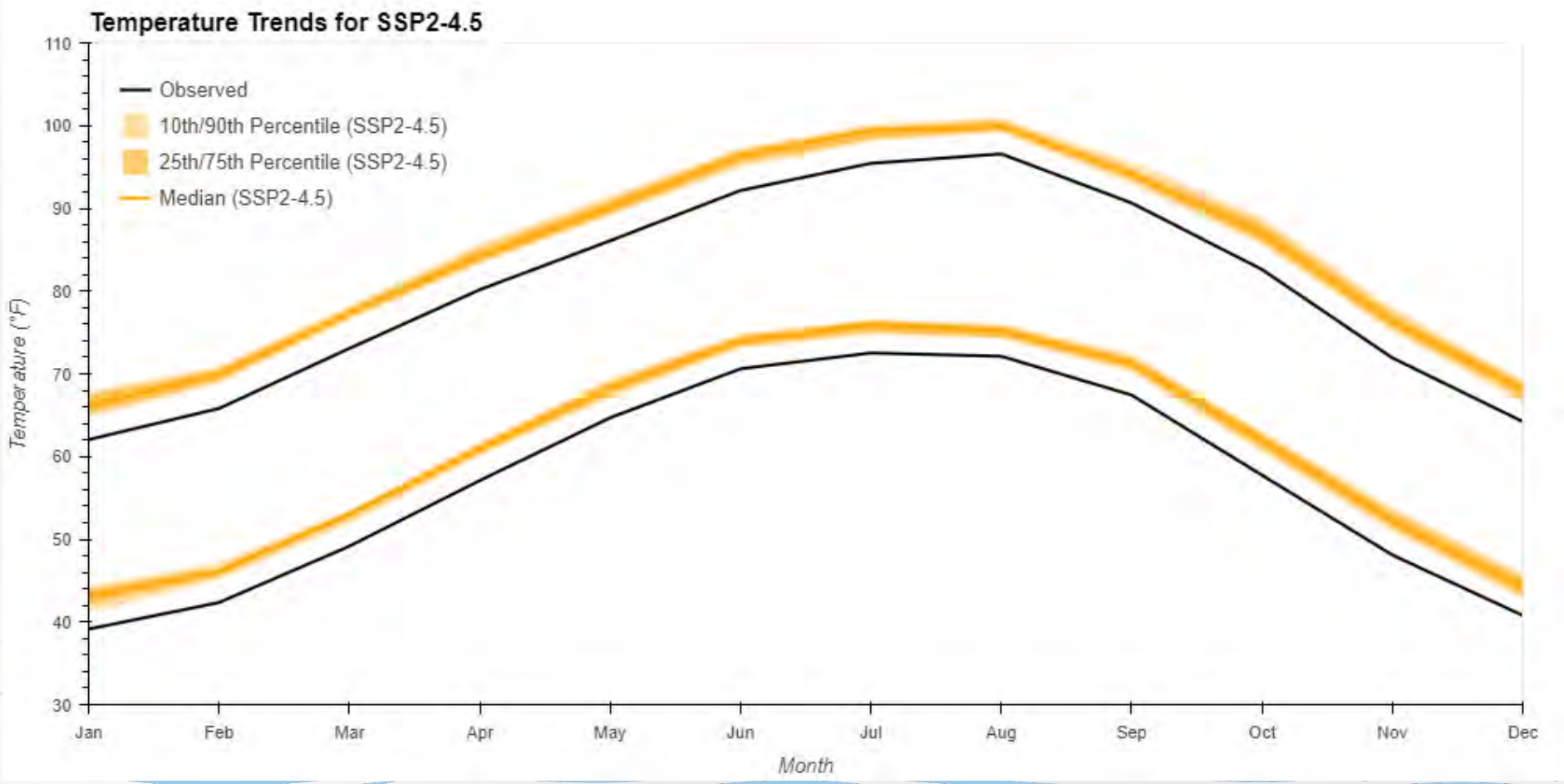
SSP2-4.5 Monthly Temperature Trends

- Future projections for 2020-2080 for monthly minimum and maximum temperature maintain a similar distribution across the year as compared to historical observations.
- The model percentiles and median model below show agreement on an increase in temperatures across all months during the period of 2020-2080. Future projections indicate the potential for an increase of approximately 4°F across all months of the year under SSP2-4.5.



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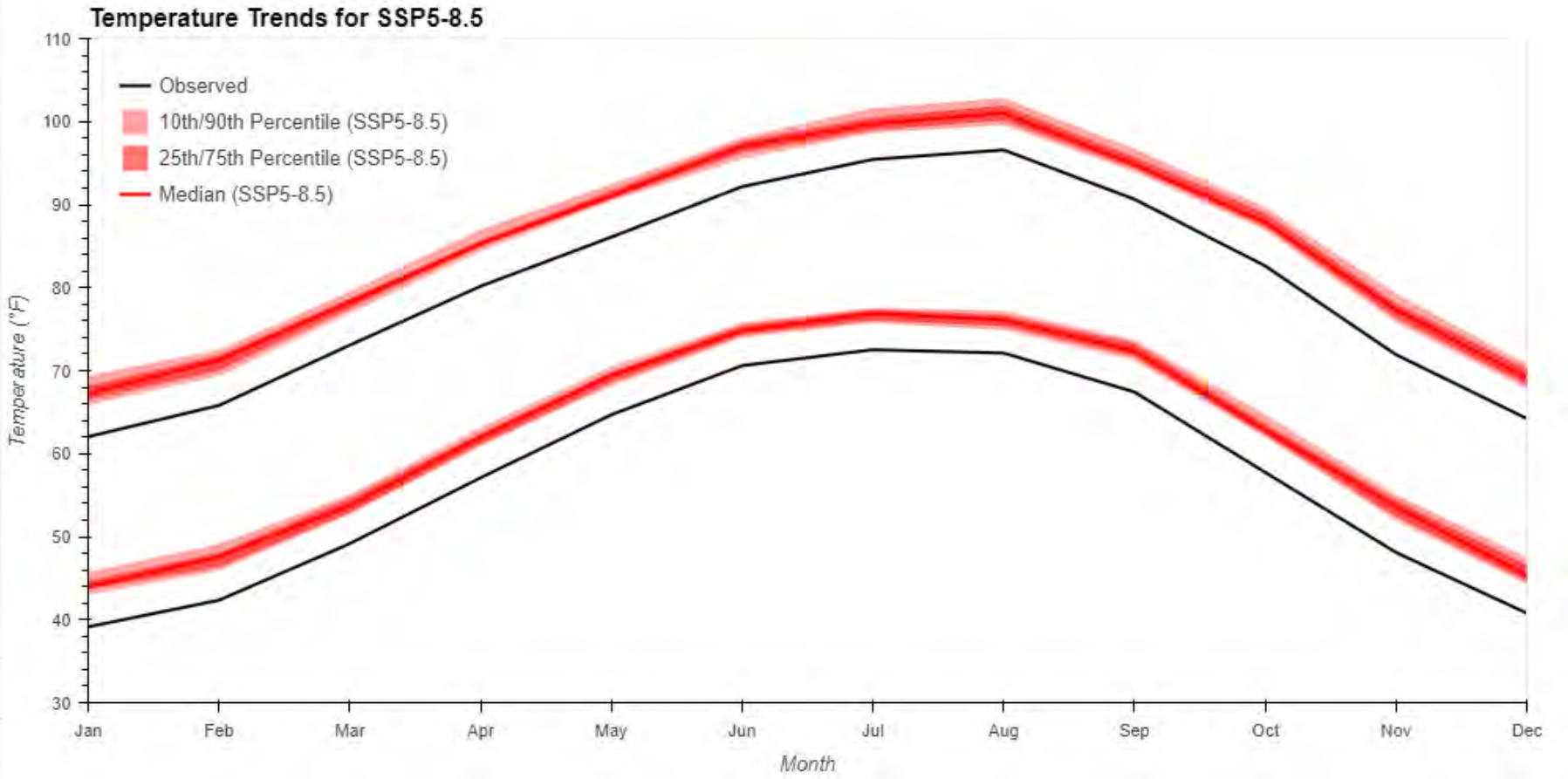
SSP5-8.5 Monthly Temperature Trends

- Future projections for 2020-2080 for minimum and maximum temperature by month maintain a similar distribution across the year as compared to historical observations.
- The model percentiles and median model below show agreement on an increase in temperatures across all months during the period of 2020-2080. Future projections indicate the potential for an increase of approximately 5-6°F across all months of the year under SSP5-8.5.



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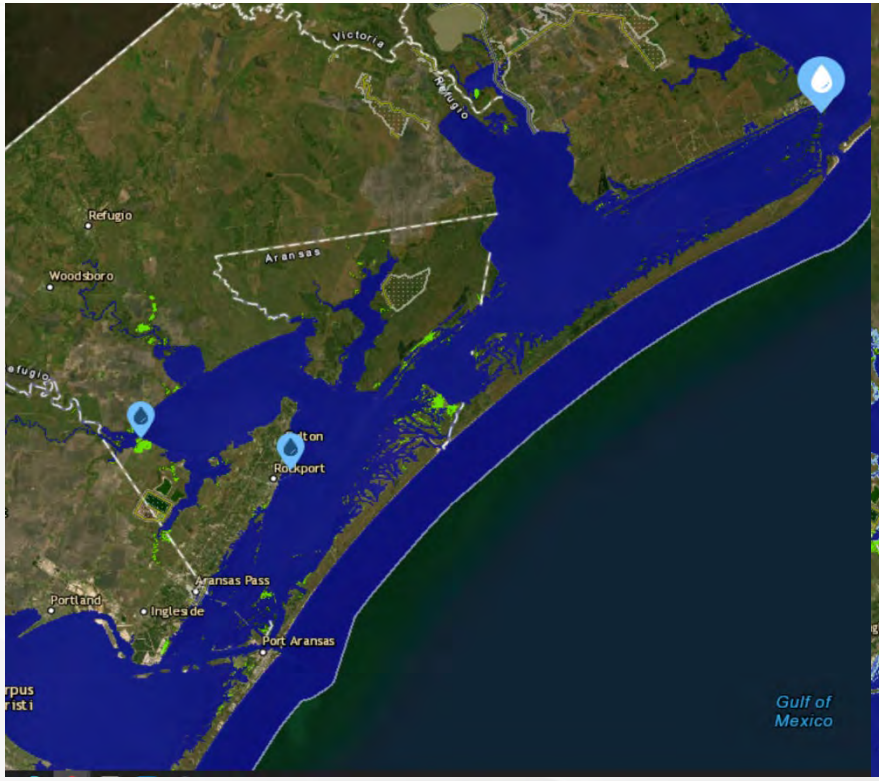
Results: Application

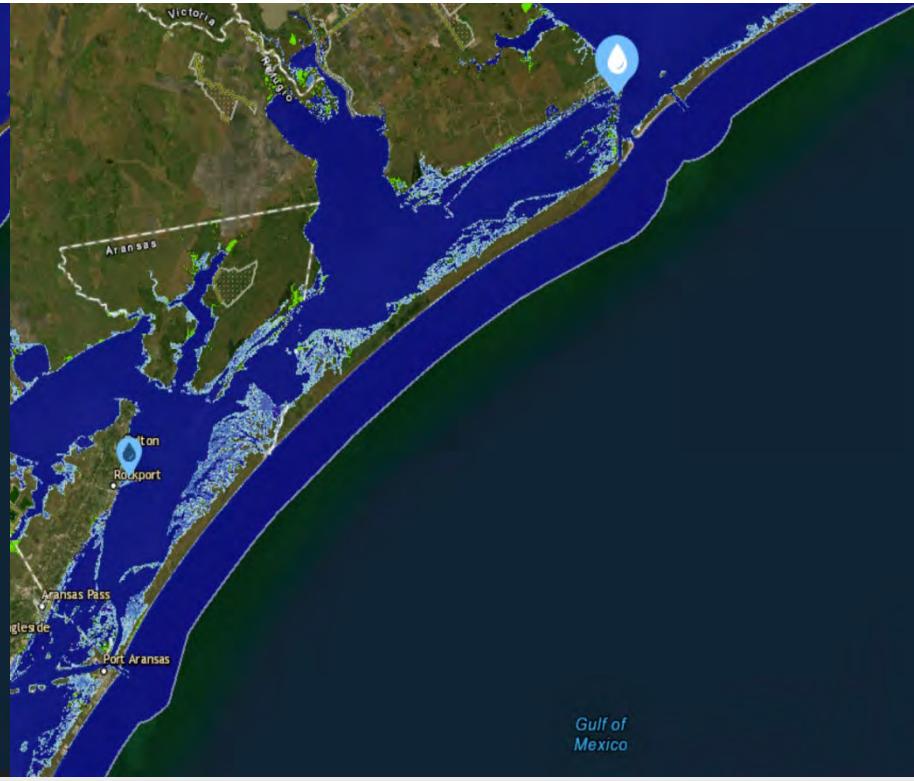
- Consider the *effect of increased temperature* on covered species
  - **Water quantity**: Increased evaporation affecting water quantity
  - **Water quality**: Water temperature thresholds for covered mussel species
  - **Food availability**: Blue crab availability for whooping crane

Projection: Sea Level Rise in the Plan Area

- NOAA 2022 Sea Level Rise Technical Report:
  - Texas coastline, including regions in the Plan area, could experience 10-12 inches of sea level rise by 2050.
  - Sea level rise viewer



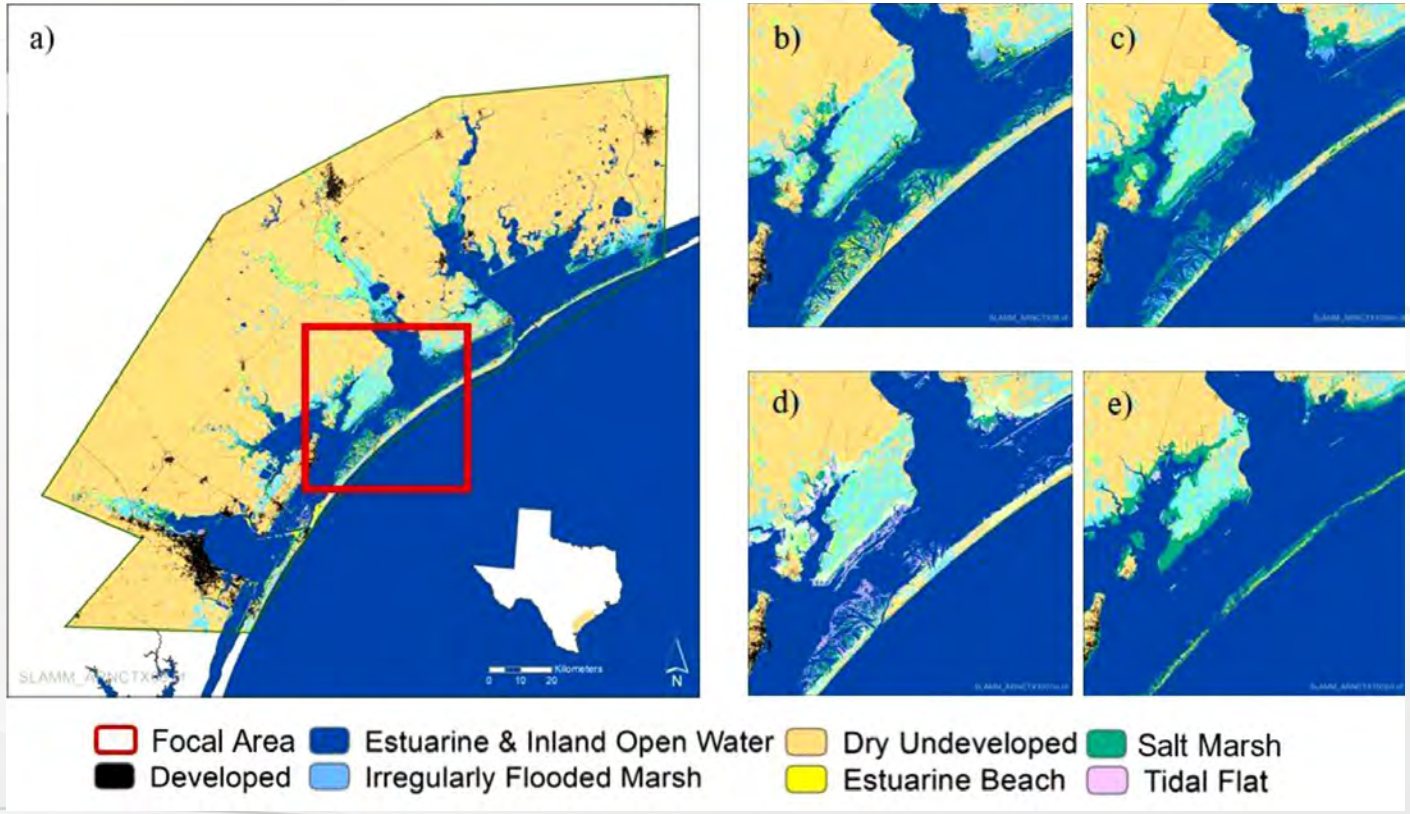
Current conditions of sea level along Texas coast within Plan area



Projected sea level rise of 12 inches by 2050

Analyzing effects from Sea Level Rise: Increase Resiliency of Conservation Strategy for Coastal Birds

- Resiliency of conservation strategy increased by identifying what effects should be considered
- Identify likely sea level rise assumptions based on best available information
  - 2022 NOAA Sea Level Rise Technical Report
  - "Identifying sustainable winter habitat for whooping cranes" (Metzger et al. 2020)
- Project impacts of sea level rise to eastern black rail and whooping crane habitat
- Consider in design of conservation measures, monitoring, and adaptive management



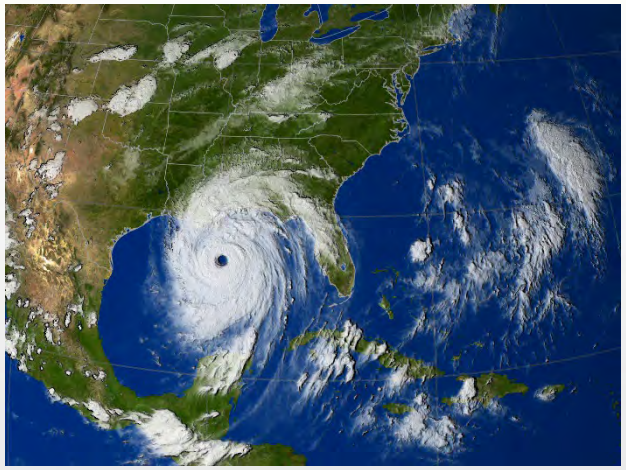
Source: Metzger et al. 2020

What extreme events are covered species sensitive to?

Drought

Flooding

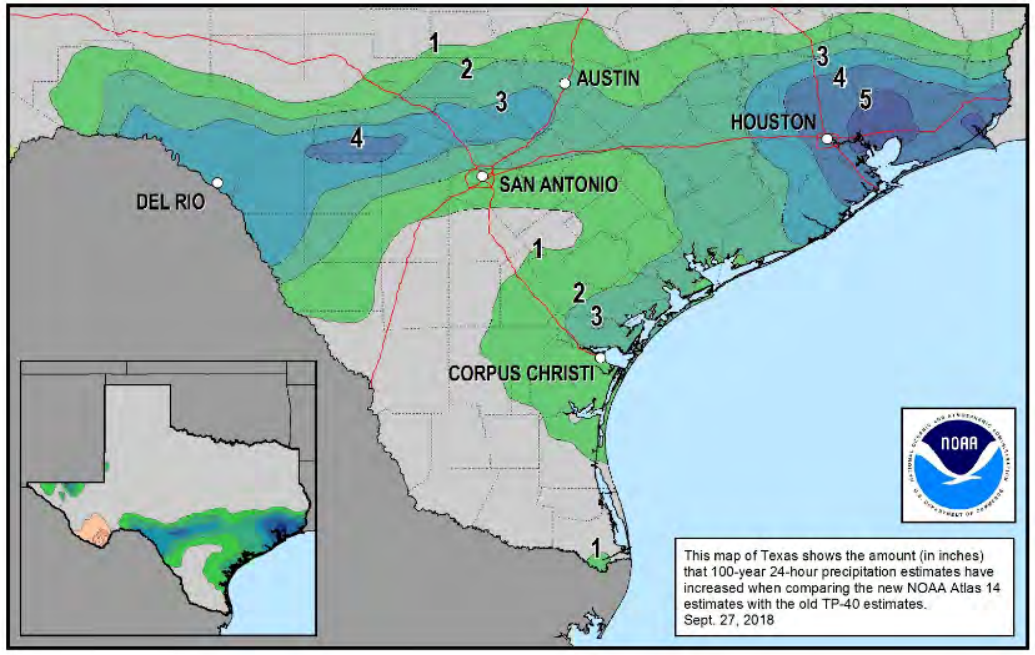
Storm Surge



Winter Storm

Current trends: Extreme events in south central Texas

- Drought:
  - Drought of Record: 1950-1956
  - Recurrence of severe prolonged drought in south central Texas is the norm, not the exception (Cleaveland et al. 2011)
- Flooding:
  - Rainfall frequency values from 1960s-2017: NOAA's Atlas 14 or Hydrometeorological Designs Studies Center (https://www.weather.gov/owp/hdsc)
- Hurricanes, tropical storms, winter storms:
  - 1900-2020, there were over 85 tropical storms and hurricanes.
  - Storm surges between 11-13 feet along the Texas coast have a typical return period of 25 years (Runkle et al. 2022).
  - Winter storms with extremely low temperatures and snow/ice have occurred in the Plan area as recently as 2021.



NOAA Atlas 14, Increase in 100-year 24-hour Precipitation Events (1960s-2017).

Addressing effects from extreme events

Droughts, Floods, Storm Surges, Winter Storms

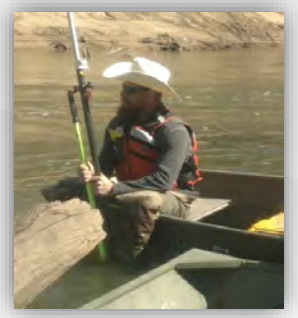
- Uncertain frequency/severity
- Consider resiliency to these events in designing conservation strategy
- Address in **changed** and **unforeseen circumstances**
  - Consider historic trends and future projections (if available)
  - Establish a threshold to distinguish between an **unforeseen** and **changed circumstance**
  - Consider potential effects to future species conditions
  - Develop remedial measures for responding to identified changed circumstances
  - Beyond what is identified as a changed circumstance is unforeseen (not reasonably anticipated)

Technical Advisory Group Update

TAG Members

Dan Opdyke
Chair of Committee
Anchor QEA
Water quality and hydromodeling

Cindy Loeffler
Retired TPWD
Texas Water Policy and HCPs



Webster Mangham
Trinity River Authority
Mussel Policy and River Authority operations

Ryan Smith
Texas Nature Conservancy
Texas water and ecosystems

Recent Activities

- Provided comments on HCP draft chapter 1 to 3
- Met with HCP team on May 24, 2024
  - Water quantity modeling
  - Water quality modeling

Overall Comments

- TAG members are appreciative of the organization, level of detail, and quality of the writing in the HCP
  - Quality writing allows everyone to focus on the content

- TAG members are appreciative of the thoroughness and openness of the discussions we've had with GBRA, consultants, and USFWS

- The following slides document concepts that the TAG is focusing on. **The questions are not meant to imply that GBRA has not, or will not, answer them.** Rather, they are the concepts that we feel require careful consideration.

HCP: Key Concepts of Interest to the TAG

- USFWS requirements of “best available science”
  - GBRA has supported some new studies, but generally is not obligated to
- Chapter 1 – Introduction
  - TAG provided suggestions for additional detail in specific areas
  - TAG recommends wordsmithing the representation of environmental flows legislation and regulations, particularly with respect to studies versus rules

HCP: Key Concepts of Interest to the TAG (continued)

- Chapter 2 – Environmental Setting
  - *Climate change*
    - What methods and assumptions will be used to predict climate change?
    - How may climate change influence the performance of conservation strategies?
  - *Covered species*
    - Is the list of covered species appropriate?
    - Are other key species, such as host fish for mussels, adequately considered?
    - How do we weigh in on the decision regarding species that are not proposed for coverage because GBRA could not reasonably anticipate take?

HCP: Key Concepts of Interest to the TAG (continued)

- Chapter 3 – Covered Activities
  - TAG members are requesting additional detail, e.g., water rights permits, USACE operations, GBRA streambed activities.
  - Is there clear correspondence between the covered activities (including spatial locations) and covered species?
  - How might new 2nd party participants or new activities be incorporated in the future?
    - How might the list of covered species, modeling, analysis, etc. change?
  - Are the potential benefits of covered activities adequately represented?
    - Discharge of properly treated wastewater
    - Reservoir releases for downstream use during drought
  - How water transfers (from one subbasin to another) and groundwater pumping affect flows and quality in both the donor and receiving waterbodies

Key Concepts from May 24, 2024 Workshop

- Participants: GBRA, consultants, USFWS, TAG
- Water Quantity Modeling
  - Is the WAM the “best available science”?
  - How will climate change be modeled and will it be limited to evaluation of conservation strategies?
  - How has hydrology since 1989 been evaluated?
  - The WAM strictly enforces senior water rights, but this doesn’t always occur in the real world. What are the implications of reduced passage to downstream seniors?
  - How sensitive are the study conclusions to the daily WAM output during the very driest periods?
- Water Quality Modeling
  - Is QUAL-TX the “best available science”?
  - How precise are the temperature regressions?
  - What is the vulnerability of covered species to temperature and ammonia?
- The TAG appreciates the conservative assumptions of
  - Full reuse for water quantity modeling
  - Maximum discharge and 1st percentile streamflow for water quality modeling

Upcoming Activities

- TAG/USFWS impacts analysis and take assessment workshop on August 15, 2024

- Expected workshops on Biological Goals & Objectives and Conservation Strategy in October and January

GBRA Comment

- Recognition of time and commitment
- Valuable input
- Some issues have been resolved, some ongoing

Next Steps

Winter 2024

5th Public Stakeholder Meeting: Impacts Analysis & Take Assessment

Spring 2025

6th Public Stakeholder Meeting: Biological Goals & Objectives, Conservation Strategy

Summer 2026

7th Public Stakeholder Meeting: Public Draft HCP

Q&A

Email questions or comments to GRHCP@GBRA.org

GBRA.ORG

Nathan Pence
Executive Manager of Environmental Science
npence@gbra.org

Chad Norris
Deputy Executive Manager of Environmental Science
cnorris@gbra.org

Daniel Large
HCP Director
dlarge@gbra.org

Jana Gray
HCP Coordinator
jgray@gbra.org

GBRA
Guadalupe-Blanco River Authority